ENERGY TRANSITION PARTNERSHIP

REPORT

Study on the Financial Implications of the Early Retirement of Coal-fired Power Plants in Indonesia

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Glossary

ADB	Asian Development Bank
BESS	Battery energy storage system
BPP	Electricity generation basic cost (Biaya Pokok Penyediaan)
CAPEX	Capital Expenditures
CATA	Coal Asset Transition Accelerator
CCGT	combined cycle gas turbine
CCS	Carbon Capture & Storage
CCUS	Carbon Capture Use & Storage
CF	Capacity Factor
CFPP	Coal-Fired Power Plant
COD	Commercial Operation Date
COP	UN Climate Change Conference
CRR	Coal Retirement Roadmap
CT	Carbon Tax
DFI	Development Finance Institutions
EBITDA	Earnings Before Interests, Taxes, Dividends and Amortization
ETM	Energy Transition Mechanisms
ETP NZE	Net Zero Emissions Scenario
ETP	Energy Transition Partnership
ETS	Emission Trading Scheme
EU	European Union
EUR	Euros
FCDO	UK Foreign, Commonwealth and Development Office
FIRE	Friends of Indonesian Renewable Energy
GDP	Gross Domestic Products
GHG	Greenhouse Gases
GOI	Government of Indonesia
GW	Gigawatt
IDR	Indonesian Rupiahs
IGCC	Integrated gasification combined cycle
IPP	Independent Power Producer
JTM	Just Transition Mechanism
JTT	Just Transition Transaction
KEN	Indonesia's National Energy Policy
kWh	kilowatt-hour
LCDI	Low Carbon Development Indonesia
LCOE	Levelized Cost of Energy
LTS-LCCR	Long-Term Strategy for Low Carbon and Climate Resilience
MEMR	Ministry of Energy and Mineral Resources

MOEF	Ministry of Environment and Forestry
MOF	Ministry of Finance
MOSOE	Ministry of State-Owned Enterprises
MtCO2e	Megatons of CO2 equivalent
MW	Megawatt
NDC	National Determined Contribution
NRE	New Renewable Energy
OPEX	Operation Expenditures
PLN	Perusahaan Listrik Negara
PPA	Power Purchase Agreement
PV	Photovoltaic
RE	Renewable Energy
RUEN	National Energy General Plan
RUPTL	National Electricity Supply Plan
SOE	State Owned Enterprise
STEM	Science, Technology, Engineering and Mathematics
US$	US Dollars
VAT	Value-added tax
VRE	Variable Renewable Energy

Chapter 1: Implications of early retirement of coal-fired power plants in Indonesia

UNOPS
Energy Transition Partnership

Study on the Financial Implications of the Early Retirement of Coal-fired Power Plants in Indonesia

1 Introduction

Over the past decades, Indonesia has capitalized on its substantial coal reserves and has managed to drive major economic development in the country. In 2020, coal made up 28% of the country's total primary energy supply and 62% of the country's electricity generation mix.[1]

Coal has also played a significant role in Indonesia's economy, being the world's top coal exporter by weight. In 2021, it exported 441.5 million tons of coal, equaling 31% of global coal exports.[2] The mineral and coal sector alone contributed 5% of Indonesia's GDP in 2019.[3] In 2021, preliminary figures showed that the GDP from coal and lignite mining in Indonesia amounted to almost US$ 40 billion, almost doubling that of the previous year.[4]

As one of the world's fastest-growing economies,[5] Indonesia will need substantial energy to power its continued development. But amid today's climate change crisis, Indonesia will need to significantly lessen its reliance on coal and other fossil fuels. As part of Indonesia's commitment to combat climate change, the Government of Indonesia has announced its intention to achieve NZE in 2060 or sooner. The anticipated plan of early retirement of coal-fired power plants (CFPPs) could be the first step to accelerating NZE to 2040.

The aim of this study is to support the Government of Indonesia in analyzing, evaluating, and providing suggestions on the current and alternative retirement pathways for coal-fired power plants with respect to their financial implications. Compared to other concurrent studies on early decommissioning, this study pairs a financial study on PLN with a fiscal and a high-level social analysis to support a CFPP screening tool to support the identification of the mechanisms relevant for Indonesia.

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[1] Climate Transparency. (2021) *Indonesia*.

[2] The Maritime Executive. (2022) *Indonesia's New Partial Ban on Coal Exports Will Impact EU and Bulkers*. 12 August.

[3] EITI. (2021) *New report shows Indonesia's extractive revenues in decline*. 12 May

[4] Statista. (2022). *Gross domestic product (GDP) from coal and lignite mining in Indonesia from 2014 to 2021*.

[5] McKenney, C. (2022) Harvard Growth Lab projects fastest-growing economies to 2030. *The Harvard Gazette*. 22 July.

The study's primary purpose is to respond to the expectations of the TORs, providing an in-depth analysis of the pathways, policy and regulatory frameworks and its implications on PLN and to the Government of Indonesia.

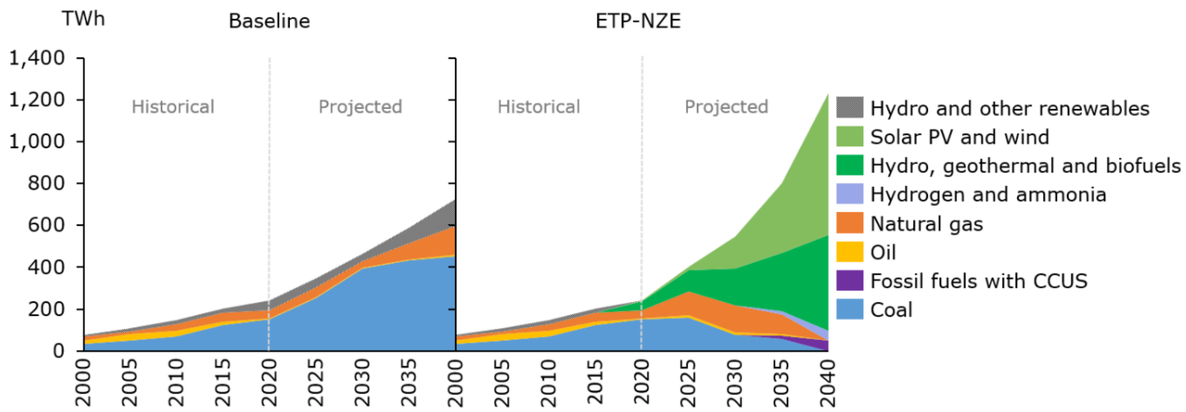
This study comes at a time when several relevant announcements have been made on Indonesia's coal retirement, highlighting the immediate relevance of this study. For example, The Asian Development Bank (ADB) announced the Energy Transition Mechanism (ETM); The Climate Investment Fund announced that its Accelerating Coal Transition Program (ACT) commits US$ 500 million on concessional loans; the Government of Indonesia announced its Energy Transition Mechanism Country Platform, and the Just Energy Transition Partnership (JETP) announced US$ 20 billion, one half being mobilized by the members of the International Partners Group (IPG) and the other half from private finance, subject to conditions to be met. This study intends to directly inform investment plants and disbursement strategies to maximize the impact of the resources allocated to these funds.

2 Implications of roadmaps, policy, and financing frameworks

2.1 Scenarios

Two scenarios are used to support the comparative analysis on the roadmaps, policy and financial implications of early CFPP retirement in Indonesia (Figure 2.1). The scenarios are based on government public statements and government targets. Stakeholder engagement provided guidance on what statements and regulations should drive the scenarios.

Figure 2.1 Generation projected in Baseline (left) and ETP-NZE (right), area graph.



The Baseline Scenario describes the future where no early retirement takes place but does eventually transition to a lower carbon power system after prohibiting the installation of new CFPPs after 2030. The scenario considers the 14 GW of CFPPs in the pipeline by 2030 defined in the RUPTL (≈77GWh[6]), as stipulated by Presidential Regulation 112/2022[7]. **The ETP-Net-Zero Emissions Scenario (ETP NZE)** describes a more proactive role where CFPPs are retired before their expected retirement date and is primarily replaced by RE to meet the 2050 net zero targets. Electrification rates increase, thereby raising electricity demand by 70%.

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[6] Assuming new CFPPs will have a Capacity Factor of 64%, which is the average of the 32 CFPP plants for which we have data gathered at this stage of the project.

[7] PT Perusahaan Listrik Negara (PLN) (Persero) (2021) *RUPTL 2021-2030*; includes mine-mouth CFPPs.

2.1.1 Baseline Scenario

The Baseline projects the electricity demand for the next twenty years as a continuation of historical trends from the previous two decades. The Baseline considers Presidential Regulation 112/2022, which stipulates that no new CFPPs will be installed except the ones already in the pipeline of the RUPTL[8]. As suggested by the RUPTL, The Presidential Regulation states that the only new CFPPs to be installed will be the ones defined in the RUPTL, the pipeline includes the installation of 11GW from 2021 to 2025 and 3 GW from 2026 to 2030. Most of them are already operating before 2029 (for a detailed COD see RUPTL).

Key assumptions of the Baseline Scenario are:

- Coal-fired power generation share peaks in 2030 at 85% and then declines to reach 62% in power generation share by 2040;
- Oil share in power generation reaches 1% by 2025 and then remains constant until 2040;
- The share of natural gas-fired generation increases to 19% by 2040 from 16% in 2022;
- RE power generation share, including hydro, geothermal, biofuels, wind and solar, reaches 18% by 2040 from 17% in 2022;
- The natural gas and RE share in power generation will dip in 2030 due to the new CFPPs coming online.

2.1.2 Net Zero Emissions Scenario (ETP-NZE)

The ETP-NZE scenario considers aggressive electrification in Indonesia to reach net zero targets, thereby increasing electricity demand by 70% (1,231 TWh) in 2040 compared to the baseline case (Figure 3.1). Due to the assumed early retirement of coal-fired power plants, it considers a different breakdown of technologies. This scenario incorporates the early coal phase-out plan endorsed by the MEMR[9]

[8] President of Indonesia. (2022, September). *Peraturan Presiden Nomor 112 Tahun 2022 tentang Percepatan Pengembangan Energi Terbarukan Untuk Penyediaan Tenaga Listrik* [Presidential Regulation No. 112/2022 on Acceleration of The Renewable Energy Development for Electricity Supply]. Government of Indonesia. https://jdih.maritim.go.id/perpres-no-112-tahun-2022

[9] Ministry of Energy and Mineral Resources (2021, Nov 2) Speaking at COP26, Energy Minister Gives Indonesia's Commitment to Net Zero Emission. Head of Bureau of Communication, Public Information Services, and Cooperation. From: https://www.esdm.go.id/en/media-center/news-archives/speaking-at-cop26-energy-minister-gives-Indonesias-commitment-to-net-zero-emission.

which is aligned with the Net-Zero Emissions Scenario developed by the IEA[10] and meets the decarbonization requirements set in the Just Energy Transition Partnership (JETP)[11]. The ETP-NZE scenario considers the following assumptions:

- Net Zero by 2050 – JETP
- Electricity and unabated coal reach Net Zero by 2040 – IEA NZE
- Electricity demand: 550TWh (2030), 1710 TWh (2050) – IEA NZE
- Coal Generation: 15% (2030), 7% (2050) – IEA NZE
- 34% generation from renewable energy by 2030 – JETP

The key milestones for ETP-NZE are (Figure 2.2):

- By 2040, demand is 70% higher than Baseline due to highly accelerated electrification advances;
- Unabated coal, oil and natural gas-based generation decrease until full retirement in 2040;
- Hydro and other renewables like geothermal and biofuels reaches 37% by 2040;
- Solar PV and wind reach 55% by 2040;
- Fossil fuels-based generation with CCUS along with hydrogen and co/firing ammonia start operating in 2030 and reach 4% each by 2040

It is worth noting that under the ETP-NZE scenario, electricity demand by 2040 is about 70% higher than Baseline due to stronger advances in electrification rates in end-use, which is only partially offset by energy efficiency.

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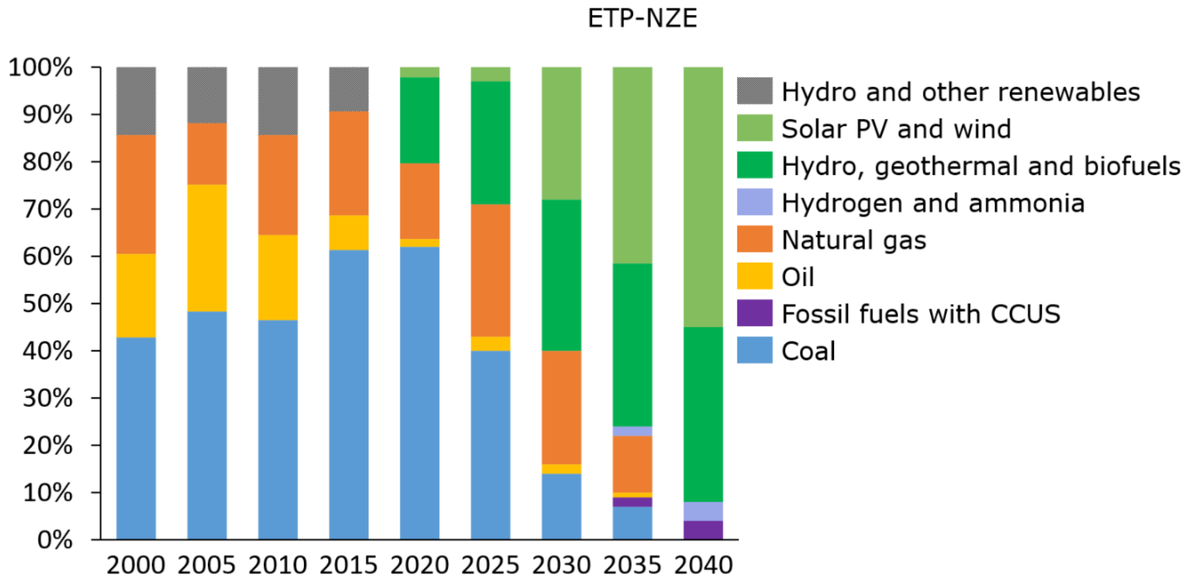
[10] IEA (2022), An Energy Sector Roadmap to Net Zero Emissions in Indonesia, IEA, Paris https://www.iea.org/reports/an-energy-sector-roadmap-to-net-zero-emissions-in-Indonesia , License: CC BY 4.0

[11] The European Commission. (2022, 15 November). Joint Statement by the Government of the Republic of Indonesia and International Partners Group members on the Indonesia Just Energy Transition Plan

Figure 2.2 Forecasted NZE Energy Mix, stacked graph



Presidential Regulation No.112/2022 states that the only new CFPPs to be installed will be the ones defined in the RUPTL, the pipeline includes the installation of 11GW from 2021 to 2025 and 3 GW from 2026 to 2030[12]. Table 2.1 reports the annual generation from CFPPs would need to be displaced in periods 2 and 3 to meet the retirement roadmap milestones. The table also shows the estimated capacity to be retired to meet the two milestones.

Table 2.1 Annual coal-fired generation to be retired in each milestone of the roadmap.

Period	Start Year	End Year	CFPP Generation to be displaced (GWh)
1	2021	2030	83,430
2	2030	2035	4,570
3	2035	2040	22,740
		Total	**110,740**

[12] PT Perusahaan Listrik Negara (PLN) (Persero) (2021) *RUPTL 2021-2030*.

2.2 Indonesia's state fiscal conditions

Indonesia has maintained a low debt level during the last decade showcasing a fiscal policy oriented under principles of prudency and promotion of long-term economic growth. The average Indonesian debt level[13], (30.5% measured as a percentage of its GDP) appears lower than other economies sharing the Pacific Basin like Australia and Malaysia (42% and 32% lower respectively)[14]. (See Table 2.2).

Table 2.2 Indonesia debt level, measured as GDP percentage. 2010-2020

Year	Indonesia	Malaysia	Australia
2010	26.2%	49.6%	28.7%
2011	24.9%	50.0%	30.1%
2012	25.0%	51.6%	39.5%
2013	27.8%	53.0%	37.6%
2014	27.4%	52.7%	41.7%
2015	30.3%	53.6%	46.5%
2016	31.4%	51.9%	54.7%
2017	32.4%	50.0%	53.3%
2018	33.1%	51.2%	54.5%
2019	33.7%	52.4%	60.3%
2020	42.9%	62.1%	69.4%
Average	30.5%	52.6%	46.9%
Indonesia vs others		58.0%	64.9%

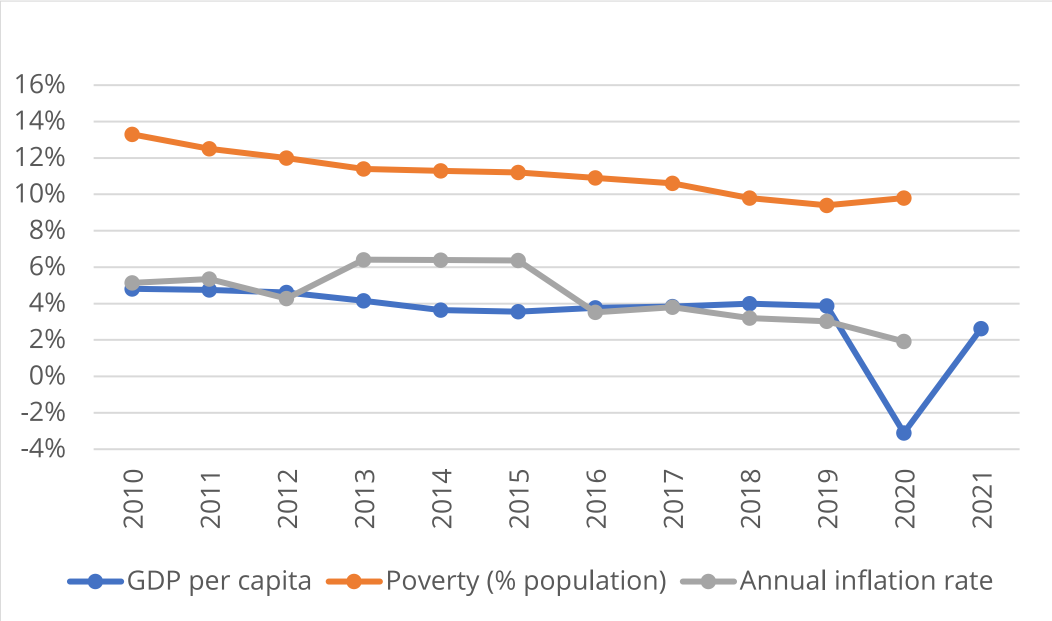
A prudent fiscal policy has supported Indonesian government with (i) remarkable economic growth, (ii) reduction of poverty rate, and (iii) low inflation levels. As shown in Figure 2.3, the GDP per-capita at constant prices, has had an average growth rate of 4%, excluded the effect of COVID-19 pandemic, during the last decade, the poverty rate has decreased from 13.3% in 2010 to 9.8% by 2020 whereas annual inflation fell from 5.1% in 2010 to 3.0% in 2019 and 1.9% by

[13] Maximum allowable debt is 60% of the GDP as stated by Law 17/2003 on the State Finances.

[14] The World Bank Data (2022) Central government debt, total (% of GDP) – Indonesia. From: https://data.worldbank.org/indicator/GC.DOD.TOTL.GD.ZS?locations=ID

2020[15], which can be considered good rates for a developing country having its own currency.

Figure 2.3 Per capita GDP, debt (% GDP) and inflation rate in Indonesia. 2010-2021



Indonesia has targeted to become a high-income country by 2036 and the world's fifth-largest economy by 2045, envisioning a 5.7% yearly GDP average growth. In 2021, Indonesia GDP reached US$ 1.18 billion at current prices (US$ 1.06 billion at constant prices 2015) and was placed as the 16th economy around the world. Therefore, the country should obtain this growing rate (or higher) and maintain macroeconomic stability to reach such goal[16].

Power sector is not the exception to this macroeconomic strategy, establishing the need to focus subsidies on vulnerable social groups. According to the G20 summit report "Effort to Phase out and Rationalize its Fuel-fossil Subsidies", important reforms to the policy on electricity tariffs have been carried out in Indonesia, basically applying a progressive scheme of "tariffs adjustment and

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[15] The World Bank Data (2022) GDP per capita, Poverty (%) and Annual inflation rate (%) – Indonesia. From: https://data.worldbank.org/indicator/NY.GDP.PCAP.KD?locations=ID
https://data.worldbank.org/indicator/SI.POV.NAHC?locations=ID
https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=ID

[16] Data extracted from World Bank data source: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD

subsidies elimination" that has reduced the classes of subsidized customers from 37 in 2012 to 23 in 2015, corresponding to small household (with consume less than 900 VA), small businesses and government offices[17]. In the case of non-subsidized groups, the government started to pay a compensation to PLN in 2018 to cover the gap between generation costs (BPP) and consumer tariff.

This fiscal policy has oriented our analysis for estimating the most likely impacts in government accounts based on quantitative parameters but preserving at the same time qualitative one's correspondent to the political decision level, especially the electricity tariffs.

2.2.1 Fiscal structure

The country's fiscal architecture clearly, described in Table 2.3 and Table 2.4, shows that both Income Tax, and the Value Added Tax (VAT) are revenue sources of importance to the Indonesian government, jointly representing more than 60% of its total revenues. In contrast, "Transfer to local governments" and "Personnel and Goods Expenditure" are the items through which government exert its largest expenditures with the non-oil subsidies (electricity) representing only around 7% of the total.

Table 2.3 Indonesian National Budget: Revenues

Revenue Items	2010	2015	2020
Total Government Revenues and Grants	**100%**	**100%**	**100%**
Domestic Revenues	**100%**	**99%**	**99%**
Tax Revenues	73%	82%	78%
Domestic Taxes	70%	80%	76%
Income Tax	36%	40%	36%
Non-Oil and Gas	30%	37%	34%
Oil and Gas	6%	3%	2%
Value Added Tax	23%	28%	27%
Land and Building Tax	4%	2%	1%
Exercise Duties	7%	10%	11%

[17] Ministry of Finance, 2019 www.oecd.org/fossil-fuels/publication/G20%20peer%20review%20Indonesia_Final-v2.pdf

Revenue Items	2010	2015	2020
Others Domestic Taxes	0%	0%	0%
International Trade Taxes	3%	2%	2%
Import Dutyfies	2%	2%	2%
Export Dutyfies	1%	0%	0%
Non-Taxes Revenues	27%	17%	21%
Natural Resources	17%	7%	6%
Oil Revenues	11%	3%	3%
Gas Revenues	4%	2%	1%
Other Natural Resources	2%	2%	2%
Other Non-Tax Revenues (1)	10%	10%	15%
Grants	**0%**	**1%**	**1%**

Table 2.4 Indonesian National Budget: Expenditures

Expenditure Items	2010	2015	2020
Total Government Expenditures	100%	100%	100%
Central Government Expenditures	**67%**	**66%**	**71%**
Personnel Expenditure	14%	16%	15%
Goods Expenditure	9%	13%	16%
Capital Expenditure	8%	12%	7%
Interest payment	8%	9%	12%
Domestic Interest	6%	8%	11%
External Interest	3%	1%	1%
Subsidy Expenditure	18%	10%	8%
Oil Subsidy	13%	3%	1%
Non-Oil Subsidy	5%	7%	7%
Grant Expenditure	0%	0%	0%
Social Assistance Expenditure	7%	5%	8%
Other Expenditures	2%	1%	5%
Transfer to Local Government and Rural	**33%**	**34%**	**29%**
Balance Budget	30%	27%	25%
Transfers to local autonomy and others transfers	3%	7%	4%

From a fiscal item standpoint, the Early CFPPs Retirement Program could impact a) the non-Oil and gas income tax historically paid by CFPPs and mining companies, b) the VAT generated in domestic coal transactions, c) the electricity subsidy as part of the non-oil subsidy, and d) Capital expenditure and likely Interest payments. The constituent elements of the fiscal impact analysis are shown in Table 2.5.

Table 2.5 Summary of variables considered in the fiscal impact analysis

Driver	Output to be estimated
Government Revenues	a) Variation in income tax revenues due to change in energy source (Renewable energy instead of Coal-based) b) Variation on Income tax revenues from coal mining companies c) Variation in Carbon tax (new tax not still included in the budget structure)
Government Expenditures	1. Subsidies and compensations: Likely subsidies and compensations variation due to the replacement of CFPPs, with renewable energy plants. 2. Funding for power producers' compensation schemes for early retirement (Capital expenditure), including: • Funding for arrangements with IPPs • Direct/indirect transfers to PLN

2.2.2 Government Support in Electricity Sector

There are at least 12 support/incentives from the government for the electricity sector which can be classified in three forms, direct transfers of funds, government revenue foregone, and income or price support. Throughout the years, the largest quantified measure was a transfer that the government paid to PLN to compensate PLN for losses that occur due to the below-market tariff setting by the government for end-user electricity prices—referred to as electricity subsidies and compensations.[18]

Moreover, to support government agendas such as increasing the electrification rate; improving the interconnection grid; COVID-19 recovery program; etc., GoI

[18] International Institute for Sustainable Development (IISD) (2022). *Indonesia's Energy Support Measures: An inventory of incentives impacting the energy transition*

may also disburse funds in the form of State Equity Participation (*Penyertaan Modal Negara*, PMN).

This Section Analyzed the impact of CFPP early retirement initiatives on changes in electricity subsidies and compensations which accounted for between 58% and 67% of all the quantified spending to support the electricity sector between 2016 and 2019 and about 40% in 2020.[19]

In Indonesia, electricity customer categories are divided into 38 types based on installed power rating on the consumer side—measured in Volt-Ampere (VA). Electricity tariffs for all categories (i.e., households, industries, and commercial and government services) are set by the government. However, the current electricity tariffs for all categories are below the generation and distribution cost of the electricity. Therefore, annual subsidies and compensation are provided by GoI to the PLN to make up for the losses due to lower selling prices.

Electricity Subsidies

Subsidies are intended to support vulnerable communities with affordable electricity prices. However, until 2014, all categories of PLN customers received electricity subsidies. Changes in the electricity subsidy policy were only translated to an increase or decrease in tariffs e.g., the policy to increase electricity tariffs by 10% in 2010 and by 15% in 2013.

The procedure for budget provision, calculation, payment, and accountability for electricity subsidies is regulated through MoF Regulation 174/PMK.02/2019 and allocated in the State Budget (*Anggaran Pendapatan dan Belanja Negara*, APBN) and/or the Revised APBN.

It was not until 2015 that the government removed electricity subsidies for 12 types of PLN customers, consisting of household customers with the power of 1300 VA and above, large industrial customers (200 kVA and above), large business customers (6600 VA and above), and government group customers (6600 VA and above). This policy is based on the understanding that these customer groups are not entitled to receive electricity subsidies. This policy

[19] International Institute for Sustainable Development (IISD) (2022). *Indonesia's Energy Support Measures: An inventory of incentives impacting the energy transition*

significantly reduced the electricity subsidy budget from IDR 99.30 trillion in 2014 (around US$ 6,620 million) to IDR 56.55 trillion in 2015 (around US$ 3,770 million).

Electricity Compensation

The Electricity Tariff Compensation Fund hereinafter referred to as the electricity compensation is the compensation paid by the government to the business entity for the lack of business entity revenue due to the net difference between the non-subsidized electricity power generation cost with the electricity tariff set by the government. Table 2.6 present the historical figures of the government's direct support in form of subsidies and compensations. The procedure for providing, disbursing, and being responsible for compensation funds is regulated in the MoF Regulation 159/PMK.02/2021.

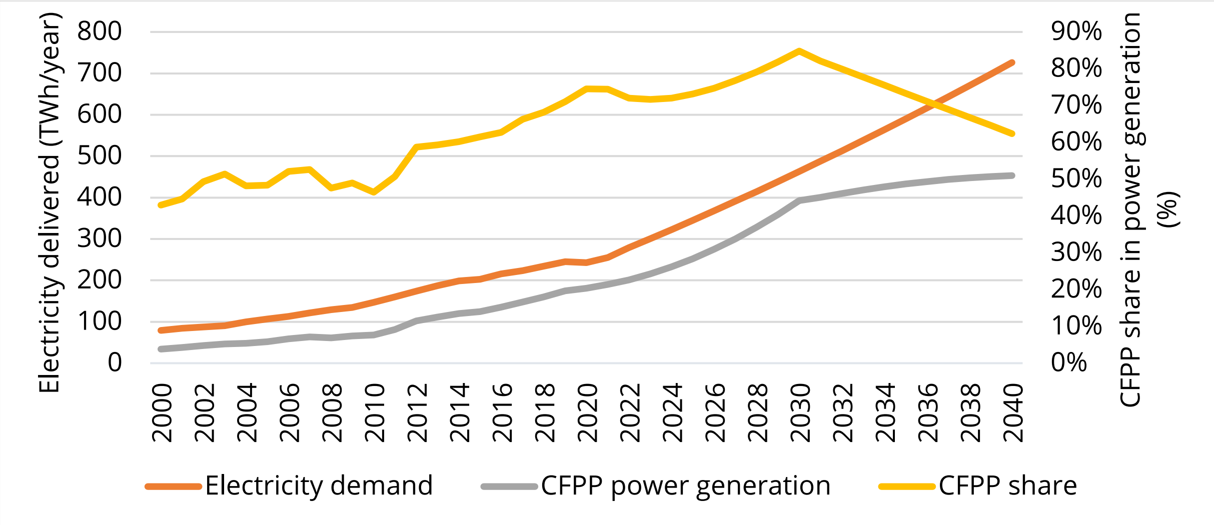
Table 2.6 Historical data of government direct support[20]

Government Direct Support		2013	2014	2015	2016	2017	2018	2019	2020	2021
Subsidies	Trillion IDR	101	99	57	58	46	48	52	48	50
	Million US$	6,747	6,620	3,770	3,870	3,049	3,207	3,447	3,199	3,320
Compensation	Trillion IDR	-	-	-	-	-	23	22	18	25
	Million US$	-	-	-	-	-	1,545	1,484	1,194	1,640

The baseline scenario shows an increasing electricity demand (Figure 2.4), reaching about 723 TWh in 2040, with CFPP's share in power generation peaking in 2030 (up to 84.8%) and then decreasing linearly until 2040. The rationale behind this corresponds to the commitments related with SDG and to what is required in the global 1.5°C scenario.

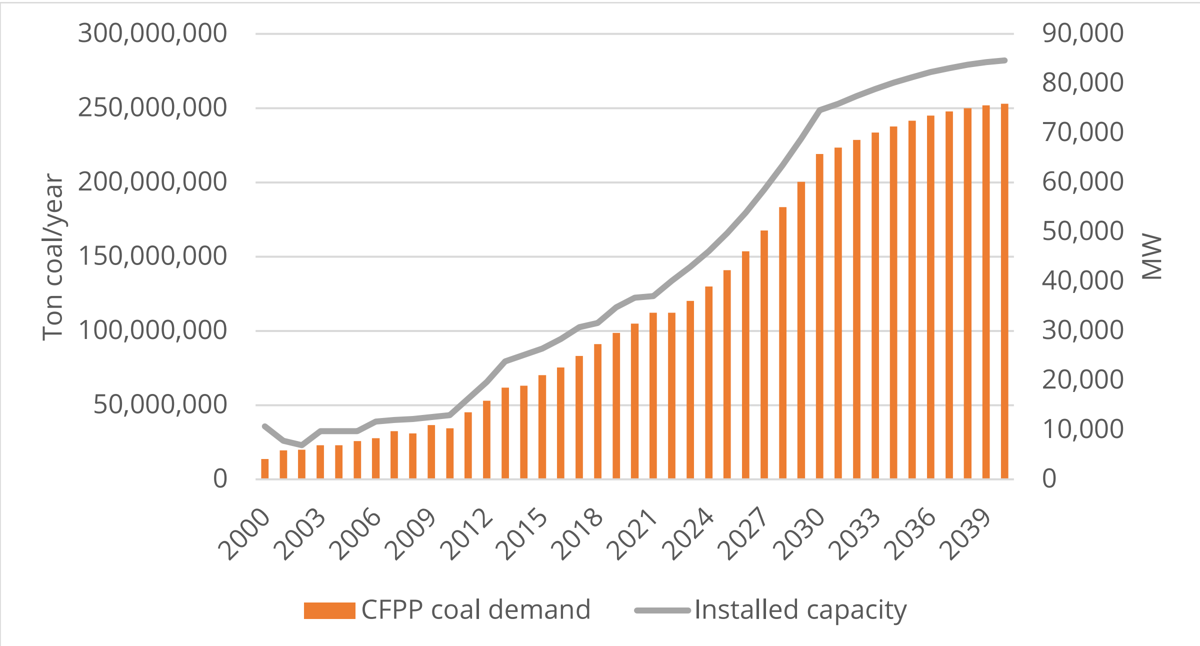
20 Compiled from PLN Financial Statement from 2014 to 2021.

Figure 2.4 Electricity baseline scenario, line graph



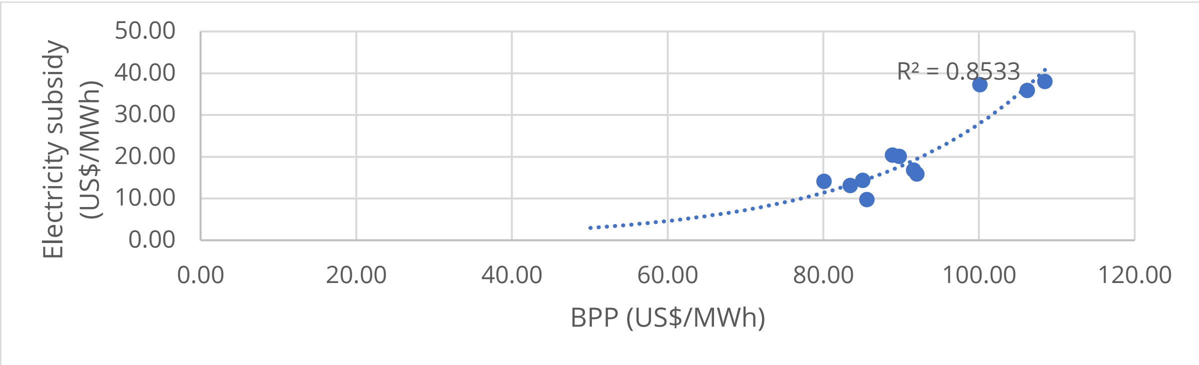
In the baseline scenario, CFPPs installed capacity will continue expanding few years beyond 2030 as result of covering an increasing electrical demand but at a decreasing share relative to the total power generation (Figure 2.5). The CFPP's coal demand will vary accordingly, as it has been occurring in the historical period.

Figure 2.5 CFPP coal demand and installed capacity in the baseline scenario, bar graph



The BPP (*Biaya Pokok Penyediaan*) indicator provides the average cost of production in the Indonesian power sector (i.e., power generation, transmission, and distribution) therefore, it determines the amount of electricity subsidy to be applied every year over the electricity tariff. Since the electricity subsidy complements the tariff every year, the following correlation can be observed between BPP and subsidies in recent years.

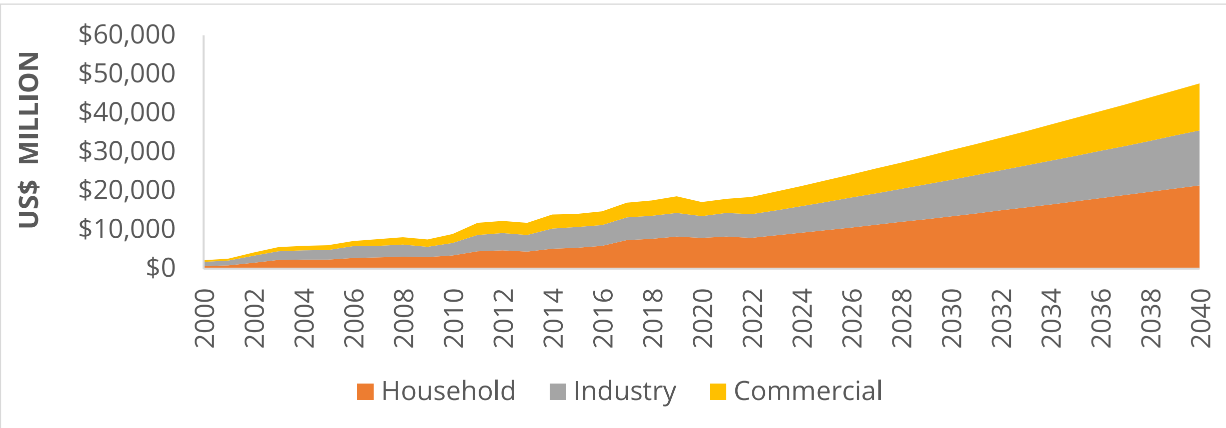
Figure 2.6 BPP and electricity subsidy correlation, line graph



Electricity subsidy in Indonesia has ranged between US$3 billion and US$4 billion annually from 2017 through 2020[21] (IDR 44,379 billion and 59,172 billion, respectively).

In terms of electricity revenues for PLN, it is assumed in the baseline scenario that differentiated tariffs will be maintained to the sectors in the demand side, being the household sector the greater contributor and from where a subsidy energy policy can be strengthened.

Figure 2.7 Electricity revenues in the baseline scenario, line graph



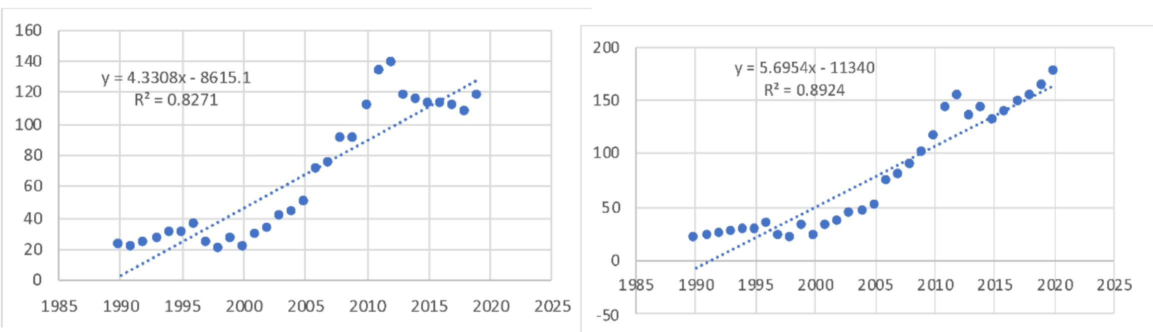
[21] International Energy Agency. 2022. Enhancing Indonesia´s Power System. Pp 28.

Prior to the establishment of direct and indirect impacts resulting from CFPPs early retirement, the baseline scenario profiling step is crucial to depict future behavior of key parameters involved in the Indonesian coal phasing out. The following are the considerations made to the baseline scenario setting:

- The historical data covers the 2000-2021 period, with 2021 being the base year for the scenario (2022-2040), whose time horizon is the year 2060, in line with that of the Net Zero Emission proposal.
- The electricity demand has been adjusted to match the baseline scenario proposed by BAPPENAS in later discussions of August 2022.
- The share of steam coal power plant production will continue increasing with respect to the total electricity demand, peaking in 2030 and linearly declining until 2060. The same applies to the related installed capacity.
- In terms of CFPP's coal demand, a proxy of 558 ton/GWh has been applied, which corresponds to the average consumption reported in the last 11 years, thus considering thermal efficiency decline.
- The total cost to provide electricity to final users (BPP), results from the aggregation of electricity revenues from tariffs and electricity subsidies.

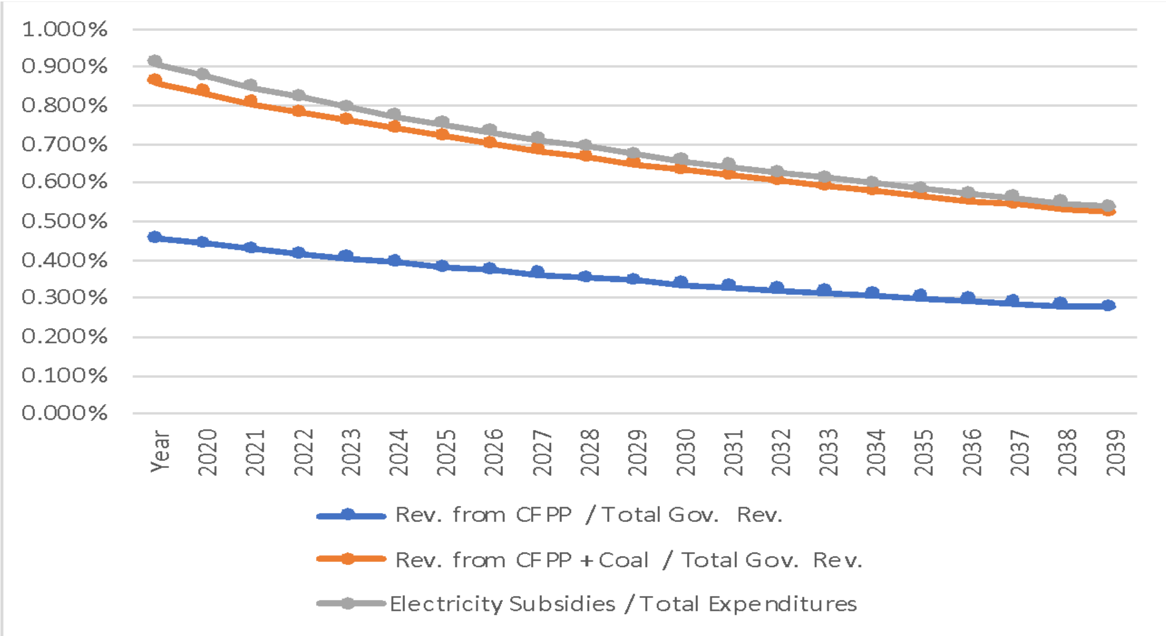
In terms of the fiscal situation in Indonesia, total government revenues and expenditures show a regular increasing tendency during the historical period, which has been maintained in the baseline scenario by means of linear regression adjustments.

Figure 2.8 Indonesian government expenses (right) and revenues (left), line graphs



As it can be observed, the share of both, government expenditures (subsidies) and revenues in the power sector are relatively low when compared to the corresponding total expenditures and revenues: always less than 1% with decreasing tendency throughout the forecasted period.

Figure 2.9 Share of CFPPs associated revenues and expenditures in the national budget, line graph



2.2.3 Direct and indirect subsidies

Historically, end users of electricity in Indonesia have witnessed an increasing trend in sectoral tariffs. In 2021, tariff gathering amounted US$ 17.9 billion (IDR 264,794 billion) by the contribution of household (46%), industry (33%), commercial (20%) and transport (1%) sectors, with foreseeable changes on these shares due to expected advances of electrification in transport and household sectors in the future. Notably, electricity sales have remained below the BPP cost pushing the GoI to disburse fiscal resources to close the gap.

Coal fired power plants in Indonesia has been benefited from an indirect support of the private sector in form of low coal prices due to Domestic Market Obligation (DMO) regulation. To ensure coal availability, since 2009 DMO has mandated coal mining companies to direct a portion of their production to the domestic market at a price defined by the government. Stipulated in Minister of Energy and Mineral Resources Decree No. 267/2022, the DMO quota for all coal producers is currently set at 25% of their annual production, with a selling price capped at US $70/ton.

Consequently, CFPP generation fuel costs are lower than what they would obtain if coal were provisioned at Steam Coal Reference Prices (HPB)[22].

2.2.4 Sensitivity Analysis

The comparative analysis includes a sensitivity analysis on carbon tax and coal fuel subsidy (Table 2.7 and Table 2.8).

Given there is no clarity on what the carbon tax is expected to be when implemented, two estimations were run, (i) a carbon tax rate of US\$10/tCO_2 (147,930 IDR/tCO_2) and (ii) an estimation for a carbon tax rate of US\$2.03/tCO_2. Table 2.7 presents the results for both estimations and as it could have been supposed the lost revenues for the government with the first price are approximately five times higher than with the second one.

Table 2.7 Sensitivity analysis for Carbon tax during de analyzed.

Results for retirement period: 2025 - 2040	Carbon Tax Revenue (at US\$ 2.03 / tCO2e) – MUS\$	Carbon Tax Revenue (at US\$ 10 / tCO2e) - MUS\$
Total Revenue in BAU Scenario	4,856	23,951,102
Total Revenue in ETP NZE Scenario	1,900	9,162,203
Variation (decrease) caused by Retirement Project	2,956	14,788,899

In addition, if the cap price would be eliminated, the mining sector could earn savings in subsidies delivered to the energy sector equivalent to US\$ 40,171.84 million.

[22] The HBA value is determined by the Minister every month by referring to coal price indexes such as the Indonesian Coal Index/Argus Coalindo, New Castle Export Index, Globalcoal New Castle Index, Platts Index, Energy Publishing Coking Coal Index, and/or IHS Market Index.

Table 2.8 Estimated variation for coal-based fuel for CFPPs during de analyzed period (2024 – 2040)

Scenario	Subsidies amount at Cap Price (US$ at PV) (1)	Variation (US$ at PV) (1)
Baseline	92,918.23	40,171.84
Net Zero (ETP NZE)	52,746.38	-

(1) Million US$ dollar at present value.

The earlier the CFPPs retirement, the sooner mining companies will experience increases in their income flows due to the consequence of a DMO reduction. In this regard, the mining private sector can become a key financial resource allocator for RE deployment. Should an appropriate public policy framework facilitating private sector investment is in place, a cornerstone policy backed by a comprehensive roadmap is expected to accelerate finance for energy transition.

2.3 PLN's financial condition

PLN is a state-owned utility that operates the entire electricity system value chain, whose finances are supported by Indonesia's state subsidies and compensations. PLN has been able to meet its objective of providing a public service achieving a national electrification rate of 99.45% otherwise not possible without governmental subsidies and grants[23].

PLN has reported to have a positive gross and EBITDA margin for the past 5 years; however, this includes subsidies and compensations. Without subsidies or governmental compensations, PLN has had negative operating profit during the last five years (Figure 2.10). In 2021, PLN's operative profit decreased by 4.5% more, compared to 2020 mainly due to an increase in its fuels and lubricants expense and an increase in the purchased electricity.

23 PLN (2022) Annual Report: Transition to Net Zero Emissions. From: https://web.pln.co.id/stakeholder/laporan-tahunan

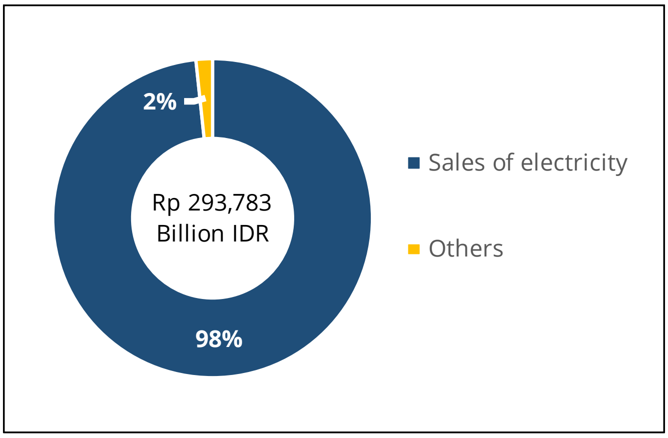
Figure 2.10 PLN's historical operating revenues, operating expenses, and profit, stacked bar chart

The increase in revenues can be attributed to post Covid economic recovery, increasing sales by 5%. Over the last three years, the debt-to-assets ratio has decreased 0.4 in 2021, While this could be considered a safe range for a state-owned utility, the number can be largely attributed to the asset valuation, which experienced a change in accounting methodology in 2015. As PLN finances investments in new CFPPs in, and new PPAs are signed, more debt should be cautioned. First, PLN's high noncurrent liabilities to noncurrent assets ratio of 31.6%, suggests high dependence on PPAs being signed with IPPs, and second, the loans currently being approved for PLN are highly dependent on Indonesia's backing and therefore sovereign rating.

2.3.1 Revenue

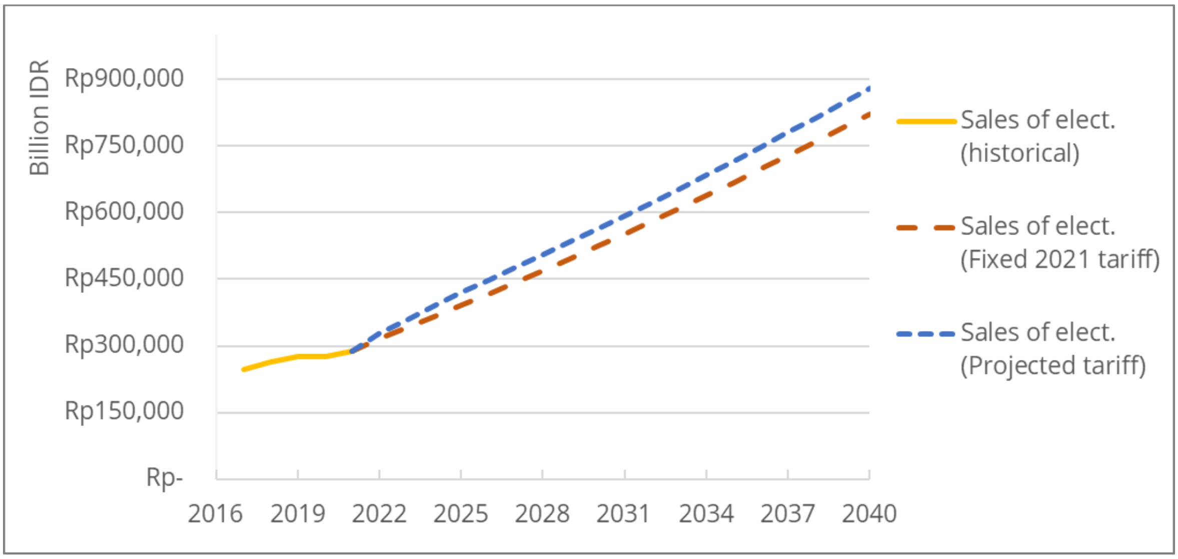
PLN's 2021 total income considering operating revenue has increased 7% from 2020 and is composed of sales of electricity (98%), (Figure 2.11). PLN's revenue is composed of 98% electricity sales which increased by 5% from 2020.

Figure 2.11 Operating revenue by source, pie chart



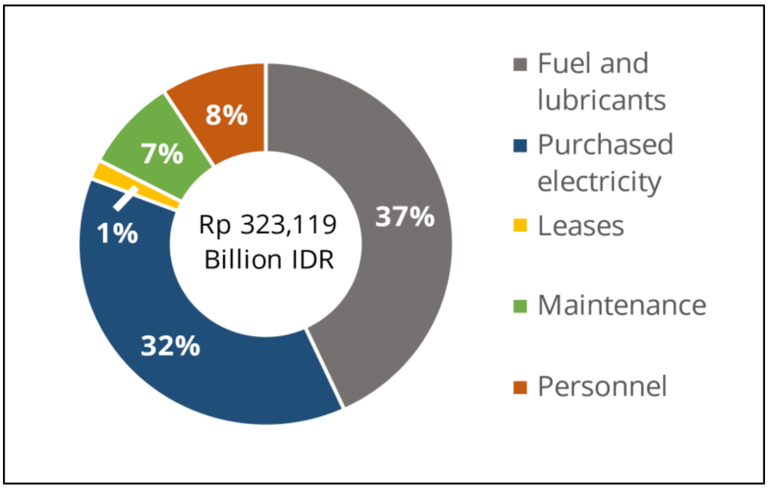
PLN's primary revenue source has been sales of electricity, primarily originating from CFPPs. Following the demand projections modelled and presented in the Baseline scenario, electricity sales could increase by around 185% by 2040, compared to 2021, if tariffs remained constant since 2021 (1.13 Million IDR/MWh or about US$ 76/MWh), and around 118% by 2040, if tariffs change following historical trends (1.21 Million IDR/MWh or about US$ 81/MWh by 2040), as described in Figure 2.12. On the other hand, there has been a declining tendency in the last 5 years of the relevance of sales of electricity within the PLN's income i.e., from 82% in 2017 to 78% in 2021. This decrease is due to increasing primary fuel costs, new PPA contracts especially with CFPPs and investment activities, which in turn have required increasing government subsidies and compensation income to maintain PLN afloat. Although there is no information available about the contractual characteristics of the PPAs PLN has engaged in recent years, it can be deducted from the increment in purchased electricity expenses that PLN has also increased its contractual obligations.

Figure 2.12 PLN's sales of electricity revenue projections, line graph



2.3.2 Expenses

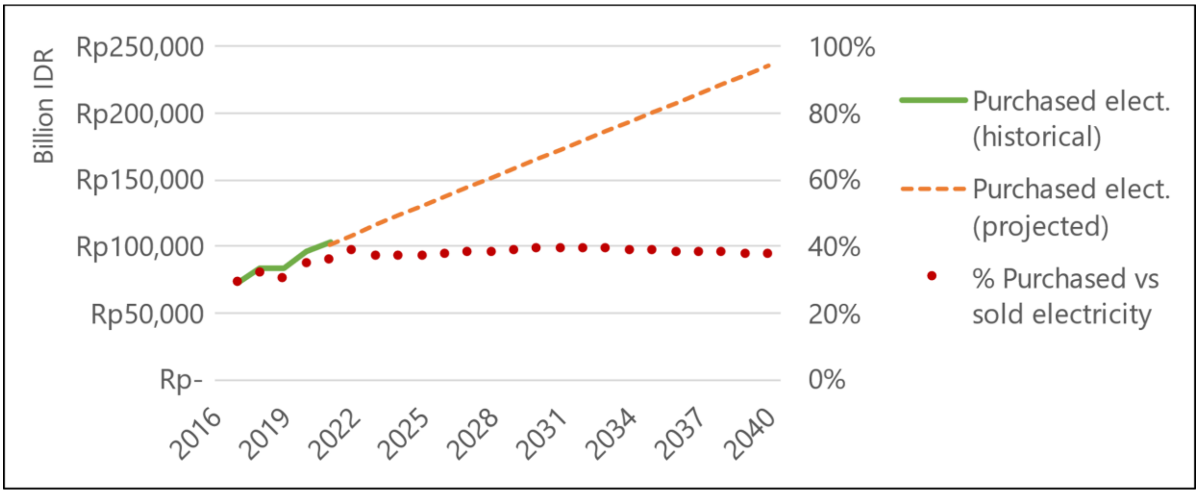
Figure 2.13 Expenses by source, pie chart



In 2021, PLN's total expenses represented IDR 323,119 billion (US$ 21.7 billion), which was an increase of 7% compared to 2020. PLN's expenses are composed of fuel and lubricants (37%), purchased electricity (32%), personnel (8%), maintenance (7%) and leases (1%) (Figure 2.13). These shares highlight that PLN is significantly exposed to changes in fuel prices and PPA contract conditions. The increase in fuel and lubricant expenses (12% from 2020) and an increase in purchased electricity (8% from 2020) were the greatest contributors to the increase in expenses PLN faced in 2021.

PLN's second largest expense is purchased electricity, and it has been increasing since 2017. If the historical trend continues, as shown in Figure 2.14. Purchased electricity would represent a greater percentage of the revenues that PLN obtains from sales of electricity, meaning that there will be less profit for PLN and that PLN would have less control over its own decisions, as they would be obliged to meet legal obligations provided in PPAs. One of the most relevant and costly legal obligations is the take-or-pay (TOP) clauses. These are usually defined in PPAs to secure revenue for power producers to pay their fixed costs, however, this clause leaves utilities with excess installed capacity like PLN locked to fixed expenses for 15 to 20 years24. The large CFPPs IPP pipeline for which PLN will have obligations to buy its energy and the investment needs are two expenses that need to be considered as we analyze the future health of PLN. IPPs have gained greater relevance in PLNs portfolio and though no specificities of the PPAs between PLN and IPPs is known, there are two unconditional truths that will have a direct impact on PLN's finances. First, IPPs are in the pipelines to be constructed, which will require investments in transmission and distribution infrastructure. Secondly, the PPAs PLN agrees to come up with capacity payments which put PLN at risk if energy demand projections are not met i.e., payments of undelivered power. This is a common clause in PPAs, and therefore only a renegotiation would change the burden of capacity payments.

Figure 2.14 PLN's purchased electricity expenses projection, and share of purchased electricity compared to sold electricity, line graph



There is an eventual need for PLN to continue investing in grid development, especially considering the objective of increasing the renewable energy

24 IEA (2022), Enhancing Indonesia's Power System, IEA, Paris https://www.iea.org/reports/enhancing-Indonesias-power-system

penetration within the Indonesian grid systems and the increase foreseen in energy demand/supply. PLN has foreseen a required investment of IDR 213 trillion (US$ 14.3 billion) in transmission lines and substations from 2021 to 2030 and has identified internal funds, state equity participation and loans as possible funding options, being open to foreign loans, government loans, bonds and other commercial banking grants[25]. As we look forward, there are two options for these expenses to be paid for, either the government will inject money to PLN to have sufficient cash to invest, thereby decreasing the share of sales in revenues, or for PLN to seek loan-funded projects, which would threaten the positive situation where PLN is not considerably in debt, thereby having little exposure to interest risks. Though positive, PLN would require free cash to pay this debt, for which it might struggle to meet given the difficulty for PLN to recover its costs.

PLN's health can be impacted by the carbon tax (CT) that is expected to be implemented in 2023. The CT will only apply to CFPPs with over 100MW of installed capacity and according to the Harmonization on Tax Regulation Law, the tax will start at 30 IDR/kgCO_2e (US$ 2.10/ton CO_2e)[26]. PLN owns 55 units of CFPPs of over 100MW which account for 17.8GW of installed capacity[27]. At the preestablished price, the CT could represent around IDR 3,800 billion (US$ 255 million) to PLN representing 1.2% of its annual expense[28].

2.3.3 Subsidies and Compensation

PLN's dependence on government subsidies and compensations is not minor and cannot be overlooked. Governmental subsidies on tariffs and compensations from the government make up 21% of the company's total income, and its reduction would significantly hit PLN's profitability. However, though there have been announcements of reducing subsidies and compensation payments to PLN

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[25] Clean Energy Finance & Investment Mobilization from the OECD (2021) RUPTL 2021-30: PLN steps up ambitions to accelerate clean energy investments in Indonesia. From: https://www.oecd.org/environment/cc/cefim/Indonesia/RUPTL-2021-30-PLN-steps-up-ambitions-to-accelerate-clean-energy-investments-in-Indonesia.pdf

[26] Christi, P. (2022, June) *Does Indonesia's Carbon Tax Have the Power to Trigger a Sustainable Market Shift?* ADB. https://seads.adb.org/solutions/does-Indonesias-carbon-tax-have-power-trigger-sustainable-market-shift

[27]Transition Zero (2022) TransitionZero's Coal Asset Transition (CAT) Tool, Indonesia. From: https://www.transitionzero.org/coal-asset-transition-tool

[28] The CT expense has been estimated using a 1,211 tCO_2e/GWh emission factor, estimated as the average of the 32 CFPPs included in this study.

and Pertamina, government subsidies and compensations are most probably not going to disappear due to their importance for economic stability.

Based on historical tendencies, government subsidies and compensation could increase 135% by 2040, from 2021, and represent between 25-33% of total income by 2040. While this situation allows for a stable stream for PLN, it hides the underlying risk of weakening the economics of the country and for revenues to not keep up with the expenses, widening the gap from a cost recovery model. Currently, Indonesia has favorable economic forecasts, enabling this model to work. Additionally, PLN benefits from an indirect subsidy through coal prices, this is another example of how the gap between PLN and reality is widening. Coal price for power plants is capped at US$ 70 per ton (IDR 1.03 million per ton) of coal 6,322 kcal/kg GAR and is adjusted for lower quality coal types. For example, for 4,200-4,500 kcal/kg, the cap is estimated to be around US$ 39 per ton (IDR 576,927 per ton). This cap allows PLN to save on fuel expenses, which represents around 65-75% of operating costs of a CFPP. As can be seen in Figure 2.15, coal prices have been above the price cap ten of the last twelve months, thereby reducing the price shock it would have otherwise received. The price cap protected PLN's financial solvency by reducing price volatility, which in turn benefits the Indonesian electricity consumers.

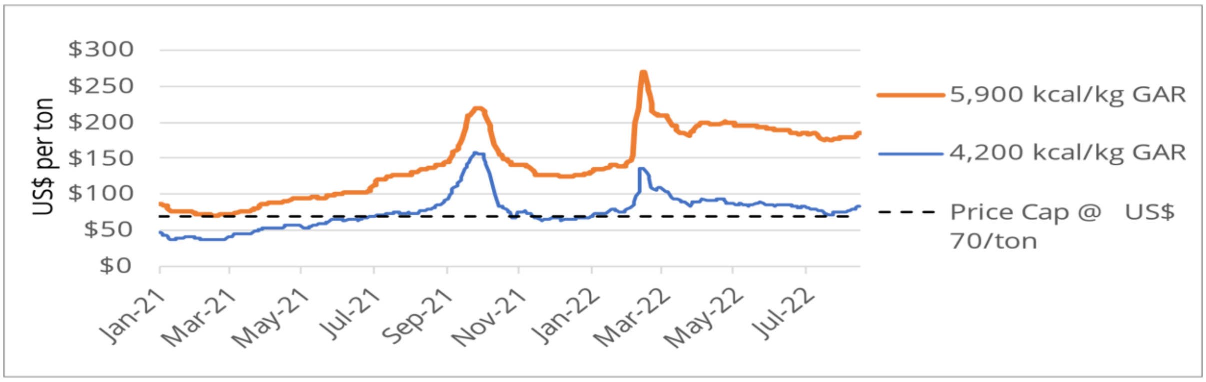
Despite this being a solution for PLN, it can represent an inconvenience for coal producers who would have also seen their sales capped by this mandate. This cap will have to be revised as it hides the dependency of coal in Indonesia, as with PLN's apparent need for IPPs and PPAs. In 2021, for example, we estimate the cap represented around US$ 1.2 billion (IDR 18 trill), which would represent a 5% additional cost for PLN.

However, it has become more difficult to make coal miners sell the volumes required to comply with their domestic market obligation (DMO) as coal prices spike, as they did this year. When coal prices spiked at the beginning of 2022, some coal producers preferred to pay the fines for not complying with the 25% of domestic allocation and rather export at market prices[29]. This caused a coal shortage for PLN and IPPs. So, trying to avoid another coal crisis that could result in blackouts, the government has started the discussion of implementing an

[29] Government of Indonesia (2012) *Decree of the Minister of Energy and Mineral Resources Number 13.K/HK.021/MEM.B/2022* on the *Prohibition of Coal Exports, and Guidelines for the Imposition of Fines and Compensation Fund for Fulfilling Domestic Market Obligation.*

agency that acts as an intermediary between coal producers and PLN. The agency would oversee collecting fines and compensations, balancing domestic sales and exports, and ensuring the DMO is complied[30]

Figure 2.15 FOB Kalimantan coal prices 2021-2022 (US$/ton), line graph



[30] Mamit Setiawan (2022), BLU Batu Bara dan Keadilan Bagi Seluruh Industri Penikmat DMO, *CNBC Indonesia. https://www.cnbcIndonesia.com/opini/20220816011141-14-363997/blu-batu-bara-dan-keadilan-bagi-seluruh-industri-penikmat-dmo*

3 CFPPS retirement decision framework

A CFPP early retirement decision framework is proposed to identify the CFPPs for which early retirement could be an option considering relevant criteria i.e., energy security, environmental, financial, contractual and societal criteria. A subsist of 32 CFPPs provided by MEMR[31] was evaluated using the decision framework, which resulted in a shortlist of CFPPs for immediate early retirement. Though the framework does order the CFPPs in preference, its order is indicative and should not be considered a recommendation.

3.1 Retirement decision framework

The early retirement decision framework considered other retirement decision frameworks and was modified to consider the Presidential Regulation 112/2022, data limitations and the end objective of showcasing an indicative early retirement project to meet NZE targets by 2050. The Presidential Regulation 112/2022 stipulated 7 criteria: 1) Capacity; 2) Age; 3) Utilization 4) CFPP GHG emissions; 5) Economic added value 6) Availability of funding support; and 7) Availability of technology support. The development of the tool and the selection of CFPPs considered screening tools from CMMIA, MEMR, PLN, and ADB (Annex III. List of the 32 CFPPS considered). Data accessibility and financial considerations led us to propose a modified framework as can be seen in Figure 3.1.

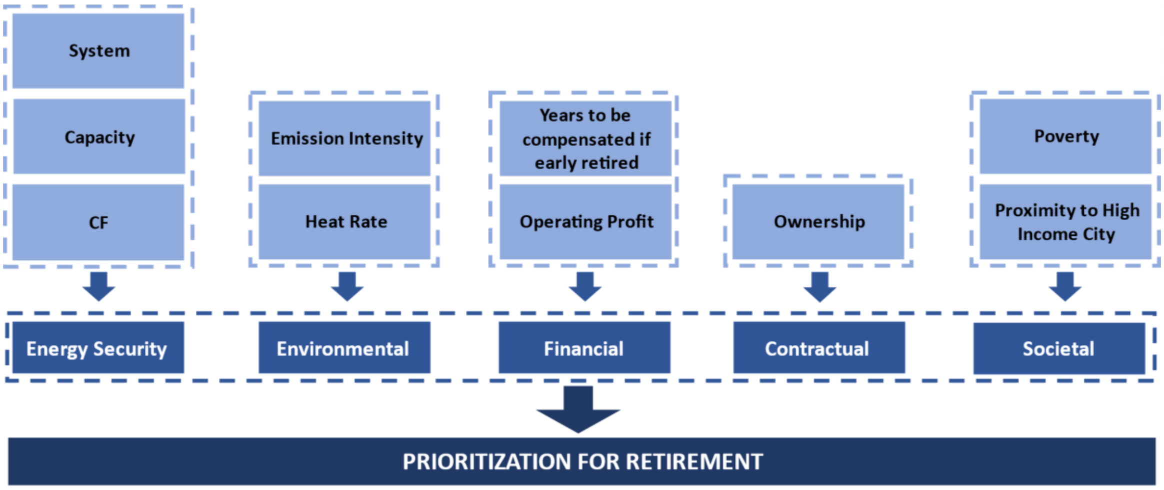
The framework involves the five criteria, each of them formed by indicators. The indicators are used to describe and assess each CFPP, A score is assigned to each CFPP according to the scoring matrix of each indicator, representing the impact it has on the CFPP retirement.

The five criteria used to prioritize closure of a CFPP are:

1. Energy security,
2. Environmental efficiency,
3. Financial performance,
4. Contractual preference and,
5. Societal aspects.

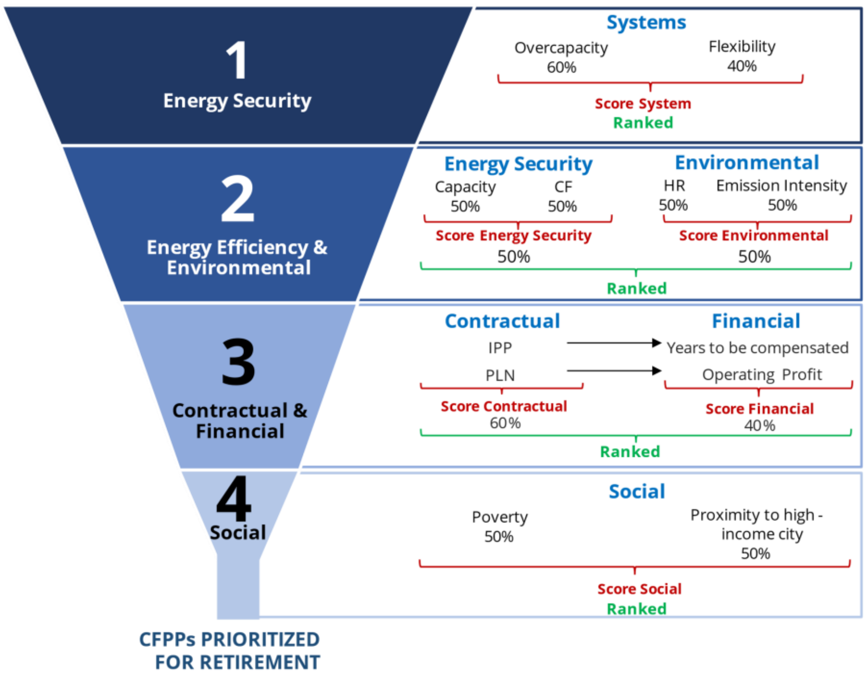
[31] MEMR (2022) SKENARIO NET ZERO EMISSION SEKTOR PEMBANGKITAN TENAGA LISTRIK

Figure 3.1 Criteria and sub-criteria included in the CFPP retirement decision framework



The evaluation of the criteria is developed following a four-step approach and each step evaluates specific indicators (Figure 3.2). A step-by-step structure has been selected to select CFPP based on systematic consideration and thereby showcase the relevance of each criterion in the development of a retirement program. The indicators per step are evaluated as follows:

Figure 3.2 Selection process of the early retirement decision framework



- **Step 1. System:** This step determines the most adequate power systems based on which one could tolerate a CFPP retirement and still ensure quality of supply. The two indicators that will be used are (i) overcapacity and (ii) flexibility.
    - Overcapacity is looked like a proxy to determine the potential impact of the retirement of a CFPP to the balance of the system.
    - Flexibility is measured by looking at power plants designed for base load and quantifying the percentage of such in the system to ensure that by 2040 sufficient base load power plants are present.

  Provided the uncertainty of what the CFPP capacity would be replaced by e.g. gas, the score of each indicator is not evenly weighted. Overcapacity is 60% of the score, and flexibility, 40%. As a result, the CFPPs located in the two more technically feasible systems are prioritized and shortlisted.

- **Step 2. Efficiency:** This step evaluates the enabling factors efficiency and performance of CFPPs. The installed capacity of the power plant and its capacity factor (CF) are weighted evenly to evaluate the size of the CFPPs against its utilization rate. In addition, environmental measures are considered. Due to lacking data availability, emission intensity was estimated for each plant and then evaluated by evenly weighting it with the heat rate (HR) of the CFPP. This way, a score can be assigned based on how efficient the power plant is, even though no specific details are known on SOx and NOx measures.

- **Step 3. Contractual:** This step evaluates the enabling conditions for negotiations for early retirement. It contemplates financial and contractual conditions for each CFPP. First, it discriminates between a CFPPs owned by PLN and its subsidiaries and those owned by an IPP. IPPs have been known to have disadvantageous "take or pay" clauses that would add preference to IPP early closures.

    - If the plant is owned by an IPP, a PPA is expected between PLN and the IPP. Exit conditions and costs of terminating the contract early are of high relevance in the negotiations. Because of limitations of data availability, an estimation of the remaining years of the PPA are considered as a proxy for the penalization of terminating a contract i.e. future cash flow of the plant that would have to be compensated.

  - If the plant is owned by PLN, operational efficiency will be determined per plant to evaluate the financial i.e. revenue to costs of goods sold.

  Given the confidence levels of the indicators for financial conditions, the contractual criterion is weighted with .60, and financial .40.

- **Step 4. Social Vulnerability**: The last step determines the social vulnerability surrounding the CFPP. It determines a proxy for the social cost that could be derived by retirement of a CFPP. In this step, two indicators are used: local poverty rates, and the proximity to high-income cities. Here, the poverty level and how much more retirement could accentuate it is evaluated by weighing it evenly with how proximate a high-income city with possible new job opportunities for the workers is.

3.2 Results of the simulated early retirement roadmap for ETP NZE scenario

The existing and estimated data for the MEMR's 32 CFPPs were evaluated using the early retirement decision framework, presents the inputs for each indicator required. The framework results in a list in the order in which they should be prioritized for retirement (Table 3.1). Years have been assigned to simulate when the retirement should happen to be in line with the NZE target defined by the government. The 32 CFPPs are not sufficient to meet the requirements for the NZE scenario, and an addition 7.2TWh of retired CFPPs would be required to meet the ETP NZE scenario (≈1.4GW).

Table 3.1 Results of framework in order by years of retirement

Year Retirement	Facility / Unit Name	Installed Capacity (MW)	Year Retirement	Facility / Unit Name	Installed Capacity (MW)
2023	Ombilin Unit 1, 2	200	**2028**	Keban Agung Unit 2	240
	Air Anyir Unit 1, 2	60		Adipala Unit 1	660
	Labuhan Angin Unit 1, 2	230		Rembang Unit 1, 2	630

2024	Celukan Bawang Unit 1, 2, 3	380
	Tanjung Balai Karimun Unit 1, 2	14
	Sebalang Unit 1, 2	200
2025	Bukit Asam Unit 1, 2	260
	Cilacap Unit 1, 2	600
	Tarahan Unit 3, 4	200
2026	Nagan Raya Unit 1, 2	220
	Teluk Sirih Unit 1, 2	224
	Pangkalan Susu Unit 1, 2	400
	Suralaya Unit 8	625
2027	Suralaya Unit 1, 2, 3, 4	1800
	Suralaya Unit 5, 6, 7	1600
	Pacitan Unit 1, 2	630
	Labuan Unit 1, 2	600

	Lontar Unit 1, 2, 3	945
2029	Paiton Unit 1, 2	800
	Paiton Unit 9	660
2030	Tanjung Awar-awar Unit 1, 2	700
	Paiton Unit 5, 6	1220
	Cirebon Unit 1	660
2033	Pelabuhan Ratu Unit 1, 2, 3	1050
2035	Indramayu Unit 1, 2, 3	990
2036	Ende Unit 1, 2	14
	Tidore Unit 1, 2	14
2037	Anggrek Unit 1, 2	55
	Amurang Unit 1, 2	50

Due to the difficulty of data, the resulting order is indicative and should not be interpreted as a recommendation. The years assigned are illustrative of the number of CFPPs that would need to be retired to meet the ETP NZE objectives. The following table shows the capacity to be retired in each period to meet the ETP NZE targets.

Table 3.2 Total generation and installed capacity to be retired by 2040 to meet ETP NZE

Period	Start Year	End Year	Annual Coal-fired Generation to be replaced. (GWh)	Installed Capacity to be retired. (GW)
1	2023	2030	73,188	14.8
2	2031	2035	23,172	2.0
3	2036	2040	7,178	0.1
			7,202*	1.4*
Total (2023 - 2040)			**110,740**	**18.3**

**Annual energy and installed capacity should be retired by 2040 in addition to the 32 CFPPs to meet ETP NZE scenario.*

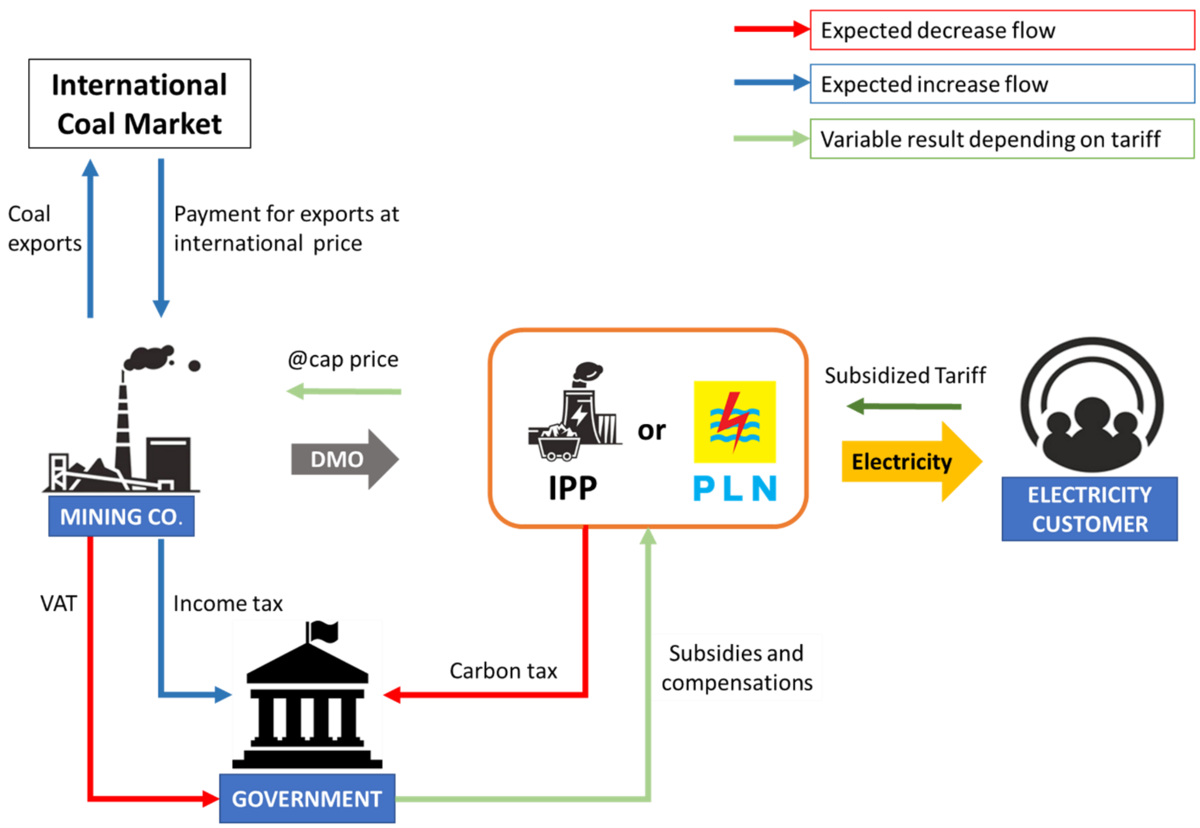
4 Fiscal evaluation

The evaluation of the impact of early CFPP retirement is complex due to the interventionist policies in place by the GOI seeking affordability, stability, and economic growth. The interventionist policies are reflected in the taxes and subsidies present along the entire supply chain of coal fired power generation and consumption. From the production side, coal prices are capped, and domestic market obligations (DMO) are set and from the consumption side, electricity tariffs are subsidized and compensated. Figure 4.1 summarizes the fiscal flows to consider during the fiscal impact evaluation of early CFPP retirement, with explanations provided in Table 4.1:

Table 4.1 Summarized explanation of fiscal impacts flows

Primary Results	Secondary Results
CFPPs retirement will release coal that can be used for the international market. So, coal exports and their prices would increase, given that historically, international prices have been higher than national prices.	1) Income Tax increase from mining companies. 2) VAT decreases due to less domestic coal sales (exports do not pay VAT). 3) Decrease in DMO from mining companies to PLN at cap price.
Renewable energy increase in energy matrix	1) Variation on subsidies and compensations to PLN 2) Variation on subsides for customers tariffs (Quantitative results for theses variations will depend on electricity tariff system adopted by the Government)

Figure 4.1 Summary of fiscal impact flows



4.1 Early Retirement Impact on Fiscal Condition

4.1.1 Domestic Market Obligation (DMO): Relevant implications and effects on the Indonesian Economy

The Domestic Market Obligation (DMO) plays a pivotal role in the power generation legal framework. While it doesn't formally appear as an expenditure or revenue in the government budget, its significance lies in gauging the economic resource flow from the mining to the energy sector. Essentially, it quantifies the savings public and private mining firms provide to Coal-Fired Power Plants (CFPPs). Table 4.2 shows the share of different coal classes in the overall consumption of the 32 listed CFPPs.

Table 4.2 CFPP's annual coal consumption by classes

Coal Classes	Consumption (Million Ton)	Consumption share (%)
LRC	63.3	80.8%
MRC	14.3	18.4%
HRC	0. 7	0.9%
Total	78.4	100%

LRC: Low Rank Coal; MRC: Medium Rank Coal; HRC: High Rank Coal.

The majority of CFPPs in Indonesia consume the LRC class of coal[32]. As per the IEA's "Coal in Net Zero Transitions Report", Indonesian coal exports predominantly range between 3,600 to 4,800 kcal/kg[33]. During periods of high international coal demand[34], the reduced coal demand from the early retirement program could likely be redirected to international markets by mining companies. This assumption is made considering the IEA's estimation about Indonesia continue being the highest coal exporter in Asian-Pacific region, until 2050[35] (Figure 4.2) .Indonesia exports all classes of coal (Figure 4.3). So, no matter what coal class will be released from CFPPs, it could be exported.

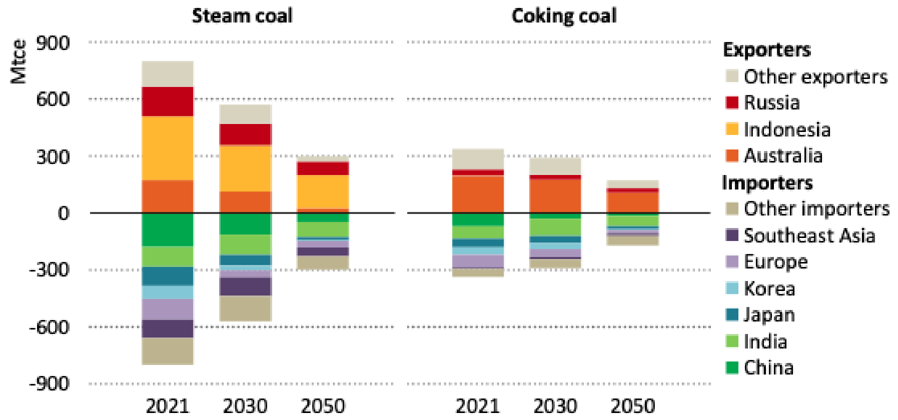
[32] IISD (2019) Indonesia's Coal Price Cap: A barrier to renewable energy deployment. From: https://www.iisd.org/system/files/publications/Indonesia-coal-price-cap.pdf

[33] IEA (2022), Coal in Net Zero Transitions, IEA, Paris https://www.iea.org/reports/coal-in-net-zero-transitions, License: CC BY 4.0

[34] The report considers a high global coal demand period from 2022 to 2027 and a low global coal demand period from 2028 onwards.

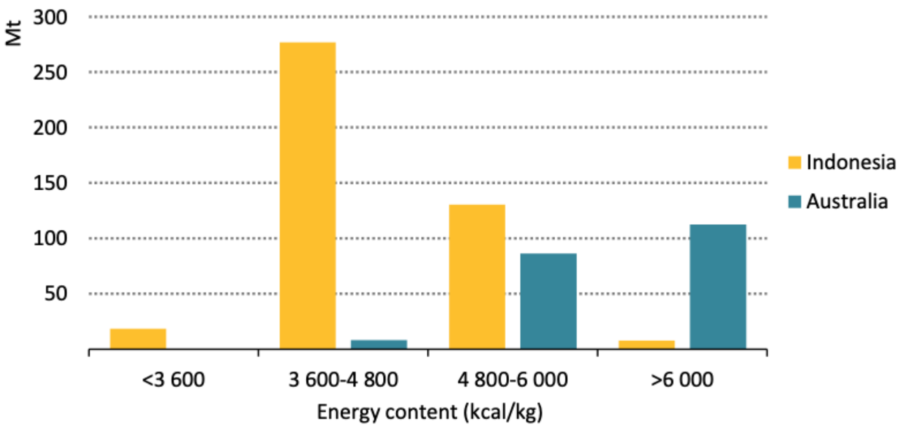
[35] IEA (2022), Coal in Net Zero Transitions, IEA, Paris https://www.iea.org/reports/coal-in-net-zero-transitions, License: CC BY 4.0

Figure 4.2 Forecast of coal exports in the Asian-Pacific Region



Declining global coal demand leads to a 60% drop in coal imports to 2050; steam coal trade declines further and faster than coking coal trade

Figure 4.3 Coal exports from Indonesia

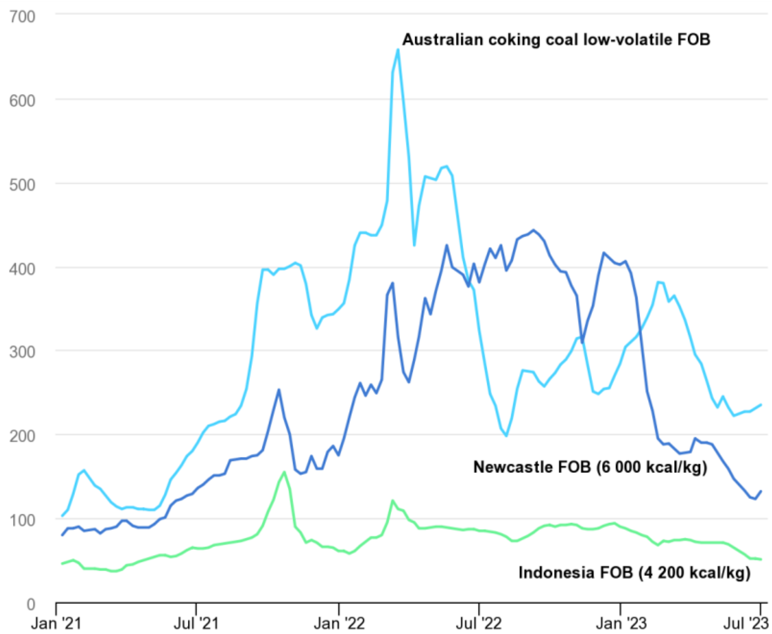


Indonesia's thermal coal exports are mostly in the lower quality, lower energy content segments of the market

The domestic market obligation has set a cap price of US$ 70 per ton for HBA coal class. As a consequence, a significant portion of domestic coal production (18.6% in 2019) misses out on the potential of fetching international prices, which are often above US$ 70 per ton (refer to Figure 4.4). The difference between the cap price and the international market price of coal for power generation marked by HBA indicator becomes the pivotal variable in terms of fiscal impact.

This disparity became especially evident in 2022. Events like Russia's invasion of Ukraine and the El Niño phenomenon escalated energy prices and led to an Australian coal supply shortage. This scenario culminated in unusually high global coal prices, creating monthly differences exceeding US$ 100 per ton (IDR 1.47 million) relative to the mentioned cap[36]. The declining trend in the Indonesian coal price marker during the first half of 2023 (see Figure 4.4.) reveals the anomaly of the 2022 values when compared with the 2021-2023 timeline, as presented in the IEA's "Coal Market Update Report 2023". Consequently, the annual variances between distinct coal price markers and the cap price were averaged out: US$ 42.41 (IDR 627,371) for coal with a calorific value of 4,200 kcal/kg GAR, and 59.26 and 79.80 for coal of 4,900 and 5,800 kcal/kg GAR respectively. This data refined the DMO forecast.

Figure 4.4 Market prices for different types of coal, 2021-2023.



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[36] According to the Indonesian Mining Portal iMining (http://imining.id/solutions/coal-price-calculator), the HBA coal averaged US$ 272.93 per ton from January to October 2022. Previous years shown HBA values significantly lower such as 121.47 in 2021, 58.17 in 2020, 77.89 in 2019 and 98.99 in 2018.

The International Energy Agency's data from the first half of 2023 suggests that the rise in coal prices witnessed in 2022 has plateaued[37]. Prices in 2023 appear to align more closely with 2021, albeit slightly higher. Given the significant difference between pre-2021 prices and those seen from 2021 onwards, it's essential to frame a scenario accounting for price differentials by coal classes, focusing on the years 2021 and 2023 and excluding the atypical 2022. This approach was adopted based on credible information available up until the conclusion of this study in August 2023. Therefore, this scenario is regarded as the best estimate for future price differentials and will be applied for fiscal impact estimations.

Table 4.3 Price differential by coal classes, as of October 2022

Coal Classes	Calorific Value (kcal/kg GAR)	DMO Coal Price (US$/ton)	International Price*	Price Difference (US$/ton)
LRC (Bay Gumas Coal)	4,200	39	81.41	42.41
MRC (IBP 5000)	5,000	48	107.26	59.26
HRC [38](Cap reference)	6,322	70	206.16	136.16

**Average prices are from 2021 - 2023, excluding 2022*

These price differentials (as highlighted in Table 4.3) also inform the indirect coal-fuel subsidy from the private sector under the ETP NZE scenario, detailed in Table 4.4.

[37] IEA's Prices reference for 2023: https://www.iea.org/reports/coal-market-update-july-2023/prices

[38] "Bay Gumas Coal", "IBP 5000" assumed based on the calorific value of LRC, MRC, and HRC

Table 4.4 Variation of indirect coal-fuel subsidy from the private sector in the ETP NZE scenario (2024 – 2040)

Indicator for Impact Measurement	Million US$ at present value
Indicator 1: Total DMO indirect subsidy during the entire period of retirement under the Baseline scenario	88,679
Indicator 2: Total savings during the entire period of retirement – under the ETP NZE scenario	17,703
Indicator 3: Average annual savings in subsidy (US$/year)	1,041
(1) This period beings in 2023 because it is the year for the 1st planned retirement	

Note: Average of real interest rate has been used as the discount one, based on World Bank data series for the last decade.[39]

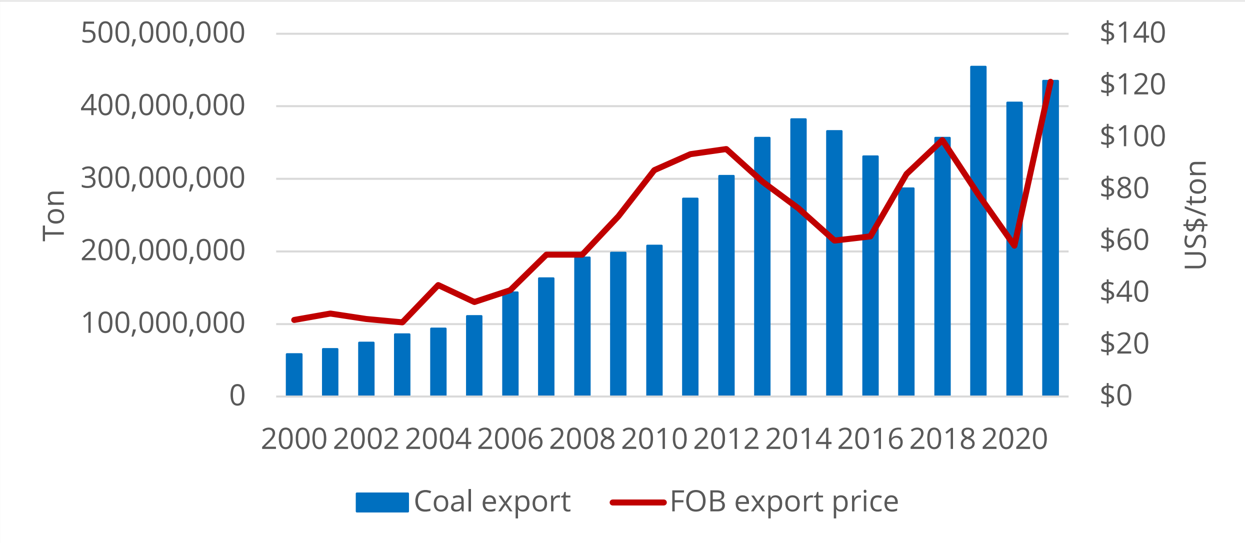
The main assumption in the analysis is that the cap price (max. US$ 70 /ton) covers the mining production costs, thus any value above it directly contributes to the net profit of the mining companies. This assumption is based on the following:

- The absence of subsidies for mining firms to counterbalance cap price-induced losses.
- Between 2000-2009, the export FOB price for Indonesian coal, covering production costs and profits, remained under US$ 60/ton (IDR 887,580 / ton). For a significant duration within this period, prices were even below US$ 40/ton (IDR 591,720 /ton).
- From 2010-2020, inflation surged by 58.9%, while the Indonesian Rupiah devalued by 60.4%[40]. Although mining companies would continue to receive a fixed US$ per ton, this should cover any cost increases due to inflation.

[39] Data Series has been obtained from: https://data.worldbank.org/indicator/FR.INR.RINR?locations=ID

[40] These calculations have been made based on World Bank data series of inflation and exchange rate, which can be found at: https://data.worldbank.org/indicator/PA.NUS.FCRF?locations=ID, https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=ID

Figure 4.5 Historical Indonesian coal export. 2000-2021



4.1.2 Revenue: Income Tax & VAT

The CFPP's Early Retirement Program will modify the historical coal balance in Indonesia, reflecting variations on the non-oil and gas income tax and the value-added tax (VAT) fiscal revenue items. With a significant amount of coal now available for export due to reduced CFPP demand, mining companies will see an increase in the amount of coal sell at international prices which will favor their annual income, causing an increment on the tax flow to be paid to the government. Exported coal, on the other side, will not be subject to VAT generation according to fiscal regulation, as opposed to the current situation where coal domestic transactions do generate VAT.

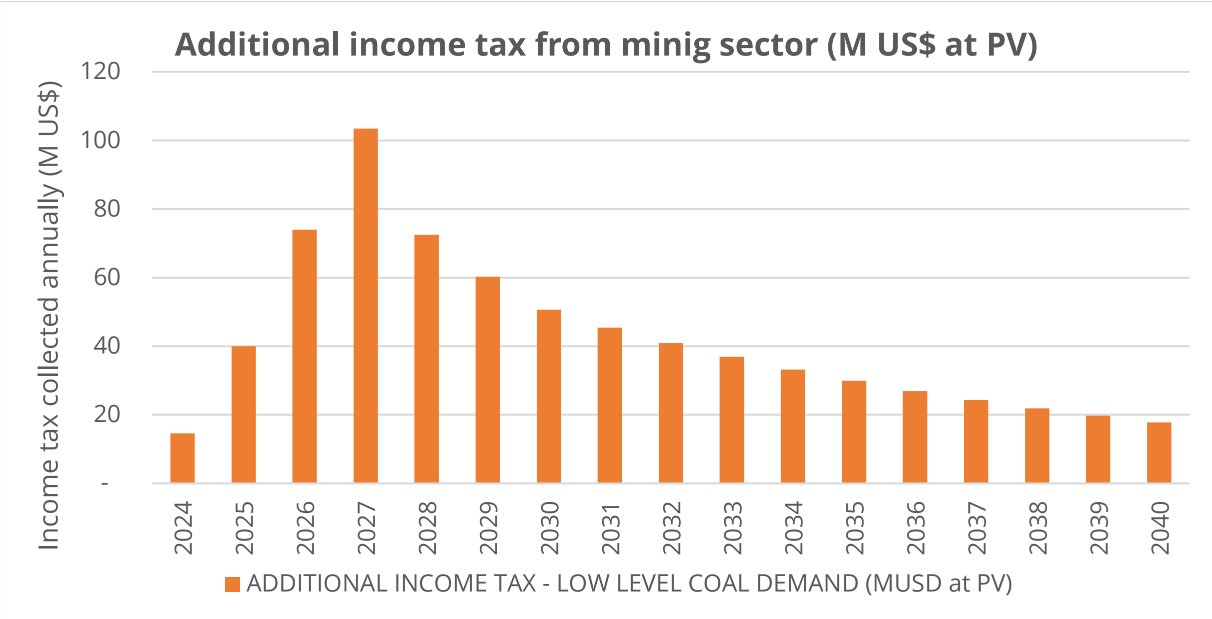
In addition to the price differential analysis detailed above, a complete analysis about the likely impact on income tax from mining sector requires the inclusion of future international demand evolution, which can be summarized in two scenarios presented in Table 4.5 the corresponding assumptions for coal exports in the future.

Table 4.5 International coal demand periods and export assumptions

International coal demand	Assumptions for coal exports
Period 1: High Level International Demand	Entire coal released from retired CFPPs will be exported, due to high international coal demand.
Period 2: Low Level International Demand	From 2028 onwards, only a fraction of coal will be exported due to an expected decrease of international coal demand.

Figure 4.6 illustrates the differential impact on income tax from the mining sector under each of these scenarios.

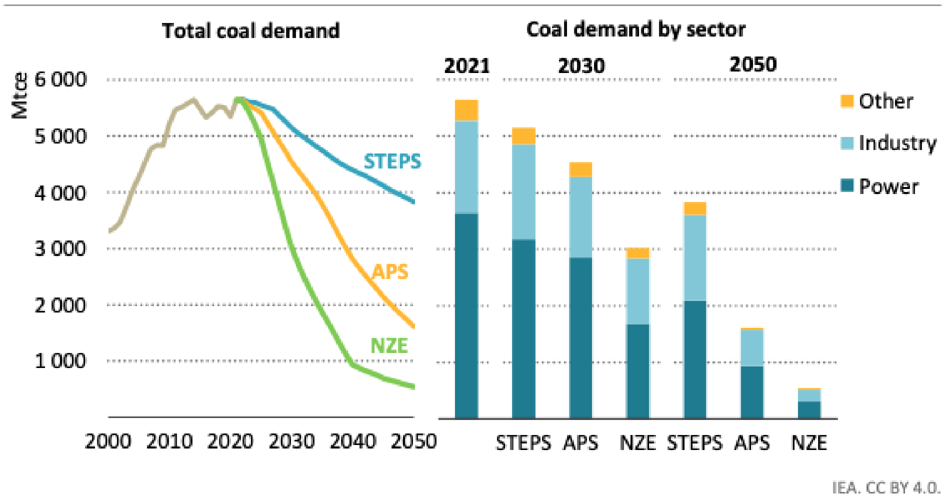
Figure 4.6 Additional income tax from mining sector: Scenario 1, High Level International Demand MUS$ at PV)



Note: MUS$ at PV means millions of US$ at present value (2022)

Although the amount of exported coal may be attractive, its price is subject to international coal demand which falls in each IEA's scenario in 2050 (Figure 4.7). The rebound of coal demand in 2021 after the COVID-19 pandemic, appears to be of shorter duration in the IEA's NZE scenario (three to four years).

Figure 4.7 Coal demand by scenario and sector, 2010-2050, IEA Coal in Net Zero Transitions[41]



In the analysis, the total amount of exportable coal is estimated for every year according to the retirement plan. The difference between the cap price due to the DMO and the international price should be considered as an additional net income for mining companies, amplifying this way the taxable income base for the government. As the CFPP retirement advances, the suppressed coal demand will change as international coal demand drops (Table 4.6).

Table 4.6 Suppressed coal demand not exportable.

Retirement year	International coal demand drop[1] (%)	Suppressed coal demand not exported[2] (ton/year)
2024	0%	0
2025	0%	0
2026	0%	0
2027	0%	0
2028	25%	5,594,554
2029	36%	3,778,104
2030	46%	3,345,092
2031	50%	5,426,223
2034	61%	2,692,330

[41] IEA. 2022. Coal in Net Zero Transitions. Strategies for rapid, secure and people-centred change. https://iea.blob.core.windows.net/assets/4192696b-6518-4cfc-bb34-acc9312bf4b2/CoalinNetZeroTransitions.pdf

2036	68%	3,207,855
2037	71%	84,255
2038	75%	337,496
TOTAL		24,465,908

Notes:
1. Drop of international coal demand taken for the 32 CFPPs to be retired.
2. Applied as a percentage of the total coal demand for each year.

Downstream, in the value chain, income tax paid by power generators will likely increase due to a competitive renewable energy levelized cost of electricity (LCOE). The energy mix in the ETP NZE scenario result in an average LCOE of about 0.057 US$/kWh for renewables[42] (IDR 843/kWh), which is 22% lower than the current 0.069 US$/kWh cost recorded for shortlisted CFPPs (IDR 1,020/kWh). Acknowledging that this LCOE for coal-fired generation resulted from a sample of 32 CFPPs and that renewable energy LCOE must be adjusted to Indonesia's specific market conditions, the competitiveness of RE with respect to CFPPs is of high uncertainty at this point in time, thus restricting the feasibility for quantitative fiscal analysis in this regard.

Table 4.7 describes the indicators used to measure the impact on each form of government revenue.

Table 4.7 Indicators used to measure variation on government revenues.

Indicator for Impact Measurement	Calculation	Application field
Income Tax from coal mining. Additional Income tax generated by coal exports thanks to CFPPs closure.	**Indicator 1:** Aggregated variation in Income Tax due to ETP NZE scenario (US$). **Indicator 2:** Annual average variation in Income Tax (US$ / year). **Indicator 3:** % of Total Annual Income Tax (presented in National budget)	All likely coal exports from mining companies, with coal released from CFPPs after retirement.

[42] Obtained as the weighted average of renewable energy share in the NZE for Indonesia, times average LCOE of different technologies published by IRENA, i.e., Solar PV (0.048 2021 US$/kWh), Geothermal (0.068 2021 US$/kWh), Bioenergy (0.067 2021 $/kWh), Hydro (0.048 2021 $/kWh), and Onshore Wind (0.033 2021 $/kWh).

Indicator for Impact Measurement	Calculation	Application field
Income Tax from power generation Additional Income tax generated by power generation based on RE plants.	**Indicator 1:** Aggregated variation in Income Tax due to ETP NZE scenario (US$). **Indicator 2:** Annual average variation in Income Tax (US$ / year). **Indicator 3:** % of Total Annual Income Tax (presented in National budget)	Power generation replacement from CFPPs to RE plants
VAT from coal purchases (for power generation): Decrease in VAT generated by coal re-oriented from domestic market to international market. Coal sales for domestic market pays VAT but sales for export don't	**Indicator 1:** Aggregated variation in VAT due to ETP NZE scenario (US$). **Indicator 2:** Annual average variation in VAT (US$/year). **Indicator 3:** % of Total Annual VAT (presented in National budget)	Coal consumption for all CFPPs included in ETP NZE
Notes: a) Inputs for indicators estimation are at constant prices. b) Net Present Value apply for future flows with a discount rate equivalent to the previous 10-year average interest rate since it reflects the opportunity cost of money in Indonesia.		

Table 4.8 summarizes the results for Income Tax and VAT impact[43] indicators, for the analyzed period, corresponding to the duration of the entire ETP NZE (2023 – 2040).

[43] VAT Calculation was made from crossing data of Directorate of Taxes about VAT data and Supply-Use table, to estimate a quantitative relation between VAT and sales. It is important to note that VAT rate of 11% is applied to Aggregate Value, not on sales. Sources: VAT: Consolidated Report of DG Taxes, "accessed 8 December 2022". Supply-Use table: https://data.adb.org/dataset/supply-and-use-tables-Indonesia

Table 4.8 Income tax and VAT impact results

Indicator for Impact Measurement	Income Tax change (Million US$ at PV)	VAT change (Million US$ at PV)
Measurement of impact on VAT		
Indicator 1: Aggregated variation in VAT due to ETP NZE scenario (US$).	-	9.44
Indicator 2: Annual average variation in VAT (MUS$ / year).	-	0.56
Indicator 3: % of Total Annual VAT (National Budget 2020)	-	0.0004%
Measurement of impact on Income Tax from mining companies (Low Level International Coal Demand Scenario)		
Indicator 1: Aggregate variation in Income Tax due to ETP NZE scenario	712.36	-
Indicator 2: Annual average variation in Income Tax (MUS$ / year).	41.9	-
Indicator 3: % of Total Annual Income Tax Non-Oil (National Budget 2020)	0.028%	-
Measurement of impact on Income Tax from power generation replacement		
Indicator 1: Aggregate variation in Income Tax due to ETP NZE scenario	173.38	-
Indicator 2: Annual average variation in Income Tax (MUS$ / year).	10.20	-
Indicator 3: % of Total Annual Income Tax Non-Oil (National Budget 2020)	0.007%	-

4.1.3 Expenses: subsidies and compensation and participation in retirement

4.1.3.1 Subsidies and compensations

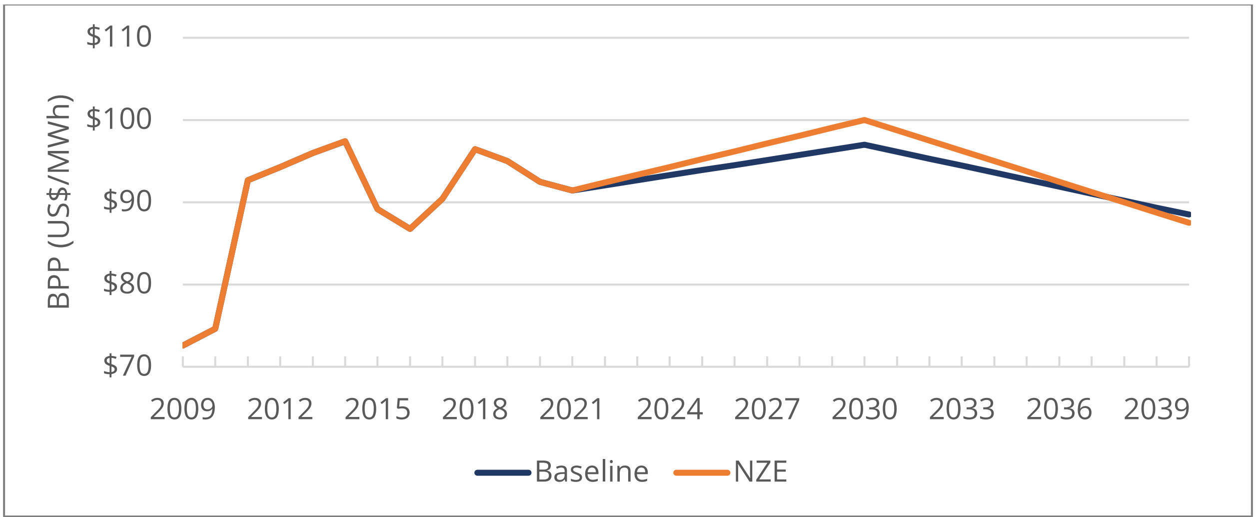
The generation costs, represented by the BPP, serve as the independent variable. Based on its behavior up to 2050, it will influence various annual government expenses. These expenses pertain to the tariff, including compensations to PLN and electricity subsidies for vulnerable households. In the baseline scenario, BPP increases up to US$ 97 /MWh in 2030 (IDR 1.4 million/MWh), a quite similar value to its highest record registered since 2009, driven by an increased capital recovery for power plants and grids, and then declining to US$ 80/MWh in 2050 (1.183 million/MWh). This is because high fuel and CO2 costs surpass the reduced capital recovery costs, with coal costs being 2% of the BPP[44].

In the ETP NZE scenario, 2030 is also the peak year for BPP with the highest value of US$100/MWh (IDR 1.4 million/MWh) due to accelerated deployment of renewable energy, mostly solar and wind, which have high up-front costs in capital investments. In 2040, the ETP NZE scenario delivers a lower cost of electricity, US$ 88/MWh (IDR 1.3 million/MWh) due to lower fuel cost (Figure 4.8)[45]

[44] IEA (2022), Coal in Net Zero Transitions, IEA, Paris https://www.iea.org/reports/coal-in-net-zero-transitions, License: CC BY 4.0

[45] IEA (2022), Coal in Net Zero Transitions, IEA, Paris https://www.iea.org/reports/coal-in-net-zero-transitions, License: CC BY 4.0

Figure 4.8 BPP evolution in Baseline and ETP NZE

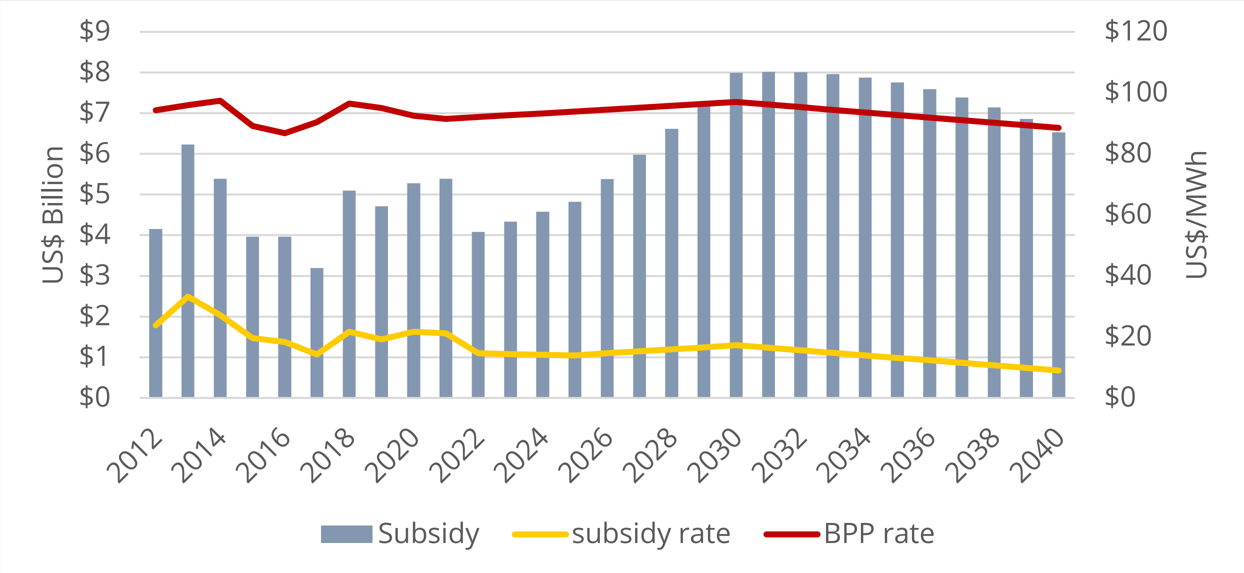


Electricity subsidies arise from the difference between BPP cost and the electricity tariff. Therefore, in the baseline scenario, we've estimated tariff variations based on the following considerations:

- Different sectoral tariffs apply to expected electricity sales for household, industry, commercial and transport sectors.
- Industry and commercial tariffs increase following historical trends until 2025 when the renewable energy share in the mix will reach 23% according to the energy policy, remaining constant at 2025 prices onwards.
- Household and transport tariffs are the same and remain constant at 2021 tariff values.

With the previous assumptions, the average tariff for the Baseline scenario results in US$ 79.46/MWh (IDR 1.17 million/MWh) which translates into a yearly accumulated total value of US$ 745.13 billion (IDR 11 trillion) due to the electricity tariff. Conversely, on the expense side, the average subsidy rate i.e., subsidy plus compensation, result in US$ 13.90/MWh (IDR 205,622/MWh) with a marked decline trend which leads to a total government disbursement of US$ 126.18 billion (IDR 1,860 trillion) over the period, as shown in Figure 4.9 .

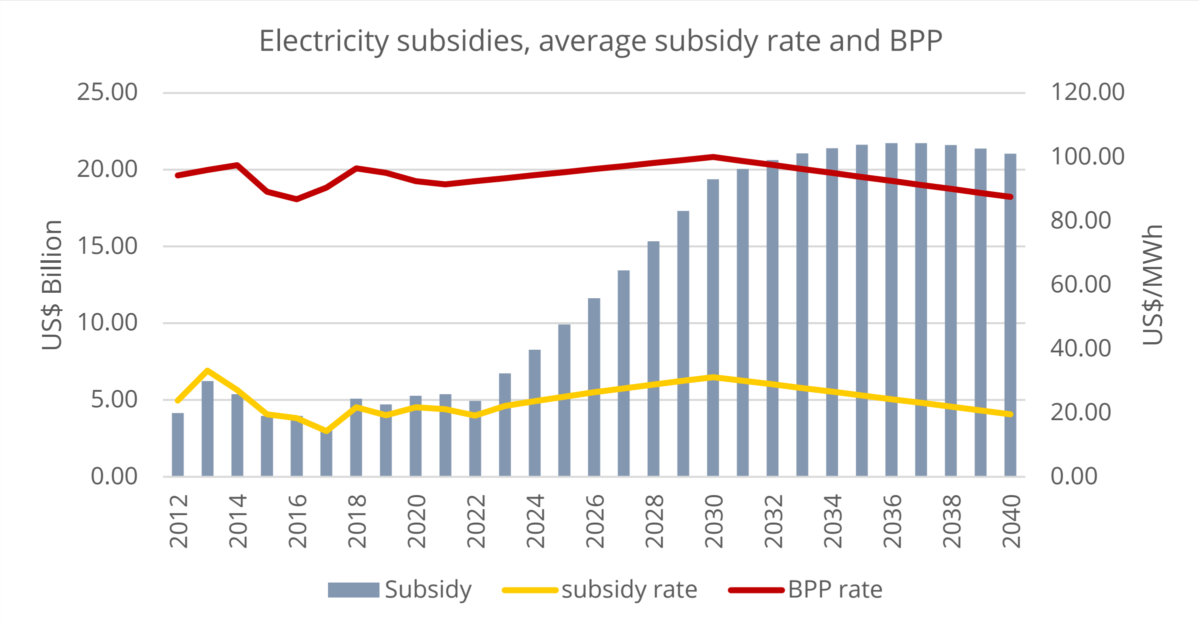
Figure 4.9 Electricity subsidies, subsidy rate and BPP rate in the Baseline scenario



In the case of the ETP NZE to 2050 scenario, two assumptions were made: First, the electricity tariff would remain constant at 2021 values throughout the period. Second, the electricity tariff would rise according to historical trends until 2030 and then remain constant.

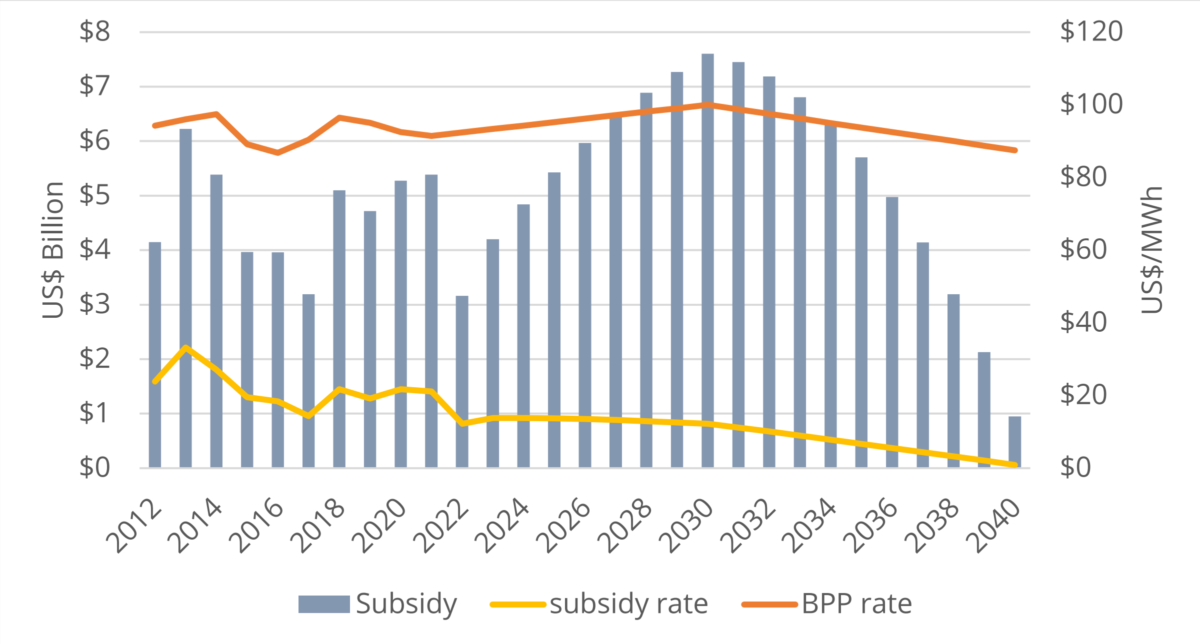
For the first assumption, shown in Figure 4.9, the electricity tariff averages US$ 69.2/MWh for the period (~IDR 1 million/MWh), a 12.9% lower than the Baseline, resulting in a total net income of US$ 873 billion (IDR 12,914 trill), whereas an average subsidy rate of US$ 25.4/MWh (IDR 375,742/MWh) implies a cumulative expense for the government of US$ 319billion (IDR 4,718 trill) over the period, a 2.5-fold increase with respect to the baseline scenario.

Figure 4.10 Electricity subsidies, subsidy rate and BPP rate in the NZE scenario, fixed tariff



The second assumption, shown in Figure 4.10, i.e., where the tariff increases following its historical trend up to 2030 to support capital investments on renewable energy, mainly wind and solar PV, present a rapid decline in the annual subsidy amount, in line with a conservative fiscal policy focused on reducing the burden of subsidies as soon as possible in favor of the national budget. In this case, the average electricity tariff results in US$ 85.16/MWh (IDR 1.25 million/MWh), 7.17% higher than the Baseline, involving a net income for PLN of US$ 1,091 billion over the period (IDR 16,139 trill). On the subsidies side, the average subsidy rate is US$ 9.42/MWh (IDR 139,350/MWh) totaling an over-the-period government disbursement of US$ 100.64 billion (IDR 1,488 trill).

Figure 4.11 Electricity subsidies, subsidy rate and BPP rate in the NZE scenario, variable tariff



In the NZE to 2050 scenario, the fuel cost counterbalances the capital recovery costs[46]. Thus, it's probable that by 2043-2044, electricity subsidies will become unnecessary, as the tariff with cover the BPP. The findings on subsidy variation are summarized in Table 4.9.

Table 4.9 Subsidy summary for different scenarios

Scenario (2021-2040)	Total Subsidy (US$ billion)	Average electricity tariff (US$/MWh)	Average subsidy rate (US$/MWh)	Max. subsidy in a year (US$ billion)
Baseline	126.18	79.46	13.90	8.02
NZE, fixed tariff	319.33	69.19	25.39	21.74
NZE, variable tariff	100.64	85.16	9.42	7.61

46 IEA (2022), An Energy Sector Roadmap to Net Zero Emissions in Indonesia, IEA, Paris https://www.iea.org/reports/an-energy-sector-roadmap-to-net-zero-emissions-in-Indonesia, License: CC BY 4.0

4.1.3.2 Financial valuation of selected CFPPs

Early retirement of CFPPs will reduce the fixed asset value in the PLN's balance sheet. It will also disrupt IPP's revenue stream, affecting its capital investment recovery and overall income. This is the reason why an asset valuation becomes determinant prior to the decommissioning of power facilities. Such valuation has been carried out according to the following assumptions:

i. Both PLN and IPPs must receive a payment for every early-retired CFPP, equivalent to the asset value at its retirement year. Valuation is expressed in terms of present value (2022), considering the remaining lifetime at that year.
ii. An independent valuation carried out by the ADB throughout a Technical Assistance for Indonesia, Philippines and Vietnam in 2021, based on market-based methodology has been considered appropriate to be taken as starting value to determine the actual value for the CFPPs and consequently as the starting value to determine the payment value at the retirement year.
iii. A secure and viable funding mechanism should be implemented to guarantee and facilitate the corresponding payment to CFPP's shareholders at the year of its closure. The proposed mechanism is a trust fund. The Government of Indonesia would deposit into this fund in advance, every year before the planned closure date, an equal yearly installment calculated to complete the value of every CFPP at the year of retirement. This payment should be made provided the CFPP continues its electricity generation.

The calculation process to determine the yearly payment for every CFPP is as follows:

1. Determination of Yearly variation value

YV = Ae / El (Ec. 1)

YV = Yearly variation value
Ae = Actual value (at 2022)
El = Entire remaining lifetime

2. Determination of Value at Retirement Year

RYV = YV * Rl (Ec. 2)

RYV = Value at Retirement Year

Rl = Remaining lifetime at retirement year

3. Determination of yearly Payment to cover Value at Retirement Year, using a financial Lease Payment Formula

$Pm_t = Axi / (1 + i)^n - 1$ (Ec. 3)

Where,

Pm_t = Periodic payment from the first period to the final one.

Ax_i = Future value of the asset needed to be covered, at period "i"

n = number of periods from the first period to the final one.

The ADB's report "Opportunities to Accelerate Coal to Clean Power Transition in Selected Southeast Asian Developing Member Countries"[47]which present a CFPPs valuation exercise based on a peer reviewed methodology considered as an independent source of valuation data for the CFPPs included in this project. The results of the payment estimation for IPPs and PLN facilities are described in Table 4.10 and Table 4.11.

Table 4.10 Payment estimation for IPP facilities

CFPP	Value at Retirement Year (US$ Million)	Payment for Retirement Fund (US$ Million per year)
Celukan Bawang Unit 1, 2, 3	570.00	257.20
Cilacap Unit 1, 2	674.67	195.98
Cirebon Unit 1	622.29	56.58
Keban Agung Unit 2	281.74	36.76
Paiton Unit 5, 6	-	-

47 ADB (2022) Opportunities to Accelerate Coal to Clean Power Transition in Selected Southeast Asian Developing Member Countries: Technical Assistance Completion Report.

Table 4.11 Payment estimation for PLN facilities

CFPP	Value at Retirement Year (US$ Million)	Payment for Retirement Fund (US$ Million per year)
Ombilin Unit 1, 2	140.80	132.14
Air Anyir Unit 1, 2	91.83	86.18
Labuhan Angin Unit 1, 2	333.36	312.86
Tanjung Balai Karimun Unit 1, 2	20.85	9.45
Sebalang Unit 1, 2	293.33	132.96
Bukit Asam Unit 1, 2	-	-
Tarahan Unit 3, 4	242.00	70.62
Nagan Raya Unit 1, 2	281.60	59.49
Teluk Sirih Unit 1, 2	291.39	61.56
Pangkalan Susu Unit 1, 2	528.00	111.54
Suralaya Unit 8	770.00	162.66
Suralaya Unit 1, 2, 3, 4	-	-
Suralaya Unit 5, 6, 7	-	-
Pacitan Unit 1, 2	756.00	123.27
Labuan Unit 1, 2	666.95	108.75
Adipala Unit 1	807.84	105.40
Rembang Unit 1, 2	665.28	87.19
Lontar Unit 1, 2, 3	1,029.60	134.94
Paiton Unit 1, 2	-	-
Paiton Unit 9	663.77	71.89
Tanjung Awar-awar Unit 1, 2	718.67	65.64
Pelabuhan Ratu Unit 1, 2, 3	803.48	47.67
Indramayu Unit 1, 2, 3	435.60	20.24
Ende Unit 1, 2	8.21	0.34
Tidore Unit 1, 2	8.87	0.37
Anggrek Unit 1, 2	38.03	1.42
Amurang Unit 1, 2	13.20	0.49

4.1.4 Final Remarks

The fiscal impact analysis has been categorized into two scenarios: High Fiscal Effort and Low Fiscal Effort. These scenarios reflect adverse and favorable progressions of their drivers, respectively. The primary features of each scenario are detailed in Table 4.12.

Table 4.12 Configuration of output scenarios

Scenario driver	High Fiscal Effort Scenario (Fixed tariffs for electricity and high subsidies)	Low Fiscal Effort Scenario (Variable tariffs and low subsidies)
Electricity tariffs	Fixed: Higher subsidies ETP NZE implementation	Variable: Lower subsidies. In some years even lower than in baseline scenario.

The outcomes for each scenario are given in Table 4.13 and Table 4.14 with present values for 2022. This presentation facilitates comparisons between them and the associated account in the Government budget. It's evident that the tariff schemes and related electricity subsidies lead to significant variations in the results.

Table 4.13 Results for the high fiscal effort scenario

FISCAL IMPACT ITEM	Annual average (US $ Million)	Revenues (%)	Expenditures (%)
A. Income Tax Increase from power generation (MUS$ at PV)	10.20	0.0067%	-
B. Income Tax Increase from mining sector (MUS$ at PV)	41.90	0.0276%	-
C. VAT decrease (MUS$ at PV)	-0.56	-0.0004%	-
D. NET REVENUES VARIATION	51.55	0.0339%	-
M. Subsidies variation in Fixed Tariff Scenario (MUS$ at PV)	5,369.57	-	2.63%
N. Payments for early retirement (US$ at PV)	476.82	-	0.24%
P. NET EXPENDITURES VARIATION	6,021.15	-	2.58%

FISCAL IMPACT ITEM	Annual average (US $ Million)	Revenues (%)	Expenditures (%)
Net Fiscal Impact (Detrimental; MUS$ at PV): P - D (1)	5,969.61	-	2.66%

Table 4.14 Results for the low fiscal effort scenario

FISCAL IMPACT ITEM	Annual average (US $ Million)	Revenues (%)	Expenditures (%)
A. Income Tax Increase from power generation (MUS$ at PV)	10.20	0.007%	-
B. Income Tax Increase from mining sector (MUS$ at PV)	41.90	0.028%	-
C. VAT decrease (MUS$ at PV)	-0.56	0.000%	-
D. NET REVENUES VARIATION	51.55	0.034%	-
M. Subsidies variation in Fixed Tariff Scenario (MUS$ at PV) (1)	-470.28	-	-0.24%
N. Payments for early retirement (US$ at PV)	476.82	-	0.25%
P. NET EXPENDITURES VARIATION	6.54	-	-0.24%
Net Fiscal Impact (Detrimental; MUS$ at PV): P - D (2)	-27.64	-	-0,00

Notes: (1) The percentage for Net fiscal impact is based on the 2020 Budget, projected until 2022; (2) Negative values in expenditures and Net Fiscal Impact indicate a positive outcome for the government. Specifically, expenditures would decrease in the Low Fiscal Effort Scenario.

From the data in the above tables, the primary takeaways are:

- The electricity subsidy is the principal determinant in fiscal impact due to its considerably larger values compared to other components.
- Tariffs, being the defining variable for subsidies, play a pivotal role in fiscal impact. Specifically, fixed tariffs yield a more pronounced fiscal effect.

- Other significant factors affecting the final fiscal impact include a) funding expenditures for early retirements, and b) increases in income tax from mining companies due to coal exports.
- Some drivers exert minimal influence on the overall fiscal impact.

5 Potential GHG emission reductions

Early retirement for CFPP has a significant potential to reduce CO_2 emissions. It has been estimated that by implementing the early retirement program, as described in section 3.1, annual emissions with the ETP NZE scenario could be reduced 61% (1,470 $MtCO_2e$) by 2040, compared to the Baseline Scenario, if renewable energy targets are met. Though direct monetization from carbon offsets and the VCM could be difficult to access early CFPP retirement with today's international standard carbon projects' requirements, there are other opportunities that can be developed to benefit from this new revenue stream that can support decarbonizing the Indonesian economy. The ETP-NZE scenario includes both the retirement roadmap for the selected 32 CFPPs, described in section 3.1, and the additional energy volume of 7.2TWh that should be retired to meet the government's NZE targets in time.

Other abatement solutions can realize the potential GHG emission reduction. CFPP emission intensity can be abated by retrofitting CFPPs through the implementation of other solutions such as Carbon Capture Utilization and Storage (CCUS), converting the units to use low-carbon fuels like natural gas, biomass, or ammonia[48]. The Indonesian government and PLN have been studying the possibility of other mitigation solutions such as Carbon Capture Utilization and Storage (CCUS). PLN has stated to have intentions of having CFPPs operating with CCUS by 2035, however, its implementation still faces economic challenges[49].

5.1 Potential emission reductions

5.1.1 Potential emission reductions from retirement

Indonesia has pledged in its Nationally Determined Contribution (NDC) to reduce national GHG emissions by at least 31.89% by 2030. In the last years, the energy sector has become the second largest emitting sector in the country, accounting

[48] IEA (2021), Phasing Out Unabated Coal: Current Status and Three Case Studies, IEA, Paris https://www.iea.org/reports/phasing-out-unabated-coal-current-status-and-three-case-studies, License: CC BY 4.0

[49] ASEAN Centre of Energy (2021) Role of Carbon Capture Utilization and Storage (CCUS) in Low-Carbon Development in ASEAN. From: https://aseanenergy.org/role-of-carbon-capture-utilisation-and-storage-ccus-in-low-carbon-development-in-asean/

for 29% of the total national emissions[50]. Therefore, reducing the energy sector's emissions will be key to achieving the target timely, and since the largest share of energy comes from coal-fired power plants, it is important to implement an early retirement program.

In 30 years, coal-fired generation has doubled from 30% of the national energy supply to over 60%. In turn, this growth has led to an accelerated increase in GHG emissions from such a generation.

Implementing an early retirement program has the intention to slow down the GHG emission growth trend and reduce its volume annually. To assess the effects that the ETP NZE would have in mitigating GHG emissions, its implementation has been compared to a Baseline scenario, to quantify the emission reduction potential with the proposed roadmap. The ETP NZE scenario includes both the retirement roadmap for the selected 32 CFPPs, described in chapter 3.2, and the additional energy volume of 7.2TWh that would be required to retire to meet the government's NZE targets in time. The Baseline scenario assumes that all the CFPPs selected for this study, listed in operate beyond the typical 30 years lifespan[51] and will continue to operate until 2040. The emission generated or avoided by the 32 CFPPs has been calculated using the corresponding emission intensity estimated, The emissions corresponding to the additional energy volume have been estimated using the overall emission intensity of the 32 CFPPs. The latter, under the assumption that the following CFPPs to be retired would have similar characteristics than the first 32.

By implementing the ETP NZE scenario described in section 2.1.2, emissions from unabated CFPPs could be reduced by 61% by 2040 compared to Baseline. The following figure shows the CO_2 equivalent emissions that could be reduced with the ETP NZE compared to the Baseline scenario.

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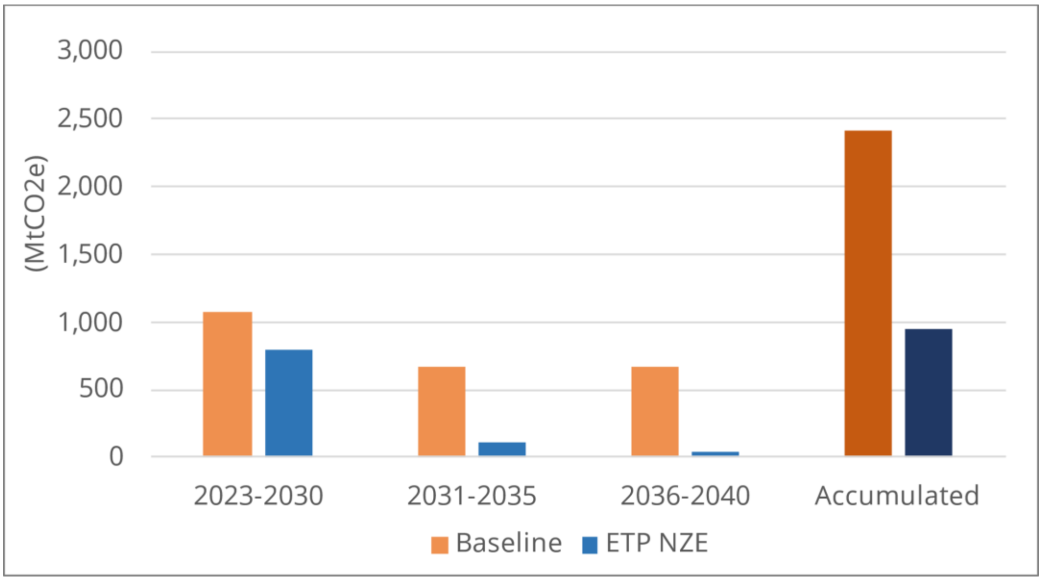
[50] IESR (2021) Indonesia Energy Transition Outlook 2022. Tracking Progress of Energy Transition in Indonesia: Aiming for Net-Zero Emissions by 2050. Jakarta: Institute for Essential Services Reform (IESR).

[51] IEA (2022), Enhancing Indonesia's Power System, IEA, Paris https://www.iea.org/reports/enhancing-Indonesias-power-system

Figure 5.1 ETP NZE Vs. Baseline Generated Emissions from 2023 to 2040, bar graph.



To compare the impact of the ETP NZE on GHG emissions reduction, four retirement scenarios were defined. To do so, the simulated years of early retirement for the 32 CFPPs were used, and it is assumed that the additional energy volume is retired in 2039. This analysis assumes that the CFPPs' CF will not change over the next 18 years.

The four comparative scenarios are the following:

A. **Baseline:** According to the International Energy Agency (IEA) the typical lifetime of a CFPP is 30 years, however, some power plants in Indonesia with over 30 years are currently in operation. For such reason, the Baseline scenario considers that the 32 CFPPs will continue operating until 2040 regardless of their commercial operation date (COD).
B. **ETP Net-Zero Emission (ETP NZE):** Assumes that the simulated early retirement scenario, described in section 2.1.2, is applied and executed on time for the three established periods of retirement, the last one ending in 2040.
C. **CFPP 30-year lifespan (CFPP-30):** This scenario shows the emissions from 2023 to 2040 if all 32 CFPPs were retired 30 years after their commercial operation date (COD). This scenario assumes that the two CFPPs with over 30 years of operation had already been retired.
D. **CFPP 35-year lifespan (CFPP-35):** The last scenario follows the idea of scenario C, except that the lifetime is capped at 35 years. This scenario

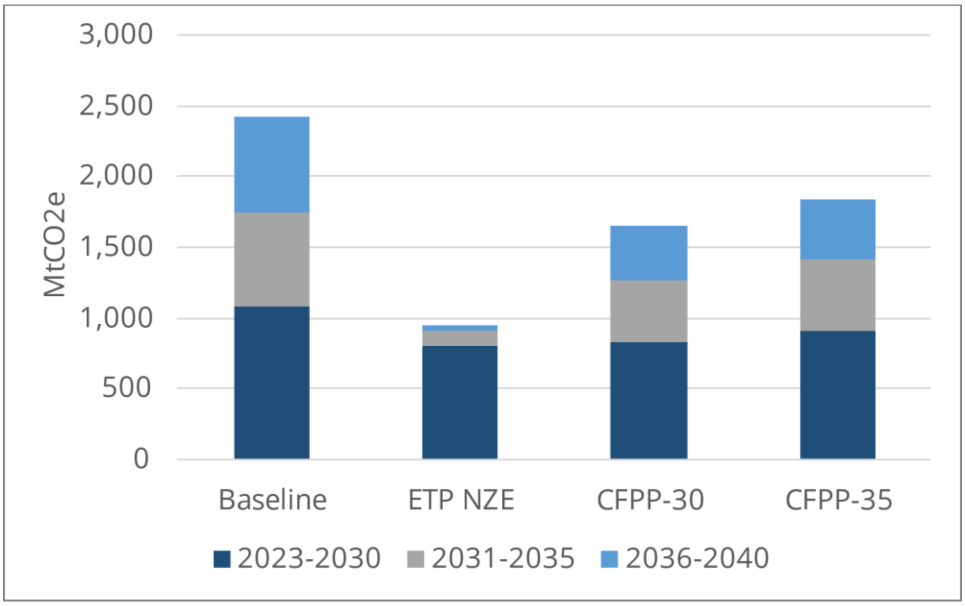
allows CFPPs soon-to-be 30 to retire in a few years but sets a strict year cap for their retirement.

Table 5.1 summarizes the GHG emissions reduction for each scenario compared with the Baseline scenario. Results show that setting a 30-year lifetime cap on the CFPPs, being a straightforward retirement criterion, would result in about half of the emissions reduction that could be reached by ETP NZE, however, this would imply that 1.7GW currently operating had already been retired and that additional ~2.8GW should be shut down in the next five years. On the other hand, setting a lifespan of 35 years would also be a simple metric to retire CFPPs, it would allow for CFPPs to operate beyond their common 30-year lifespan as it has been done with currently operating power plants in Indonesia, but the potential reduction of emissions would naturally be smaller than what the CFPP-30 can achieve. Finally, the ETP NZE, which follows the NZE scenario set by the Indonesian government could result in a 63% reduction of emissions compared to the Baseline scenario.

Table 5.1 Emissions generated in each scenario and its reduction against Baseline scenario

($MtCO_2e$)	Baseline	NZE	CFPP-30	CFPP-35
2023-2030	1,076	801	834	913
2031-2035	672	111	426	500
2036-2040	672	39	396	426
Total	2,421	951	1,657	1,840
Emission reduction against Baseline	-	-61%	-32%	-24%

Figure 5.2 Generated emissions in each scenario by roadmap's periods.



The comparative outcomes were obtained considering that the generated emissions reported in these scenarios correspond to the generation from the 32 CFPPs plus the addition volume of energy required to fully meet the ETP NZE scenario.

5.1.2 Potential emission reductions from other solutions

Measures for decarbonizing the power sector, particularly coal fleets, are available in different alternatives. The recently published World Energy Outlook 2021 highlights the need to end investment in new unabated coal-fired power plants, as well as strategies to retrofit, repurpose or retire existing ones.[52] Reflecting on this statement, ending the era of new CFPPs becomes fundamental—and should come first—to help governments focus on dealing with the existing fleets. This section presents an overview of potential emissions reductions from coal fleet decarbonization, focusing on solutions other than retirement. Table 5.2 is provided to summarize different alternatives for decarbonizing CFPPs.

[52] Alvarez, C. F., et. al. (2021). Phasing Out Unabated Coal: Current status and three case studies. International Energy Agency.

Table 5.2 Different alternatives for decarbonizing CFPPs

Category	Sub-category
Retire	Maintain & standby: maintain the plant for a potential restart; otherwise, the plant will be decommissioned.
	Decommissioning: demolish equipment and material, and remediate the site
Repurpose usually follows the retirement category, particularly decommissioning.	For renewable energy & energy storage systems, e.g. solar photovoltaic, wind, biomass, BESS, etc.
	For other uses (non-power generation purposes): industrial use, commercial use, afforestation, etc.
Retrofit, covering various energy efficiency measures	Carbon Capture and Storage (CCS) and Carbon Capture, Utilization, and Storage (CCUS) systems.
	Firing or co-firing with alternative fuels, usually biomass (co-firing) and green ammonia (firing)
	Repowering: replacing existing plant equipment to improve plant performance, including the coal to natural gas substitution, combustion-turbine (CT)-based repowering, solid fuels repowering, etc.

As discussed in the previous section, the retirement—and specifically early retirement—of CFPPs will result in a significant amount of emissions reduction as the plant operation is ceased. By retiring a CFPP, in some cases, the plant will go to a "maintain & standby" state; and in others, the plant will be decommissioned.[53] Despite its significance to emissions reduction, retiring CFPPs usually comes with long and careful considerations to mitigate its potential impacts on energy security, fiscal, and societal welfare, etc. In mitigating these impacts, especially where CFPPs are dominant to the power system, replacement of the retired CFPPs is usually needed.

Addressing the need for the replacement of retired CFPPs, repurposing presents as an alternative. As a means of securing the electricity supply, a retired CFPP facility can be repurposed for renewable energy (RE) and/or energy storage

[53] The "Maintain and standby" is considered a temporary state where the plant operation is ceased but it will be eventually restarted or decommissioned.

systems (ESS) projects, after the coal plant is decommissioned. Besides compensating for the loss of electricity supply from the retired coal plant, repurposing the site for RE and/or ESS projects will also have the advantage of using the existing transmission lines—reducing the need for building new transmission infrastructure. Where replacement to a low-carbon power generation is not pursued, a retired CFPP site can be repurposed for other uses by taking advantage of the site characteristics and surrounding infrastructures. This may cover repurposing for industrial use (e.g., petrochemical plant, industrial estate), commercial use (e.g., ports, terminals, data centers), etc. Where possible, repurposing retired CFPPs can also be implemented to facilitate non-energy sector climate mitigation projects, such as afforestation.

Options for decarbonizing coal facilities besides retirement and repurposing fall under the retrofitting category. Retrofit decarbonization is an umbrella term that includes adding carbon capture, fuel conversion, and the replacement of coal boilers with new low-carbon energy sources—in each case re-using as much of the existing equipment as economically practicable while reducing or eliminating emissions.[54] This category typically covers energy efficiency measures aiming to reduce emissions and improve technical performance.

Carbon Capture and Storage (CCS) and Carbon Capture, Utilization, and Storage (CCUS) serve as the most direct means of decarbonizing CFPPs under the retrofit category. In choosing this option, a coal facility should be assessed to identify its suitability criteria for CCS/CCUS retrofit such as access to CO_2 storage, age, size, load factors, local policy and strategic factors, and space availability. This solution can abate around 90% of emission, as it has been proven by the retrofitting of the 100 MW Boundary Dam Power Station in Canada[55].

Coal conversion to renewable fuels, through biomass co-firing or green ammonia firing, also becomes an option for retrofitting coal plants. GHG emission can be reduced up to 21% by retrofitting the CFPP to biomass co-firing, however, this solution is limited by the biomass supply from nearby industries[56]. Another

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[54] Qvist, S. (2021). *Retrofit Decarbonization of Coal Power Plants – A Case Study for Poland*. Energies 2021, 14, 120. https://doi.org/10.3390/en14010120

[55] ASEAN Centre for Energy (2017) ASEAN Clean Coal Technology (CCT) handbook for power plants. From: https://www.jcoal.or.jp/eng/upload/ASEANCCTHandbook_V2.pdf

[56] Knapp, S., Güldemund, A., Weyand, S. *et al.* Evaluation of co-firing as a cost-effective short-term sustainable CO_2 mitigation strategy in Germany. *Energy Sustain Soc* **9**, 32 (2019). https://doi.org/10.1186/s13705-019-0214-3

solution available under the retrofit category is repowering. This option is broadly defined as an addition to or replacement of existing coal plant equipment, retaining serviceable permitted components to improve generation economics, extend life, improve environmental performance, enhance operability and maintainability, and more effectively use an existing site.[57] With a broad definition, repowering solutions vary from coal to natural gas conversion, combustion turbine (CT)-based repowering, solid fuel repowering, etc.

In conclusion, there is a myriad of solutions that could be considered to reduce emissions of CFPPs, though, retrofitting may not be as ambitious as retirement and repurposing.

5.2 Monetization of the emissions reduced.

In 2021, two regulations underlining carbon pricing were enacted, Law No.7/2021 on the Harmonization of Tax Regulations which addresses the carbon tax, and Presidential Regulation No. 98/2021 on the Carbon Pricing which regulates the general instruments for carbon pricing. The implementation of a carbon tax (CT) only for CFPPs with over 100MW of installed capacity was planned to start operating in July 2022. Its application was postponed avoiding a larger rise in fuel and food prices. [58] As stated in the Harmonization on Tax Regulation Law, the tax will start at 30 IDR/kgCO_2e[59].

As per this study published, the CT was planned to be implemented in 2025 by a cap-and-tax mechanism.[60] Considering the uncertainties and readiness of the mechanism, this study assumes that all the CFPP emissions are subject to the CT to provide initial insight into potential monetization from the CFPP early retirement program.

[57] Stoll, Harry G., et. al. *Performance and Economic Considerations of Repowering Steam Power Plants* (GER-3644D). GE Industrial & Power Systems.

[58] Fiscal Policy Agency. (2022, July). *Instrumen Pajak Karbon Terus Disempurnakan di Tengah Risiko Global* [Carbon Tax Instruments Continue to be Improved Amid Global Risk]. Ministry of Finance of the Republic of Indonesia. https://fiskal.kemenkeu.go.id/publikasi/siaran-pers-detil/402

[59] Christi, P. (2022, June) *Does Indonesia's Carbon Tax Have the Power to Trigger a Sustainable Market Shift?* ADB. https://seads.adb.org/solutions/does-Indonesias-carbon-tax-have-power-trigger-sustainable-market-shift

[60] CNBC Indonesia (2022). *Pajak Karbon Ditunda Sampai 2025*. From: https://www.cnbcIndonesia.com/news/20221013175437-4-379582/pajak-karbon-ditunda-sampai-2025

An analysis was run, using the previously described Baseline and ETP NZE scenarios, to estimate the economic impact of implementing the roadmap if the carbon tax were to come into operation in 2023.

The emissions of the CFPPs were estimated considering the CO_2eq emission intensity value used as input in the early retirement decision framework, estimated from the type of coal each power plant uses, its annual generation and coal consumption. The emissions corresponding to the additional energy volume have been estimated using the overall emission intensity of the 32 CFPPs. It is also assumed that the other CFPPs to retire that would cover the additional energy volume to be retired will have an installed capacity of over 100MW, therefore, CT would be applicable to them.

Table 5.3 shows the monetization that the early retirement program would have through CT, considering the CT that does not change through time. The implementation of the roadmap could represent a 61% reduction in carbon tax collection, compared to what could be collected if the 32 CFPPs and the additional energy volume would continue to operate under the Baseline, if CT stayed flat.

Table 5.3 Table showing the tax collection from a carbon tax

Scenario	Period	Tax collection from 2023 to 2040 (Billion IDR)	Tax collection from 2023 to 2040 (Million US$)[61]
Baseline	**Total**	**71,840**	**4,856**
	2023-2030	31,929	2,158
	2031-2035	19,955	1,349
	2036-2040	19,955	1,349
ETP NZE	**Total**	**28,106**	**1,900**
	2023-2030	23,792	1,608
	2031-2035	3,199	216
	2036-2040	1,115	75

61 14,793 IDR/US$, Average exchange rate of 2022. From: https://www.bi.go.id/en/statistik/informasi-kurs/transaksi-bi/Default.aspx

5.2.1 Offsetting Revenue

A carbon offset represents one metric ton of carbon dioxide equivalent (CO_2e) as a GHG that has been permanently removed from the atmosphere or avoided from being emitted by a source. RE projects can create carbon offsets because the energy they generate reduces the amount of energy that must be procured from other projects using fossil fuels, such as CFPP. It is important to note that carbon offsets are not all equal in terms of their value, and that determining their value is not straightforward given the variety of projects that generate carbon offsets and their attributes.

Revenue originating from the carbon offsets derived from early coal retirement could theoretically originate from the compliance or voluntary carbon markets. Though theoretically plausible to argue that there are net reductions in emissions by closing CFPPs earlier, now it would be difficult to have market demand for offsets originating from early retirement of CFPPs. For a project to be credited by any of the international standards, it must demonstrate permanent GHG emission reductions. Early CFPP retirement does not ensure permanent GHG emission reductions, given that the coal that otherwise would go to the CFPP will be used elsewhere, therefore not reducing permanently the emissions. This phenomenon is otherwise called *carbon leakage,* where a carbon offset project unintentionally increases emissions in another location. Nevertheless, an option to consider generating carbon offsets could be additional projects or mitigation technologies applied to the CFPPs' operations, e.g., carbon capture use and storage (CCUS), cofiring technology or high efficiency, and other low emissions technologies. The addition of these technologies can add significant benefits to the GHG emissions reductions of a CFPP, thereby absolutely reducing its emissions.

The national government could also prioritize the development carbon offset projects generation based on permanent carbon removal, such as biochar, using waste biomass that would otherwise be burnt or left to decompose, with the objective of domestic use or reaching exports. Examples of other carbon offset projects include waste to energy projects, where methane is captured from landfill gas or agricultural waste and then converted into energy. However, exploring any of these options would require its own detailed analysis.

Chapter 2: On regulatory analysis and financing opportunities of early retirement of coal-fired power plants in Indonesia

UNOPS
Energy Transition Partnership

Study on the Financial Implications of the Early Retirement of Coal-fired Power Plants in Indonesia

6 Indonesia policy and regulatory state of play

At the G20 summit held in Bali in November 2022, the Government of Indonesia (GOI) announced its endorsement of the JETP. This translates to power sector peak emissions by 2030, i.e., no more than 290 $MtCO_2$, and reaching net-zero emissions (NZE) by 2050, which is 10 years sooner than its climate neutrality goal declared at COP26. By endorsing the JETP objectives, the GOI also sets the objective of increasing its renewable energy penetration up to at least 34% of its energy generation mix by 2030.

One of the programs relevant to NZE 2050 is the early retirement of CFPPs. The program indeed must be in accordance with the targets and plans of the Government of Indonesia which have been stated in the policies and regulations as well as the Nationally Determined Contribution (NDC), the Long-Term Strategy for Low Carbon and Climate Resilience (LTS-LCCR) 2050, and other supporting documents.

6.1 Gaps and Limitations

After stock-taking existing policies, regulations, and programs concerning energy transition in Indonesia, especially the coal phase-out, gaps and limitations were identified.

6.1.1 Energy Transition Roadmap

Though there have been continuous announcements of ambitious goals to decarbonize and reduce emissions, the government is yet to put the energy transition—including the coal phase-out—roadmap into planning documents. Currently, the government, under the coordination of the National Energy Council (*Dewan Energi Nasional*, DEN), has been preparing the energy transition roadmap toward NZE in 2060 or sooner, however, has yet to be published. The government also plans to update the National Energy Policy (KEN) and National General Energy Plan (RUEN) to adopt the visions of net zero emissions into the documents. Considering the energy transition is part of a long-term national energy policy—and requires synergized transformation across sectors—the government urges national support and collaboration in the planning process to obtain an aligned

NZE scenario.[62] To this objective, the sectoral planning documents, as stipulated by Presidential Regulation 112/2022, are yet to be developed to guide sectors towards accelerating coal phase-out. Aligned with this planning, the government will develop a roadmap for 2030 in the power sector in line with the net zero targets as stated in "the first six-month" Indonesia JETP plan.

Many studies regarding the net zero emissions roadmap, specifically in the electricity sector, have been performed by the government, including some with assistance from donors and development partners. Scenarios have been developed by introducing different pathways to achieve the NZE target, including renewable energy deployment, Carbon Capture and Storage (CCS) and Carbon Capture Use and Storage (CCUS) implementation, nuclear power, etc. With many pathways presented, the government needs to assess and eventually determine the pathway to be taken for transitioning the country's energy landscape—this will include alternatives for replacing the early retired CFPPs. Several studies that have been identified and related to the current study are depicted in the table below.

[62] Aligned with the ETP's strategic outcome area, i.e., *policy alignment with climate commitments*, this study will provide inputs to the government in the energy transition planning from the analysis, evaluation, and provision of recommendations on the current and alternative coal phase-out pathways with respect to the financial implications.

Table 6.1 Preliminary identification of similar existing studies

Scope	Consultant – Beneficiaries							
	Mott MacDonald – ADB ETM	**McKinsey – PLN**	**MEMR**	**Hartree Consortium – ETP, Bappenas, MoF, MEMR, PLN**	**Carbon Trust, Asia Grup Advisors, & Climate Smart Ventures – ADB ETM**	**USAID SINAR – Special Presidential Envoy for Climate, USA**	**IESR**	**RMI – CMMIA**
Scenario Highlight	Optimized Scenario	Optimized Scenario	Mix of simulation/ optimization	Simulation	Optimized Scenario, but retirement schedule is an input	-	Optimized	Financial modelling for specific asset
National Supply-Demand Projection	✓	✓	✓	**		✓	✓	
National PP Generation Shares Projection	✓	✓	✓	**		✓	✓	
CFPP Screening Tools	✓		✓	✓	✓		✓	
CFPP Retirement Cost	✓	*		✓	✓		✓	✓
Emissions Projection	✓	✓	✓	✓	✓	✓	✓	
Just Transition	✓			✓		✓	✓	✓
Health Impact	✓					✓	✓	
PLN Financial Impact				✓				✓
Fiscal Impact				✓				
Financing Options Idenfitication				✓				✓

* While the study indicates CFPP's early retirement plan and estimates CAPEX for power plants and grid, it is not clear yet whether the CFPP early retirement cost has been considered.
** The scope of work does not include projection of the electricity demand & supply and the regional shares of power generation. However it is deemed required as it would be difficult to estimate the fiscal impact without exercising these projections.
Disclaimer: Compiled based on preliminary identification of published presentation on a public and closed discussion. Confirmations are required.

Looking into the power system landscape, renewable energy resources and centers of electricity demand are not conveniently co-located in Indonesia.[63] With growing calls for energy transition toward NZE, this characteristic becomes a

[63] IESR. (2021). *Indonesia Energy Transition Outlook 2022. Tracking Progress of Energy Transition in Indonesia: Aiming for Net-Zero Emissions by 2050.* Jakarta: Institute for Essential Services Reform (IESR).

significant challenge and improvements in the power system landscape are undoubtedly required. The current Electricity Supply Business Plan (RUPTL 2021-2030), for example, accommodates more share of renewables in the total capacity addition compared to the previous RUPTL, accounting for 51.6% of planned capacity addition until 2030.[17] Additionally, Just Energy Transition Partnership which committed to mobilizing US$ 20 billion intends to accelerate renewable energy (RE) deployment so the share can comprise at least 34% of all power generation by 2030.

This is not to mention the need for additional renewable energy generation as an option to replace early retired CFPPs. In dealing with this changing landscape, assessments concerning security in the electricity sector—including grid stability and flexibility, supply and demand balance, interconnectivity (super grid), etc.—should be performed to ensure a secure energy transition.

6.1.2 Carbon Pricing

Carbon pricing is an enabler for CFPP retirement; however, the carbon pricing roadmap is still unclear, despite several regulations had been enacted:

- Presidential Regulation 98/2021 on Carbon Pricing[64] stipulates four mechanisms that can be implemented i.e., carbon trading (carbon allowance trading and carbon offset), carbon levies (including carbon tax), result-based payment (RBP), and other mechanisms.
- Law 7/2021[65] on the Harmonization of Tax Regulations stipulates the carbon tax mechanism.
- MoEF Reg. 21/2022[66] as the first derivative of the Carbon Pricing Regulation stipulates the governance for implementing carbon pricing mechanisms, covering carbon trading, carbon levies, RBP, and other mechanisms. It also defines the Monitoring, Reporting, and Verification (MRV) of the carbon pricing implementation; enforcement of the National Registry System on Climate Change Control (SRN-PPI); certification of emission reduction

[64] Government of Indonesia. (2021) *Presidential Regulation 98/2021 on Carbon Pricing Implementation for Achieving National Determined Contribution (NDC) Target and Controlling GHG Emission in National Development*

[65] Government of Indonesia. (2021) *Law 7/2021 on the Harmonization of Tax Regulations*

[66] Ministry of Environment and Forestry. (2022). *Minister of Environment and Forestry Regulation 21/2022 on the Governance of Carbon Pricing Implementation*

achievements; management of funds on carbon trading; and monitoring and evaluation.

These existing regulations, however, still need to be derived further into sectoral regulations. Today, the Presidential Regulation on Carbon Pricing and Law on the Harmonization of Tax Regulations only set up general rules of the carbon pricing instrument, line-ministries (MEMR, MoEF, MoI, etc) is required to develop more detailed regulations. This is also in line with the Carbon Pricing Regulations itself which states that details rules will be set by the relevant line-ministries.

Although cap-and-trade (emissions allowance trading) was exercised voluntarily at the pilot level for CFPPs[67], there is currently no information on how the government will implement carbon pricing mechanisms as the sectoral regulations are still being prepared. The carbon tax implementation, which was originally planned for July 2022, was also postponed by the government considering the development status of the carbon market, sector readiness, and economic conditions.[68]

The lacking clarity on the implementation of carbon pricing mechanisms makes more difficult the financial cost-benefit analysis on plausible transactions to early retire CFPPs. Additionally, any carbon pricing mechanism could add a revenue stream to facilitate GOI fiscal revenue, which could enable sustainable financing mechanisms, subject to the carbon price not being offset by government subsidies.

6.1.3 Finance Frameworks

At COP26, 2021, Asian Development Bank (ADB) along with Indonesia and the Philippines launched the Energy Transition Mechanism (ETM), a transformative, blended-finance approach that seeks to retire existing CFPPs on an accelerated schedule and replace them with clean power capacity. The mechanism will comprise two multibillion-dollar funds: one devoted to early retirement or

[67] It was added as a new category i.e., "Emission Trading and Emission Reduction in the Power Sector" in the Subroto Award for Energy Efficiency—the national energy efficiency award—in 2021. However, this category has not been applied in the award this year, 2022.

[68] Fiscal Policy Agency. (2022, July). *Instrumen Pajak Karbon Terus Disempurnakan di Tengah Risiko Global* [Carbon Tax Instruments Continue to be Improved Amid Global Risk]. Ministry of Finance of the Republic of Indonesia. https://fiskal.kemenkeu.go.id/publikasi/siaran-pers-detil/402

repurposing of CFPPs on an accelerated timeline, and the other focused on new clean energy investments in generation, storage, and grid upgrades.[69]

Later at a side event at G20, in November 2022, Indonesia officially launched the ETM Country Platform to facilitate Indonesia in preparing an energy transition investment plan and climate investment funding to accelerate the retirement of CFPPs. Through the Ministry of Finance Decree No. 275 of 2022 The government has appointed state-owned enterprise PT Sarana Multi Infrastruktur (Persero)—PT SMI—as the fund manager of the Energy Transition Mechanism (ETM) Country Platform.[70] As the platform welcomes the involvement of all investors—including the Asian Development Bank (ADB), the World Bank, the Indonesian Investment Authority (INA), the Glasgow Financial Alliance for Net Zero (GFANZ), other multilateral development agencies, state, private sector, and philanthropists—the fund manager will provide fiscal support for the energy transition as well as the financing framework.[71]

While the ETM Country Platform has been established, the government has yet to set out regulations and taxonomies to allocate funds for accelerating the energy transition. Finance mechanisms supporting energy transition pathways, including CFPPs' early retirement, are expected to be defined in regulations. Addressing the need for regulatory development, the government has started preparing the Draft Minister of Finance (MoF) Regulation "Supporting the Acceleration of Energy Transition in the Electricity Sector to Achieve Sustainable Development Goals through Companies (PT SMI)".[72]

As blended finance is to be developed in the energy transition platform, PT SMI as the fund manager opens for co-participation to mobilize both public and private funds. Public funds are foreseen to be delivered as concessional loans,

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[69] ADB. (2021, November 3). *ADB, Indonesia, the Philippines Launch Partnership to Set Up Energy Transition Mechanism.* Asian Development Bank. https://www.adb.org/news/adb-Indonesia-philippines-launch-partnership-set-energy-Agtransition-mechanism

[70] Oliva V, Agatha & Ruhman, Fadhli. (2022, July 14). *PT SMI designated country platform manager for energy transition*. ANTARA News. https://en.antaranews.com/news/239281/pt-smi-designated-country-platform-manager-for-energy-transition

[71] Fiscal Policy Agency. (2022, July). *Indonesia Luncurkan Country Platform untuk Mekanisme Transisi Energi* [Indonesia Launches a Country Platform for Energy Transition Mechanism]. Ministry of Finance of the Republic of Indonesia. https://fiskal.kemenkeu.go.id/publikasi/siaran-pers-detil/404

[72] Crystallin, M. (2022, August). Fiscal Policy Towards Energy Transition to Achieve NZE Commitments [PowerPoint Slides]. Ministry of Finance of the Republic of Indonesia.

considering the lack of grants. To deliver funds from multilateral development banks (MDBs) and private sectors, the platform should address the Environment and Social Standards (ESS) requirements. In this case, PT SMI plans to adopt several notable ESS requirements (e.g., from the World Bank, the IFC, etc.) to update the existing standards[73] and set out ESS frameworks for the ETM Country Platform.

In addition to regulations, transition taxonomies are crucial to be set out to facilitate the mobilization of energy transition finance. Reflecting on the current status, the Indonesian Financial Service Authority (OJK) has issued a green taxonomy, titled "Green Taxonomy 1.0", providing a classification of economic activities which supports environmental protection and management efforts, as well as mitigation and adaptation to climate change.[74] This taxonomy has helped the financial services sector (FSS) to allocate their financing to green/sustainability projects and avoid greenwashing practices. However, this taxonomy has not yet covered broader activities in the energy transition context. With many transition partnerships coming forward, a more comprehensive green taxonomy—to cover energy transition measures, including CFPP retirement—is expected at the earliest.

With the Indonesia JETP announced at the G20 summit, the government will push collaborations to expedite the development of energy transition frameworks. As stipulated in the JETP joint statements, the government will first identify an existing entity to act as a secretariat.[75] Furthermore, the government—with administrative and technical support provided by the secretariat and with the collaboration of PT SMI—will develop a JETP investment and Policy Plan to identify the investment requirements and opportunities to deliver on the just energy transition.[29] Given the gaps and limitations of the financing frameworks, this plan will provide an outline of the policy reforms necessary to address any regulatory barriers in the energy and financial markets that hinder private investment for a just energy transition.

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[73] PT Sarana Multi Infrastruktur (Persero). (2022, 06 January). *PT SMI Apply ESS for Sustainable Business*. https://www.ptsmi.co.id/pt-smi-apply-ess-for-sustainable-business

[74] Indonesian Financial Service Authority. (2022). *Indonesia Green Taxonomy Edition 1.0 – 2022*. Indonesian Financial Service Authority.

[75] The European Commission. (2022, 15 November). *Joint Statement by the Government of the Republic of Indonesia and International Partners Group members of the Indonesia Just Energy Transition Plan*.

Having a unified transition roadmap could help all efforts from different governmental and non-governmental organizations to focused on the same goal and considering the same time frame. Likewise, defining the conditions under which carbon tax will be implemented would allow to have a detailed cost-benefit analysis considering possible tax collection.

7 Implications of roadmaps, policy, and financing frameworks

7.1 Risks and opportunities of early retirement

7.1.1 For PLN

7.1.1.1 PLN Opportunities

Decarbonization

Implementing the early retirement plan provides to PLN the opportunity to retire old and unused CFPPs which would perhaps otherwise incur in expenses for PLN. Implementing the ETP NZE could spur PLN not to engage in contracts with those that supply volumes of energy not demanded by the system and represent an extra capacity expense for PLN. Early CFPP retirement can bring with it an opportunity for PLN to restructure its finance, allowing for a change in cost of capital, freeing up cash to reinvest in cleaner technologies or required infrastructure. Non-current liabilities represent around 75% of the total liabilities; this will be of great importance during the study because the retirement program can't be done without figuring out what will happen to those liabilities as the shutdown of facilities begin. Keeping NZE and its objectives in mind, it would be best to focus on finding opportunities to invest in RE.

The early retirement roadmap is ambitious, given all the structural, legal, and financial changes that are required to retire one of the youngest CFPP fleet in the region. PPAs that have a duration of 20+ years and recently built coal plants with new technologies and lifetimes of 30+ years will pose a challenge and risk for the stability of the economic and energy system in Indonesia if they are decommissioned early.[76] Although systems like Java that have high reserve margins may not be in dire need of immediate replacement sources of energy, those whose energy security may be more at risk upon the early retirement of CFPPs will most likely need clear alternatives, not to mention enablers for those alternatives. If it were to be RE, it would require substantial investment in grid reinforcements. If not, combined cycle gas turbine and CCGT plants could be a

[76] International Energy Agency. 2022. *Enhancing Indonesia's Power System*.

viable alternative, since coal emits 86% more kgCO_2 per million BTU (British thermal unit) than natural gas.[77]

The access to cheaper and cleaner energy sources will allow to decrease subsidies now needed by PLN. How CFPPs fit in the energy system of the future is yet to be defined, but there are possibilities that could complement a low-carbon power sector. For example, CFPPs could be retrofitted to apply cleaner technology. This could include cofiring technology or high efficiency with low-emission technology.

Efficiency and profitability

The early retirement of CFPPs will allow Indonesia to retire old and inefficient plants, allowing to replace them by modern and efficient energy sources, providing a more profitable energy source in the medium and long term.

Subcritical coal-fired power plants—defined by the International Energy Agency as those with a carbon intensity of ≥880 kg CO2/MWh—are the least efficient among all types of coal-fired power generation, requiring more fuel and water to generate the same amount of power. The average subcritical CFPP releases 75% more carbon pollution than an average advanced ultra-supercritical—the most advanced form.[78]

In Indonesia, up to 79% of CFPPs are subcritical.[79] Of the 337 subcritical CFPPs, 92% have been found to be "new subcritical," or those that have a carbon intensity between 880–1,120kg CO_2/MWh—the most efficient of the subcritical CFPPs.[80]

The retirement of these inefficient CFPPs, which are also growingly unprofitable due to large volumes of coal required, can help alleviate some of the costs of maintaining these carbon-intensive facilities.

It is worth noting, however, that despite the clear need to prioritize the retirement of inefficient coal-fired power plants, another strong incentive to shut down a

[77] US Energy Information Administration (EIA) (2022). Carbon Dioxide Emissions Coefficients.

[78] Smith School of Enterprise and the Environment (2015). *Stranded Assets and Subcritical Coal The Risk to Companies and Investors.*

[79] L. Yuxuan and A. Renaldi (2022). Coal Fever in Indonesia. *Earth Journalism Network*. 13 January.

[80] Smith School of Enterprise and the Environment (2015). *Stranded Assets and Subcritical Coal The Risk to Companies and Investors.*

power plant is the ease with which contracts can be renegotiated. In the early stages of coal retirement, the government may be incentivized to accelerate the first round of retirement to demonstrate the country's commitment and ability to realize such a significant feat with the hopes of attracting much needed financing from interested investors. This may be more possible through IPPs, whose contracts tend to be clearer cut and could lend to easier renegotiations. Thus, the early retirement process of these CFPPs can be expected to be more streamlined and easier to carry out. Unfortunately, since these CFPPs are typically younger, they also tend to be more efficient. Still, PLN should keep in mind which CFPPs are inefficient to fulfill the country's decarbonization needs in the long-term.

Access to finance

Amid the global shift towards a low-carbon world, financiers will be looking to invest more in clean businesses. If PLN demonstrates its commitment to this same shift away from fossil fuels by leading coal retirement in Indonesia, it can have more access to finance and become a trusted entity for future investments as financiers look for such projects. Such a move by financiers has already been observed. For example, banks in the European Union are expected to abide by taxonomy reporting obligations in a few years and thus avoid financing coal-related operations.[81] In addition, refinancing options through various financing mechanisms offer attractive interest rates for asset owners.[82]

7.1.1.2 PLN Risks

Loss of assets

Although a viable option for PLN is to replace existing CFPPs with its own renewable energy facilities, there is a possibility that owners of new RE plants are not PLN. In the case of the Asian Development Bank's Energy Transition Mechanism, the group of investors who acquire a CFPP may also be the investors and owners of new RE facilities.[83] PLN then risks losing assets, along with its book value going down.

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[81] European Commission. *EU taxonomy for sustainable activities*.

[82] M. O'Boyle (2022). Inflation Reduction Act Benefits: Billions In Just Transition Funding For Coal Communities. *Forbes*. 24 August.

[83] ADB (2021). *Energy Transition Mechanism Explainer: How ETM Will Support Climate Action in Southeast Asia*. 3 November.

Management risks

Although PLN's business operations are mainly centered around electricity generation, transmission and distribution, it has also started delving into other projects such as smart grids and energy storage. Given the foreseen transformation of power generation in the country, PLN will most likely need to take on new business operations to keep up. For example, energy roadmaps are calling for the larger penetration of renewable energy, which means that PLN will most likely be managing more plants powered by renewable energy in the future. Other plans include increasing grid stability and improving energy storage. As a company that has primarily dealt with coal-fired power plants, PLN should be careful with how it manages such a diverse set of business operations to ensure their success.

Local content requirements

As PLN looks to retire CFPPs and fulfill energy security needs with new and renewable energy (NRE), the construction of facilities and the installment of new technologies become viable alternatives. Currently, Indonesia is enforcing several laws with stipulations regarding local content requirements (LCR), with Regulation No. 10 of 2006[84] by the Ministry of Industry providing the initial context for Indonesia's current LCR regime. A subsequent regulation—Presidential Decision No. 24 of 2018[85]—reinforced LCR in the country, tasking a team to monitor, supervise, evaluate, and promote the use of domestic products. Furthermore, the Strategic Plan of the Ministry of Industry 2020-2024[86] included LCR stipulations among its 13 strategic objectives. Indicators for its LCR goals are summarized in Table 7.1.

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[84] Government of Indonesia. Ministry of Industry (2006). *Regulation No. 10 of 2006 Regarding the Use of Domestic Production Machineries to Obtain Facilities on Import Duties for Goods and Materials*.

[85] Government of Indonesia (2018). *Presidential Decision No. 24 of 2018 Regarding the National Team on Increased Use of Domestic Product*.

[86] Government of Indonesia (2020). *Strategic Plan of the Ministry of Industry 2020-2024*.

Table 7.1 Targets for LCR indicators in the Strategic Plan of the Ministry of Industry 2020-2024

	Targets	
	2020	**2024**
Local content (weighted average) (%)	49%	53%
Local content in government procurement (goods and services) (%)	46.63%	52.48%
Products certified to have ≥ 25% local content	6,200 products	8,400 products
Standard Nasional Indonesia in Industries (%)	5%	20%

Despite the common belief that LCRs can provide many benefits—including protecting domestic industries from international competition; creating jobs for the local labor force; and promoting exports[87]—LCRs can serve as a hindrance to the advancement of NREs, since locally product components have typically been found to be more expensive compared to their imported counterparts. If forced to uptake locally produced components and pay steep prices, sectors may end up non-competitive. Taking the solar energy sector as an example, manufacturing for the solar energy sector has suffered due to its relatively small scale in Indonesia. Such projects have thus been deemed financially unfeasible due to these requirements. Given that a study in Indonesia revealed that "the contribution of imported intermediate inputs remain positive and significant to firm's productivity, output, value added, exports, and employment,"[88] LCRs may not create the proper environment for domestic businesses to grow. Thus, it will very likely prove to be difficult for PLN to pursue NRE development with strict LCR regulations in place.

[87] S.D. Negara (2016). The Impact of Local Content Requirements on the Indonesian Manufacturing Industry. *Yusof Ishak Institute*.

[88] S.D. Negara (2016). The Impact of Local Content Requirements on the Indonesian Manufacturing Industry. *Yusof Ishak Institute*.

Contracts

Along with the early retirement program, PLN could try to renegotiate PPAs with IPPs. Although this is not an easy task, national utilities in other countries like Ghana and Kenya are trying to modify one of the costliest clauses in PPAs: take-or-pay (TOP). State utilities have started to negotiate with IPPs to change TOP clauses to take-and-pay (TAP) clauses where the buyers' payment is not unconditional since the buyer is only committed to buy if the agreed volume is produced.[89] PLN could try to renegotiate PPAs to shift from TOP to TAP clauses. However, TAP transfers volume risks back to the IPPs which it could represent a significant challenge when renegotiating contracts.

7.1.2 For Indonesia's state fiscal conditions

7.1.2.1 Fiscal opportunities

The most relevant opportunities for Indonesian fiscal accounts are the following:

- The possibility of a high and permanent decrease (compared with baseline scenario) in subsidies and compensations for the power generation sector.
- A boost to consolidate a dynamic and completely sustainable sector for the Indonesian economy: A strongest and more extended Renewable energy sector.
- An increase in Income tax from mining sector thanks to the exports of coal released from CFPPS.

7.1.2.2 Relevant risks

- Political pressures for non-technical tariff management:

  The system used to establish Electricity tariffs are the key driver for fiscal impact. So, a public policy heavily biased to maintain fixed tariffs will generate a very significant increase in government subsidies for power generation and will decrease the availability of money to fund adequately the payment for early retirement and public participation in the financing mechanisms that could be used to promote aggressively the entrance of renewable energy in the country.

[89] G. Arhin (2022). Ghana's shift from take-or-pay to take-and-pay. *The Energy Year*.

- Non-appropriate system for CFPPs valuation and payment for CFPPs:

  A critical step to make viable the early retirement of CFPP is to reach an agreement with IPPs and PLN to establish a retirement value and a payment system for every CFPP that do not affect their financial stability.

  Consequently, this system has to have both three: technical and objective basement, probed strategy to negotiate and real financial viability for the payments flows.

  If the system does not join these three characteristics, it is likely that government should generate a hard position from PLN executives and a higher (maybe not-viable) fiscal effort would be demanded to let the CFPPs retirement.

7.1.3 For social welfare

7.1.3.1 Social welfare opportunities

Health

Indonesia is the world's 17th most polluted country, with an average $PM_{2.5}$ concentration[90] of 34.3 µg/m³ in 2021.[91] This far exceeds the recommendation of an annual $PM_{2.5}$ concentration average of 5 µg/m³ from the World Health Organization (WHO).[92] Virtually the entire population of Indonesia lives in areas where the annual average particulate pollution level exceeds the WHO guideline. On average, air pollution cuts life expectancy throughout the whole country by 1.2 years, relative to if the air quality complied with the WHO guideline. The greatest loss in life expectancy can be found in the Greater Jakarta area,[93] where residents lose an average of 2.4 years of life expectancy (Figure 7.1). Particulate pollution

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90 $PM_{2.5}$ are particulate matters with an aerodynamic diameter of equal or less than 2.5, also called fine particulate matter that can penetrate through the lungs and further enter the body through the blood stream, affecting all major organs. Exposure to $PM_{2.5}$ can cause diseases both to the cardiovascular and respiratory systems, potentially causing stroke, lung cancer, and chronic obstructive pulmonary disease (COPD).

91 IQAir. 2021. World Air Quality Report.

92 World Health Organization (2021). *WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide*.

93 The Greater Jakarta area includes Jakarta, Bogor, Depok, Tangerang, Bekasi, and sometimes extended to include part of Cianjur Regency.

poses the third greatest threat to human health in Indonesia, after dietary risks and smoking, when measured in terms of life expectancy.[94]

Figure 7.1 Potential Gain in Years of Life Expectancy through Permanently Reducing PM2.5 from 2020 Concentration to the WHO. Source: Air Quality Life Index

In Indonesia, one of the major sources of particulate pollution is coal-fired power plants. Coal combustion emits black carbon, a form of particulate matter, as well as sulfur dioxide (SO_2) and nitrogen oxides (NO_x), which react with other substances in the atmosphere to become particulate matter.

Because most of Indonesia's CFPPs have been found to employ subpar technologies that are inefficient and highly polluting, the sharp increase in coal-fired electricity generation since 2010 has contributed significantly to an increase in particulate pollution. As expected, regions where many CFPPs can be found—particularly the Java region (Central, West, and East), Sumatra, and Banten—experience the highest $PM_{2.5}$ concentrations, finding their populations at risk. For example, in Tangerang regency in the province of Banten where one such coal-

[94] Air Quality Life Index (2022). Indonesia Fact Sheet.

fired power plant exists, particulate pollution has been found to cut an average of almost 2 years off the life expectancy[95] of its more than 3.5 million residents. In Jakarta, with ten CFPPs within a 100-km radius of the city,[96] the negative impact of CFPPs on health can be even more considerable. Nonetheless, the continued use of these CFPPs has often been justified by the need to provide affordable electricity for all.[97]

Another issue with Indonesia's CFPPs is that they are currently allowed to emit 3 to 7.5 times more particulate matter, NO_x, and SO_2 than China's coal plants, and 2 to 4 times more than India's coal plants that were installed between 2003 and 2016.[98] The government has attempted to toughen limits on emissions, but such efforts have been hindered by conflicting criticisms of the proposed revisions. However, these limits still would have been less stringent than those imposed in China and India.[99]

The early retirement of CFPPs, especially those close to urban areas, would provide significant benefits to public health. A study in the US revealed an estimated 26,610 lives were saved due to a reduction in air pollution from the closure of 334 coal-fired units between 2005 and 2016, having been replaced by 612 new natural-gas-fired units.[100] Overall, CFPP closures have also been found to lead to an average 7-4% reduction in $PM_{2.5}$ levels.[101] Results from a study by Climate Action Tracker show that Indonesia's current coal capacity expansion plans can lead to a total of 120,000 premature deaths between 2020 and 2030 due to air pollution from coal-fired power generation. However, through an early phaseout and an accompanied reduction of the coal plant construction pipeline, more than 45,000 premature deaths can be avoided.[102]

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[95] Air Quality Life Index (2022). *Indonesia Fact Sheet*.

[96] M. Taylor (2019). Asia's coal addiction puts chokehold on its air-polluted cities. *Reuters*. 20 March.

[97] Air Quality Life Index (2021). Indonesia's Air Pollution and its Impact on Life Expectancy.

[98] X. Zhang (2016). *Emission standards and control of PM2.5 from coal-fired power plants*.

[99] Air Quality Life Index (2021). Indonesia's Air Pollution and its Impact on Life Expectancy.

[100] B. Patterson (2020). *Study Finds Coal Closures Saved Thousands Of Lives*. WFPL. 8 January.

[101] J. P. Brown and C. Tousey. (2020). Death of Coal and Breath of Life: The Effect of Power Plant Closure on Local Air Quality. Federal Reserve Bank of Kansas City, Research Working Paper no. 20-15, October.

[102] Climate Action Tracker (2021). *How a COVID-19 recovery with less coal could benefit Indonesia*.

Revitalize jobs and the economy

According to the World Economic Forum[103], the transition to clean energy is expected to generate 10.3 million net new jobs globally by 2030, offsetting the 2.7 million jobs expected to be lost in fossil fuel sectors. In a scenario where the energy transition pathway is aligned with the Paris Agreement's 1.5°C climate ambition, IRENA estimates that in 2050, around 20 million jobs will be in solar energy. Seventy-seven percent of this will be in PV, 15% in solar water heaters (SWHs), and 8% in concentrated solar power. Although in the same scenario 10.5 million fossil fuel jobs are expected to be lost, this number is lower than what is expected to be gained in transition-related jobs.[104] In India, where CFPP retirement is also underway, over 3.5 million jobs are expected to be created through a 500 GW non-fossil electricity capacity goal by 2030.[105]

A study by TransitionZero compares the job loss expected per CFPP in Indonesia and the expected gain in renewable energy plants. It is estimated that, when considering both operation and maintenance, there is an average of 1.3 jobs/MW at a CFPP—translating to an average of 245 jobs per plant. Jobs associated with solar and onshore wind in Indonesia have been found to average 2 jobs/MW and 5 jobs/MW, respectively, accounting for both construction, project development, and ongoing operation and maintenance. These translate to an average of 1,580 jobs per solar installation and 2,265 jobs per onshore wind installation.[106] Due to the massive infrastructure projects that are expected for RE development, many of these jobs are expected to be found in the construction phase.

Access to external funding

The energy transition is seen as a significant business opportunity for stakeholders in various sectors across the globe.[107] According to the study *Energy*

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[103] World economic Forum (2022, March 25) *How many jobs could the clean energy transition create?* From: https://www.weforum.org/agenda/2022/03/the-clean-energy-employment-shift-by-2030/

[104] IRENA. (2021). *Renewable Energy and Jobs Annual Review 2021*.

[105] Jaiswal, A. and Lata, C. (2021) India's New Climate Target Could Create 3.5 Million Jobs. *Natural Resources Defense Council*. 9 November.

[106] TransitionZero (2022). *Financing Indonesia's coal phase-out: Coal Asset Transition Tool*.

[107] N. Nhede (2021). Energy transitions a big business opportunity for multiple stakeholders-IRENA. *Smart Energy International*. 2 July

Transition Investment Trends 2022 published by BloombergNEF,[108] global investment in the energy transition totaled $755 billion in 2021—a new record, and a 21% increase from 2020 with almost half the investment occurring in Asia. Investment rose in almost every sector covered in the study, as well as almost every geographic region. However, Indonesia's energy transition still requires a significant investment to develop energy transition projects. According to a speech given by the Ministry of Energy and Mineral Resources at a G20 seminar, "Indonesia at least needs investment for the energy transition of around US $1 trillion by 2060".

Nevertheless, Indonesia is still on track to take this context as huge opportunity to attract investment in the energy transition sector. Public finance—while not sufficient—can be key to address investment risks and unlock international private capital. It is also crucial that Indonesia creates an appealing and less risky investment market through a consistent energy transition program and policy, regulation and an integrated coordination across sectors, while developing and accessing relevant financing instruments such as green bonds. Programs such as the Just Energy Transition Partnership (JETP) with Indonesia launched in November 2022 (discussed further in Section 8.1.4) can help provide the financing needed for such an endeavor.

Overall, creating this appealing market for energy transition investments is becoming a main concern for countries in need of accessing external funding like Indonesia, especially as investment in oil, gas, coal and low-carbon fuel supply is the only area that, in aggregate, remains below the levels seen prior to the pandemic in 2019.[109] This is despite sky-high fuel prices caused by the current geopolitical context.

7.1.3.2 Social welfare Risks

Increase in social tensions

In recent years, Indonesia has been experiencing a lot of social tensions that have led to demonstrations, protests, and riots that have in turn disrupted daily life and

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[108] Energy Transition Investment Trends 2022, Tracking global investment in the low-carbon energy transition, BloombergNEF, January 2022

[109] World Energy Investment Report 2022, IEA, 2022

even led to fatalities. Protests in recent years have centered around election results,[110] racial conflicts,[111] and religious tensions.[112]

Fuel prices have also been the subject of several protests in the last ten years. In 2013, after an announcement of a fuel subsidy reduction that would increase petrol prices by 44% and diesel by 22%, protesters all over Indonesia took to the streets, ending up with violent clashes and police confrontations.[113] More recently, in April 2022, university students held demonstrations in protest of high cooking oil prices (along with the possible extension of President Joko Widodo's tenure in office). Demonstrations led to police firing tear gas and water cannons to disperse protesters in Jakarta, where it was reported that protesters were seen throwing rocks into the parliament building. Similar rallies were held in other parts of Indonesia, including South Sulawesi and West Java.[114] Then, in September 2022, thousands of protesters around the country demanded the reversal of another price hike on fuel—the first since 2013. The government's decision to reduce subsidies led to petrol and diesel prices increasing by around 30%.[115] In protest, university students in Jakarta burned tires in front of the presidential palace, clashing with the police. In the city of Bengkulu, the police injured five protestors after deploying water cannons and tear gas on crowds.[116]

Indonesia's Job Creation Act,[117] also known as the "omnibus bill," also drew a lot of criticism when it was passed in October 2020 due to the harm many identified it would cause workers and the environment. Passed to try to relax the complexities of Indonesia's business, labor, and environmental laws and attract investment and stimulate the economy, this law also significantly affected many labor regulations, eliminating the sectoral minimum wage in favor of those set by

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[110] M. Jefriando and W. Asmarini (2019). Indonesian protesters disperse after second night of post-election unrest. *Reuters*. 23 May.

[111] K. Lamb and B. Doherty (2019). *West Papua protests: Indonesia deploys 1,000 soldiers to quell unrest, cuts internet*. The Guardian. 22 August.

[112] Agence France-Presse (2016). Jakarta protests: Muslims turn out in force against Christian governor Ahok. *The Guardian*. 2 December.

[113] BBC (2013). *Indonesia fuel prices rocket by 44% sparking protests*. 22 June.

[114] Reuters (2022). *Indonesia police fire tear gas as students protest cooking oil prices, third term for president*. 12 April.

[115] R. Ramli (2022). In the Midst of Protest, Hopes of Reform in Indonesia. *The Diplomat*. 6 October.

[116] D.M. Sijabat, S-L. Wee and M. Suhartono (2022). Thousands of Angry Indonesians Gather to Protest Rising Fuel Prices. *The New York Times.* 9 September.

[117] Government of Indonesia (2020). *Undang-Undang Nomor 11 Tahun 2020 Tentang Cipta Kerja*.

regional governors; reducing severance pay from a maximum of 32 months' pay to only 19 months; and requiring businesses to give workers only one day off a week instead of two, among others. It also relaxed environmental standards, setting requirements for businesses to file an environmental impact analysis only if their projects are considered high risk. Demonstrations took place throughout Indonesia, with hundreds arrested. Though starting out as relatively peaceful protests, some protesters that were detained were allegedly found to be armed with Molotov cocktails and sharp weapons.[118] Excessive force by the police against protesters became evident in these protests.[119]

With Indonesia's history of social tensions and demonstrations due to government actions, the government should be mindful of the socio-economic impacts of its future policies and efforts. The early retirement of CFPPs pose many risks to populations if it is not executed properly, including unemployment not just in the facilities themselves but also in industries along the supply chain. To prevent violent protests and riots, proper and informed planning should be done in the early phaseout of coal-fired power generation.

Public services and infrastructure

Local public services may be affected due to a decrease in local government revenue coming from the coal mines supplying the CFPPs. Eighty percent of the royalties paid by these mines go to local administrations. When considering that subnational governments account for 63% of spending for education,[120] losses in local government revenue may have dire impacts on the socio-economic landscape.

In addition, earlier this year, the government raised the royalty rate for coal miners from a single tariff of 13.5% to a variable rate between 14% to 28% depending on the government-set coal benchmark (*harga batubara acuan*, or HBA).[121] Table 7.2 summarizes the different royalty rates for coal mines based on

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[118] BBC (2020). *Indonesia: Thousands protest against 'omnibus law' on jobs*. 8 October.

[119] B. Sutrisno (2020). Police used 'excessive force' during omnibus Jobs Law protests: Activists. *The Jakarta Post*. 10 October.

[120] R. Afkar (2020). *Spending for better results: Education*.

[121] B. Christina (2022). UPDATE 2-Indonesia raises coal royalty rate to range of 14% to 28%. *Reuters*. 18 April.

different HBAs, considering whether the contracts are first generation or later generation.

Table 7.2 Royalty rates for different HBAs for first generation contracts and for later contracts. Source: Reuters

HBA Coal Price	IUPK from first generation contracts		IUPK from later generation contracts	
	General sales	DMO	General sales	DMO
<$70	14%	14%	20%	14%
≤$70 to < $80	17%	14%	21%	14%
≤$80 to <$90	23%	14%	22%	14%
≤$90 to <$100	25%	14%	24%	14%
≥$100	28%	14%	27%	14%

At the moment, the coal mining industry is not considered to be in jeopardy due to rising international energy demand and the expansion of domestic coal utilization. Current forecasts see global coal demand either having peaked in 2022 or peaking in 2023, but it is expected to remain at that level until at least 2025.[122] Beyond that, different scenarios yield different forecasts. The IEA considers three different pathways, each demonstrating a different level of ambition (Table 7.3). Despite differing contexts, each foresee a decline in global coal demand by 2030.

Table 7.3 Global coal demand based on three different scenarios with a base year of 2021. Source: IEA.[123]

Scenario	Description	Coal forecast to 2050
Stated Policies Scenario (STEPS)	Considers existing policy settings	10% decline by 2030 30% decline by 2050
The Announced Pledges Scenario (APS)	Considers that ambitions stated by governments are met on time	20% decline by 2030 70% decline by 2050

[122] IEA (2022). *Coal 2022*.
[123] IEA (2022). *World Energy Outlook 2022*.

	and in full, including long-term net zero and energy access goals	
The Net Zero Emissions by 2050 (NZE) Scenario	Considers a pathway to limit the rise in global average temperatures to 1.5 °C, as well as universal access to modern energy by 2030	45% decline by 2030 90% decline by 2050

Thus, although the coal mining industry can benefit from the sustained global coal demand in the following years, the resulting potential increase in the industry's contributions to government revenue may lead to large losses when the industry is eventually phased out in the coal transition.

Regional revenue

As the power plants are retired, affected employees of the CFPP and its value chain may end up relocating to find opportunities in nearby locations. Regional income generated will then be redirected away from the businesses within the community and the surrounding region. Likewise, informal businesses that relied on expenditures from these employees will lose this revenue stream and will thus have less money to spend on the local economy. Overall, businesses in the region may suffer.

Unemployment

The retirement of coal-fired power plants will inevitably lead to a loss of jobs, not only in the facilities themselves but also in industries along the supply chain. The sectors at risk include:

- *Coal-fired power plants.* Employees in power plants will need to be reskilled and retrained to seek employment in other sectors. Some employees, such as those in human resources and management, will have transferable skills that can be easily utilized in other sectors, while others, such as operators, may need retraining to gain new skills relevant to other industries.
- *Coal mines.* Although coal-fired power plants in Indonesia rely on domestic mines for their coal supply, their decommissioning may have little impact on coal mines, since global demand for coal is not expected to slow down any time soon. Coal mines may redirect their supply to exports or other uses. However, the long-term goal of a low-carbon economy will eventually

require the government to consider how coal mine workers will be impacted.

- *Coal transport.* Coal transport operations focused on delivering coal domestically from mines to power plants will slow down. However, this does depend on where workers are located. Jobs of transporters who work more closely with the CFPPs may be at risk as CFPPs close down. On the other hand, jobs of transporters who work directly with coal mines may not be so. Since coal mines are currently expected to redirect their coal supply for export or to other domestic sectors amid lessened demand from CFPP, coal transporters around mines will most likely still be needed.
- *CFPP supplier workers.* As power plants are retired, the demand for equipment typically needed in facilities will go down. Manufacturers will lose revenue, especially if they provide equipment to more than one power plant. Employees may also be affected as companies may look to cut back on expenses and lay off people.

Despite these concerns, unemployment risks are expected to be localized and manageable due to the size of the affected sectors and the size of Indonesia's growing economy. Nevertheless, the government should be mindful of the types of support that need to be provided to help those that may be more at risk of unemployment. These include financial support for displaced workers, early retirement, and reskilling and retraining programs.

Poverty

Workers up and down the coal value chain who lose their jobs due to the early retirement of a CFPP can fall into poverty if they cannot find alternative sources of income. Their dependents are also at risk of falling into poverty.

Although Indonesia witnessed its lowest poverty rate in September 2019 at 9.2%, the COVID-19 pandemic drove 1.12 million individuals into poverty, increasing the rate to 10.19% by September 2020. By March 2021, the rate had decreased to 10.14%. In addition to households employing different methods to cope economically during the crisis—including selling/pawning assets and reducing non-food expenditures—the government offered social assistance to reduce the expenditure burden, including cash assistance.[124] The economic impact of the early shutdown of coal-fired power plants should be anticipated through

[124] Smeru Research Institute (2021). *Indonesia's Poverty Situation during the COVID-19 Pandemic*.

thorough analysis, not only to guide the decision-making process but also to devise appropriate government social assistance to reduce burden on affected communities and individuals.

Gender issues

Prevailing gender-related issues will have an impact on women amid the early retirement of CFPPs when it comes to both employment and family dynamics.

Women in general have been found to be relatively absent in STEM fields. In 2018, women were found to make up only 12% of graduates with STEM majors in Indonesia, lower than what was found in other countries in Southeast Asia, such as Malaysia (26%), Philippines (18%), Thailand (15%) and Vietnam (15%). In 2019, only 18% of total working females were employed in the industry sector—including mining, manufacturing, utilities, construction, and information technology and communications—compared to 28% for males. In high-tech industries like information technology and communications, the disparity can be even greater, with only 14% of women in the sector having a position as professionals or technicians, compared to 31% of men.[125]

In mining, women have been found to be more vulnerable in ever mining development stage from exploration to closure. They have been found to be excluded from consultation processes and affected differently by mining operations due to their gender-related roles. When it comes to employment, they have been found to comprise less than 10% of the sector's total workforce.[126] Such low representation can lead to women not reaping the benefits of the industry as much as men.

Such realities can be expected not just in the coal mining industry but also in industries along the coal supply chain, including CFPPs. With such low representation, women may be likely to miss out on opportunities presented by the coal transition. For example, retraining and reskilling that may be provided to workers in coal-related industries to help them penetrate emerging green

[125] J. Marshan and R. Nikijuluw (2020). Will Indonesia's 4.0 revolution leave women behind?. *University of Melbourne*. 16 November.

[126] B. Amor, H. Susanti, and S.I. Herlusia (2020). Gender mainstreaming in Indonesia's mining industry. *World Bank Blogs*. 6 March.

industries may not reach as many women due to their disproportionate absence in these sectors.

Aside from female employment in coal-related sectors, the effect of the coal transition on women when considering family dynamics should be investigated. If men, who traditionally have been the sole breadwinners of families, lose their high-paying jobs, wives and mothers are typically obliged to find additional work outside of their homes to provide income that their husbands or sons lost.

Domestic violence amid stressful situations—such as the loss of a source of income due to CFPP unemployment—may also be expected in Indonesia. For example, during the COVID-19 pandemic, an increase in violence against women due to heightened household tensions was observed when the National Commission on Violence against Women (Komnas Perempuan) received more than 4,200 complaints just by the beginning of October.[127] In comparison, only 2,389 complaints were received in all of 2020.[128] Tensions arising in households can also be expected when sources of income suddenly disappear due to unemployment. Such tensions may be exacerbated when alternative sources of incomes are not found quickly, leading to domestic violence.

[127] CNN Indonesia (2021). *Komnas Perempuan: Kekerasan Seksual Meningkat Selama Pandemi*. 5 October.

[128] National Commission on Violence Against Women (2021). *PEREMPUAN DALAM HIMPITAN PANDEMI: LONJAKAN KEKERSAN SEKSUAL, KEKERASAN SIBER, PERKAWINAN ANAK, DAN KETERBATASAN PENANGANAN DI TENGAH COVID-19*.

8 Financing opportunities

8.1 Landscape of financial instruments to aid a feasible and just coal phaseout

A wide variety of coal transition instruments and mechanisms are emerging across different geographies, being proposed by both, public and private sector entities. Implementing them successfully will require careful consideration of socio-economic benefits, drawbacks, local institutional context, and local infrastructure needs. Below are different cases of international mechanisms that have the common purpose of accelerating coal phase-out through a just, equitable and scalable transition.

8.1.1 Just Transition Transaction (JTT)

The JTT is a transition finance mechanism[129] that supports the phase-out of coal-fired power in South Africa. Its overarching objective is to enable South Africa to secure an accelerated, affordable, managed and just electricity transition[130].

The JTT is proposed as a long-term (approximately 25-year) US $12 billion blended debt facility to help refinance Eskom[131], the South African state-owned utility company. It will be structured as a series of long-term debt-financing tranches, priced at a highly concessional interest rate designed to help Eskom address its debt burden, which stands at approximately more than R400 billion[132], due to cost overruns on its power station construction program and regulated tariff increases that are too low to cover the power generation, transmission, and distribution incurred costs.

The instrument is designed as a transaction, where South Africa offers globally desirable additional GHG mitigation outcomes, in return for highly concessional

[129] Steyn, G., Tyler, E., Roff, A., Renaud, C., Mgoduso, L. (2021) "The Just Transition Transaction: A Developing Country Coal Power Retirement Mechanism" Meridian Economics, Cape Town: South Africa

[130] Ibid

[131] Eskom is South Africa's stated-owned power utility that generates more than 90% of the country's power, 84% of which comes from coal-fired power stations.

[132] Creamier, T. (2021) Just Transition Transaction can unlock fiscal space for South Africa's low-carbon shift. Creamer Media's Engineering News, from: 'Just Transition Transaction' can unlock fiscal space for South Africa's low-carbon shift (engineeringnews.co.za)

loan finance. The transaction's primary mechanism is a concessional debt instrument backed by a consortium of developed countries. The loan is repaid by South Africa with a mixture of carbon mitigation performance and cash, dependent on the extent of South Africa's ability to mitigate carbon emissions against the baseline provided by the Integrated Resource Plan of 2019[133] (IRP 2019). The transaction would be facilitated by an international financial institution, such as Climate Investment Funds.

Conceptually, the JTT offers both, a loan, and a climate concessional element. The loan element comprises a sovereign loan raised on commercial terms by South Africa as part of the external debt, representing an alternative source of finance, and offered by a variety of potential lenders e.g., capital markets and international financial institutions. The climate concession element follows the UNFCC principle of Common but Differentiated Responsibilities and Respective Capabilities, where South Africa is eligible for financial support to decarbonize its power sector and accrues to South Africa over the transaction's lifetime through concessionary interest rates tied to GHG mitigation performance, aligned with the Paris Agreement objectives and emissions cap, at an agreed $/t$CO_2$ price, which is decided individually[134].

The JTT will allow the retirement of old coal-fired power plants, by funding decommissioning costs as well as renewable replacement energy. It also aims to restore Eskom's access to capital markets. The JTT is currently under development, and its design is still being finalized.

8.1.2 The Energy Transition Mechanism (ETM)

The ETM is one of the most relevant mechanisms for Indonesia, It is a public-private finance vehicle launched by the Asian Development Bank (ADB) that aims for the early retirement of coal power plants in developing countries, leveraging from a market-based approach, while boosting renewable energy development and growth[135]. The ETM will use blended finance sourced from governments,

[133] Energy Department, Republic of South Africa. IRP-2019.pdf (energy.gov.za)

[134] Steyn, G., Tyler, E., Roff, A., Renaud, C., Mgoduso, L. (2021) "The Just Transition Transaction: A Developing Country Coal Power Retirement Mechanism" Meridian Economics, Cape Town: South Africa

[135] Environment and Development Services – International and Mott MacDonald for the Asian Development Bank (2022). Regional Scoping Report for Strategic Environmental and Social Assessment Applied to the Energy Transition Mechanism in Southeast Asia.

multilateral banks, philanthropies, and long-term investors. The ADB targets to raise a total of US$ 2.5-3.5 billion[136]. At full scale, the ETM aims to reduce coal generation capacity consistent with the mitigation targets specified in the nationally determined contributions of the country under the Paris Agreement [137].

ETM promotes just transition as a core component of the mechanism. The transition towards a cleaner energy sector will create opportunities for new greener employment. At the same time, there will be potential socio-economic impacts due to the CFPP retirement which could potentially affect direct and direct workers (including along the supply chain) and communities.

The ETM will be a public-private finance vehicle comprising two components. The first component is the creation of the Carbon Reduction Facility, which will use a blended finance approach to decommission coal-fired power plants on an accelerated schedule, allowing time to develop a clean power replacement plan. The second component is the Clean Energy Facility, which will channel investments in new renewable energy generation, energy storage, and grid requisite and storage upgrades, and will assist with technology transfer for transmission and distribution[138].

The German government has committed to mobilize €25 million to the ETM. The ETM launched in November 2022 as it announced the memorandum of understanding (MoU) signed by the ADB to retire Cirebon 1, the first CFPP to retired under ETM[139]. The plan will be carried out in collaboration with Cirebon Electric Power, PLN and the Indonesian Investment Authority. The CIF's Accelerating Coal Transition (ACT) Investment Program

ACT is a global initiative, provided by the CIF, which supports the transition to clean energy in major coal-producing and coal-consuming countries. It builds

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[136] ADB (2021)" Energy Transition Mechanism Introduction". From: https://www.thkforum.org/wp-content/uploads/2022/04/Energy-Transition-Mechanism-Introduction-ADB.pdf

[137] Donald Kanak, "How to accelerate the energy transition in developing economies," World Economic Forum, January 25, 2021. From: https://www.weforum.org/agenda/2021/01/how-to-accelerate-the-energy-transition-in-developing-economies.

[138] Environment and Development Services – International and Mott MacDonald for the Asian Development Bank (2022). Regional Scoping Report for Strategic Environmental and Social Assessment Applied to the Energy Transition Mechanism in Southeast Asia.

[139] ADB (2022). "The next stage for ETM". From https://www.adb.org/what-we-do/energy-transition-mechanism-etm

support at the local level to reconsider the development of new coal plants and accelerate the early retirement of coal assets[140].

Alongside multilateral development banks, the CIF will provide grants, loans, guarantees, and other concessional finance to public and private sector entities, for three areas, which are their pillars associated with the transition away from coal: governance, people, and infrastructure[141]. For governance, it supports countries to develop country-level strategies to implement the coal transition. For people, it provides support for people and communities directly, e.g., retraining and developing new skills, and for economic diversification. For infrastructure, it addresses land and infrastructure needs for coal transition, reclaiming and repurposing the existing coal infrastructure.

In November 2021, the CIF launched a nearly US$ 2.5 bn investment program, selecting South Africa, India, Indonesia, and the Philippines as the first beneficiaries of the initiative.

8.1.3 Coal Asset Transition Accelerator (CATA) of the European Climate Foundation

CATA was introduced in November 2021, during the COP26. It is a collaborative initiative launched by the European Climate Foundation to support accelerating best practices in the coal transition, focusing on social justice needs to accompany economic and climate policies. CATA is funded by philanthropies, including IKEA Foundation and Growald Climate Fund[142].

CATA aims to engage core audiences (countries and financial institutions) in service of five high-priority objectives[18]: 1) to build confidence that early coal phase-out is technically and economically feasible for countries in transition; 2) to design, demonstrate, and deliver models of climate financing to public finance institutions; 3) to demonstrate feasible and profitable coal phase-out pathways which private finance can help scale up to private finance and asset owners; 4) to build confidence that countries are stepping up ambition on transitioning from

[140] CIF. Accelerating Coal Transition (ACT) Investment Program. Brochure

[141] CIF. Accelerating Coal Transition (ACT) Investment Program. From: cif_act_brief.pdf (climateinvestmentfunds.org)

[142] European climate Foundation (2021). "A socially just energy transition is in our grasp": New collaboration to speed up the move from coal to clean power. November 2, 2021. From: Embargoed 4 November 2021 ECF release on CATA DRAFT.docx (europeanclimate.org)

coal to clean energy to country donors; 5) to build awareness and confidence to support and enable a just transition to civil society organizations.

It will initially be working in geographies and states that are already engaged in energy transition, such as South Africa, Indonesia, and the Philippines. The initiative will provide analysis and expertise, as well as a Technical Assistance fund to provide advice for those pursuing Coal Transition Mechanisms.

8.1.4 Indonesia Just Energy Transition Partnership (JETP)

The Just Energy Transition Partnership for Indonesia was launched at G20 in November 2022. The plan is a country-led partnership between the Indonesian government and the International Partners Group formed by the USA, Japan, Canada, Denmark, the EU, France, Germany, Italy, UK and Ireland.

The plan aims to accelerate a just energy transition from fossil fuels to renewables. The implementation of the plan will support the country to meet its decarbonization targets. The partnership involves the mobilization of US $20 billion over the next three-to-five-year period

The partnership will develop a comprehensive investment and policy plan that aims to decarbonize the power sector |by meeting the following targets:

- Power sector emissions peaking by 2030 at no more than 290 MtCO2 and immediately declining after, until achieving net-zero emissions by 2050.
- Renewable energy comprising 34% of the generation mix by 2030.
- Accelerating the early retirement of coal-fired power plants as prioritized by the government.
- Deployment of energy efficiency and electrification tools, technologies and reforms.
- Developing a competitive local industry in energy efficiency and renewable energy.
- Freezing the existing CFPPs in PLN’s pipeline.
- Implement renewable or zero-emission solutions outside the Java-Bali region.

The partnership has committed to elaborate the terms of financing during the first three-month phase which is currently in process, and to identify the financing instruments and policies relevant to PLN and its subsidiaries during the next six months.

The PT Sarana Multi Infrastructure (PT SMI), from the Ministry of Finance, will be in charge or establishing a platform to manage the funds.

8.2 Donor Mapping

During the development of the project the team reached out to a list of donors to map how they can support the early retirement program (Table 8.1). The list describes why the donors are relevant to this project. This part will require engagement with the donors to sense check the recommendations.

Table 8.1 List of donors and its description

Donor	Description
All On	Supporting and investing in existing energy solution providers to help grow and achieve scale.
Asian Development Bank (ADB)	ADB provides loans, guarantees, equity investments, grants, and technical assistance to developing countries in Asia. Loans are financed from ordinary capital resources and the Asian development Fund. Through its financial instruments, ADB is working to increase access to reliable, affordable, low-carbon energy across Asian-Pacific region to reduce poverty and promote development. The ADB has the Energy Transition Mechanism (ETM) to accelerate decommissioning of coal facilities, being this one of the possible mechanisms to fund the retirement program. Contact: Tel +63 2 86324444, info@adbi.org
Austrian Development Cooperation (ADC)	The ADC is the operational unit or the of the Austrian foreign policy. Its goal is "to bring about a sustainable improvement in the conditions of life for those in developing and emerging economies." Its priority projects include sustainable energy, supporting institutions and companies in developing countries to grasp the opportunities that renewable energy and energy-efficient technologies bring. The ADC supports and cooperates with international organizations committed to sustainable energy, such as the World Bank. Contact: Austrian Development Agency, office@ada.gv.at

Donor	Description
Bezos Earth Fund	The Bezos Earth fund was created by a commitment of US $10 billion to be disbursed as grants within the current decade. Programs include monitoring and accountability; environmental justice; economics, finance, and markets; nature solutions; and decarbonizing the economy. This fund can finance the early retirement program and help create partnerships with other fund as part of their Decarbonizing the Economy Program. This program has already funded similar projects such as the Phase down oil and gas production in the US project. Contact: info@bezosearthfund.org
Bloomberg Philanthropies	Bloomberg Philanthropies works to ensure better, longer lives. Its approach is grounded in Mike Bloomberg's experience in business, government, and philanthropy. Key areas include the arts, education, the environment, government innovation, and public health. In 2019, the organization launched the Beyond Carbon initiative, with US $500 million investment to close 100% of all US coal plants by 2030[143]. The retirement program could be presented to them propose a similar initiative. Contact: Tel +1 212-205-0100, email to be defined
Charles Stewart Mott Foundation	The Mott Foundation supports non-profit organizations that work to strengthen communities around the world by providing long-term funding to established grantees. Granting programs are for civil society projects, education, environment, and the Flint Area. Contact: Headquarters Tel +1-810-238-5651, info@mott.org

143 Bloomberg Philanthropies (2022) *Moving beyond carbon*. From: https://www.bloomberg.org/environment/moving-beyond-carbon/

Donor	Description
Climate Emergency Collaboration Group (CECG)	It is a collaborative platform and fund between some of the biggest climate philanthropies globally, founded in 2020. Contacting the group could facilitate collaboration and funding opportunities Contact : info@climatecollaboration.org, iain@climatecollaboration.org
Climate Works Foundation	Since 2008, Climate Works has granted over US $1.3 billion to more than 600 grantees in over 40 countries, from global policy to organizations and initiatives that are working to mitigate climate change. It contributes energy transition initiatives to support the transformation of the power sector toward clean energy in Africa, Asia, and South America. The Foundation's Global Grantmaking services provides an array of services for climate solutions. The foundation facilitates collaboration that enables funders to design and implement tailored grantmaking strategies, therefore could be a link to find funding for the program. Contact: Kathy Tryce Associate Director, Grants Management Climate Works Foundation Tel: +1 (415) 433-0500 Email: kathy.tryce@climateworks.org
Department for Business, Energy and Industrial Strategy, UK	The Department for Business, Energy and Industrial Strategy works backing enterprise and long-term growth, generating cheaper, cleaner, homegrown energy and unleashing the UK as a science superpower through innovation. Its key priorities include tackling climate change, delivering net zero and driving the green industrial revolution; unleashing innovation; and backing business long-term growth and levelling up economic activity. The Department has an annual fund (2021) of £44.2 billion, Contact : enquiries@beis.gov.uk

Donor	Description
Enel Foundation	Non-profit organization focused on clean energy. By developing partnerships with pre-eminent experts and institution across the globe, the Foundation conducts research to explore the implications of global challenges in the energy field. The foundation is a meeting platform for academia and research centers to encourage dialogue and promote training knowledge sharing. Contact: info@enelfoundation.org
Foreign, Commonwealth & Development Office, UK (FCDO)	The Foreign, Commonwealth & Development Office, funds projects which are in line with its policy priorities outlined in its Single Departmental Plan. This funding includes both Official Development Assistance (ODA) and non-ODA funds. The funds are used for a wide range of projects and serve to support traditional diplomatic activities. Among the funds are the Prosperity Fund, which supports economic development and reform in the UK's partner countries; and UK Aid, which is designed to achieve global goals. The Office funds several energy programs around the world and specifically Central, West and South Asia. Contact: fcdo.correspondence@fcdo.gov.uk
Friends of Indonesian Renewable Energy (FIRE)	FIRE is a collection of energy transition dialogues co-chaired by the Ministry of EMR of Indonesia and the governments of UK, Germany, and Denmark. The FIRE Dialogues have been formed to respond to Indonesia's request for greater international assistance in its low-carbon energy transition. Contact: Paul Butarbutar

Donor	**Description**
German Federal Ministry for Economic Cooperation and Development (BMZ)	Through Germany's development policy, the BMZ hopes to end poverty and environmental devastation. Their main ideals include protecting human rights and promoting growth and agency in developing countries. To boost the market for sustainable energy, the BMZ provides loans and grants through the Kreditanstalt für Wiederaufbau (KfW) – in the areas of generation, transmission, and distribution and for energy efficiency measures. The ministry could support the program by providing grants for the replacement of the coal-fired generation retired. Contact: Tel +49 (0)2 28 / 9 95 35-0
Global Energy Alliance for People and Planet (GEAPP)	Led by The Rockefeller Foundation, GEAPP benefits from the resources and influence of its partners, including the Bezos Earth Fund and the IKEA Foundation, working in partnership with countries across Africa, Asia, Latin America, and the Caribbean to operationalize renewable energy transitions. Contact: info@energyalliance.org
Global Environment Facility (GEF)	The GEF provides funding to assist developing countries in meeting the objectives of international environmental conventions. The GEF has a long history of using blended finance in environmental areas, including climate change mitigation areas with renewable energy and energy efficiency. Through GEF funding, governments place feed-in-tariffs and power purchase agreements. Contact: wehlers@thegef.org
Green Climate fund (GCF)	The GCF is the world's largest climate fund, supporting developing countries realize their Nationally Determined Contributions towards climate-resilient pathways. Under the energy transition, GCF scales up investment in renewable energy and energy efficiency. GCF can structure its financial support through a flexible combination of grant, concessional debt, guarantees or equity instruments. Contact: info@gcfund.org

Donor	Description
IKEA Foundation	The IKEA Foundation is funded by INGKA Foundation and is independent from the retail business with a sole focus on philanthropy and grantmaking. Grant themes include Climate Action and Renewable Energy. Contact: https://ikeafoundation.org/contact/
NAMA Women Advancement Establishment	Nama designs and implements initiatives that support women across professional and socio-economic sectors. Contact: info@namawomen.ae
Rockefeller Foundation	Through grantmaking, The Rockefeller Foundation works to promote the well-being of humanity throughout the world. Current energy initiatives include Powering the Last Mile, Data and technology solutions, and Driving Global Action. Contact : https://www.rockefellerfoundation.org/about-us/contact/
Swedish Postcode Foundation	The Postcode Foundation's goal is to create a better world through projects that challenge, inspire, and promote change. As a beneficiary to the Swedish Postcode Lottery, the Postcode Foundation annually receives part of the lottery's surplus. The Foundation receives approx. 1000 applications per year, 10% of these are granted financial support. Areas of influence include protection of biodiversity and mitigation of climate change. Contact: info@postkodstiftelsen.se
Swiss Agency for Development and Cooperation (SDC)	SDC is the Swiss agency for international cooperation of the Federal Department of Foreign Affairs. Swiss international cooperation aims to alleviate need and poverty around the world, foster respect for human rights, promote democracy and conserve the environment. SDC activities support access to renewable energy, promotion of energy efficiency, and contribution to clean air. Contact : info.deza@eda.admin.ch

Donor	Description
Transforming Energy Access (TEA)	TEA is a research and innovation platform that supports technologies and business models needed for a clean and inclusive energy transition. Contact: tea@carbontrust.com
USAID	Supports partner countries meet their climate goals and accelerate energy transition. US AID has programs focused on expanding grid supply of clean energy and supporting private investment. This makes it an attractive donor to support coal phase-out in Indonesia by supporting the development of renewable energy required to replace CFPPs. Contact: Jake Morris, Desk Officer USAID Bureau for Asia Phone +1 (202) 712 5528 Email: jamorris@usaid.gov
World Bank	The World Bank is an international development organization owned by 187 countries that provide finance, advice, and research to developing nations to aid economic advancement. The Bank finances public projects to build infrastructure and develop institutional capacity. Since they have already analyzed CFPPs' retirement in Indonesia the bank could finance the retirement program. Contact: Iboediono@worldbank.org

8.3 Finance Mechanisms

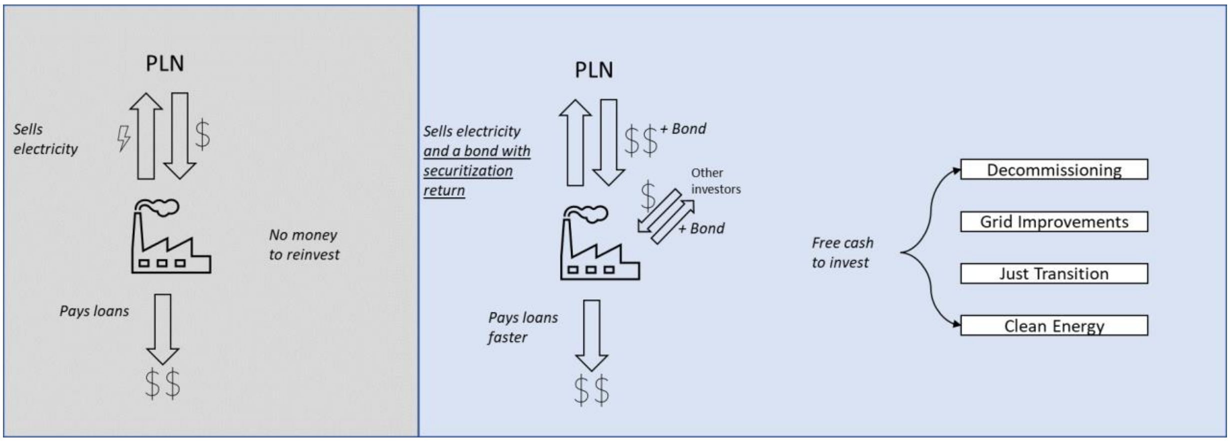
There are numerous challenges related to financing early coal retirement that include contractual specificities, contractual obligations, lacking incentives and surrounding considerations related to a just transition.

As the early retirement of coal-fired power plants has been gaining popularity, so have the financial structures proposed to facilitate this transition. The financial mechanisms usually are unique to the context, therefore, the different elements that must be considered are explained below. In summary, the key attribute that will define the financial mechanism is the net present value of the CFPP compared to the alternative. For example, if much lower than the alternative cleaner energy, commercial mechanisms might be suitable, while if the NPV of the coal asset is much higher than the alternative, more philanthropic or public financing mechanisms will be required.

Refinancing to address long-term contractual obligations

Long-term contracts, either in the form of a PPA or debt, lock coal assets in a portfolio. To be able to address these obligations and pay banks and investors, refinancing mechanisms can be used to modify the existing contracts and free up cash. By freeing up cash PLN can gain an opportunity to finance the early coal retirement, invest in new cleaner energy sources and finance those activities required for this transition to be just (Table 8.1). Under the right circumstances, under securitization, it could reduce the cost of electricity if the cost of debt is higher than the obligations that the coal owner includes in the bond securitization. This can avoid any price spikes that might be incurred by either the government or the end customer as the cost of the assets is absorbed gradually.

Figure 8.1 Cashflows in the refinancing of a CFPPS



Investment vehicles

Like the previous instrument, the premise of this finance mechanism is to buy a coal plant at a discount by having access to a lower cost of capital. By changing the ownership of the asset, you provide an opportunity for the financer to operate the asset, possibly gain a return, and decommission it in a responsible matter. The risk with these vehicles is the accountability for the investors to early retire the power plant. On the other side, there is an opportunity for the facilities to also provide technical assistance in the reinvestment towards renewable energy infrastructure.

Compensation

As the name suggests, the compensation schemes are payments to coal plant owners to compensate for revenue loss due to early retirement. As has been described above, this mechanism has been used by Chile and Germany. The framing of the compensation can be done by describing the mechanism as results-based public finance, or carbon finance, where the ton of emissions abated has a price for its early retirement. International lessons suggest that the compensation amounts, and the target dates need to be significant and additional, and not excessive, as was done by Germany in 2021.

Indirect financial support

Other indirect forms of financing exist which involve not directly paying coal-fired power plant owners. There can be grants and funds available to enable the structural framework required to support a low-carbon economy. These same funds can support and co-finance renewable energy projects, which can in turn facilitate the transition from coal to clean energy.

8.3.1 Conclusions

There are different examples of financial mechanisms and transactions for coal retirement mechanisms in highly-coal-dependent countries. Stakeholder acceptance will be a prerequisite for any financial instrument to be accepted, therefore an early coal retirement plan should be socialized through extensive engagement across the local government and society and with potential developed country sponsors and international financial institutions. The stakeholders involved in the Indonesian CFPPs are complex in institutional structuring, and therefore should be reflected in the financial mechanism proposed by this study. PLN's current financial situation, largely benefiting from government subsidies opens the possibility for early coal retirement financial mechanisms to support PLN and the federal government.

A fit-for-purpose financing strategy to manage early coal retirement not only considers financial institutions, but should also consider overcoming political, technical, regulatory, and financing barriers to accelerate the transition. The financial mechanisms must consider a risk-mitigating approach and ensure alignment with the economic, social, and environmental plans and national priorities. For example, the financial mechanisms should provide sufficient incentives for coal plant owners to retire their assets avoiding moral hazard risks;

should ensure that the value generated from the transition is shared among taxpayers and communities; and should provide transparency about how the benefits from the transition are distributed. Lastly, one must be cautious of the risks involved in the required financing environment, such as overpaying for assets and the risk of greenwashing. To address these risks, information that usually is not so public needs to be shared to ensure that accurate price recovery is made and that the emissions are reduced.

ETP Results	Project Output(s)	Indicator	Target	Data Source and Means of Verification
Impact: Summary based on RBMF indicators				
Long-Term Outcome: Summary based on RBMF indicators				
Intermediate Outcome 1 Strengthened RE and EE policy enabling environment				
Short-Term Outcome 12	Review result of deep dive analysis of the early CFPP retirement impact to the PLN financial and state fiscal conditions	Number of report and powerpoint presentation (2 reports and 1ppt presentation)	Full report and summary report, and ppt presentation on deep dive analysis of the early CFPP retirement impact to PLN financial and state fiscal conditions	Implications will come from the financial analysis and economic/fiscal analysis. A full report, a summary report and PowerPoint will be delivered.
National Fiscal policies, regulations, and Investment policies have undergone reforms to create an Investment Climate that is conducive to investment flow into RE/EE and improves its energy transition readiness for capital and investments	Identification of measures, factors, risks, and opportunities to deliver the early CFPP retirement program	Number of table (2 tables)	Table of measurement and table of key success factors of the early CFPP retirement program	SWOT analysis was built based on analysis originating from economic, financial and socioenvironmental
	Screening tool to determine the CFPP that eligible to join the early retirement program	Number of table (1table)	Table of measurement or screening to assess the eligibility of CFPP to join the early retirement program	Framework explanation on criteria used to evaluate eligibility for retirement program based on economic, financial
	Identification of 1-2 (showcase) projects that can take the early CFPP retirement program and its option funding mechanisms	- List of showcase project - Options of funding mechanism	- List of showcase project - Options of funding mechanism	Based on information obtained from PLN, a case study for 1project (Top 1 from decision framework results), putting forth funding mechanism options
	Prepared proposal or document to access potential funding or investment to support the early CFPP retirement program	Number of proposal or document (2 proposals/documents)	Proposal/document to access the potential funding/investment (GEAPP, etc)	Proposals for the case study to access potential funding/investment. Data was gathered from PLN and from the financial analysis.
	Sensitivity analysis on the early CFPP retirement program to the electricity subsidy and tariff as well as regional economic impact	Number of table (1table)	Table of sensitivity analysis of the early CFPP retirement program to the electricity subsidy and tariff	A sensitivity analysis table is included in the report measuring electricity subsity and tariff impact

Chapter 3: Case study of an early retirement: Ombilin units 1 and 2

UNOPS
Energy Transition Partnership

Study on the Financial Implications of the Early Retirement of Coal-fired Power Plants in Indonesia

9 Showcase project: Ombilin units 1 and 2

This chapter presents a CFPP selected as case study to showcase the early retirement, including the early retirement proposal the funding and financing mechanism proposed for this and the risk management and measures that should be considered.

According to the results obtained from the early retirement decision framework, the Ombilin power plant Units 1 and 2 would be proposed for retirement.

9.1 Coal-Fired Power Plant Selection

Ombilin Units 1 and 2 are in the West Sumatra province, specifically in the Sawahlunto regency. The largest industry in West Sumatra is agriculture, forestry, and fishing, estimated to have contributed 21.7% to the province's total GDP in 2021[144]. The economic concentration of the province is in cocoa processing, fisheries processing, and the snack industry. West Sumatra has been targeted by the government of Indonesia as a center of cacao in western Indonesia, as well as a center for tuna-catching, given its strategic location for landing and exporting[145].

Despite being the second smallest city or regency in West Sumatra by population, Sawahlunto has the fourth highest GDP per capita in the province, estimated to be 58.6 million IDR per capita (US$ 3,739 per capita). Its largest industry is wholesale and retail trade; repair of motor vehicles and motorcycles, which was estimated to contribute to 14.7% of the city's total GDP in 2021. Other large industries include manufacturing (3rd); construction (4th); and agriculture, forestry, and fishery (5th). The mining and quarrying sector was the 9th largest, while electricity and gas were the 13th largest[146].

West Sumatera has issued Regional Regulation 11/2019 concerning the General Plan of Regional Energy 2019-2050[147], which supports the National Energy

[144] Badan Pusat Statistik (2022). *Sumatera Barat Province in Figures*.

[145] EU-Indonesia Business Network (EIBN) (2018). *Indonesia Industrial Estates Directory 2018-2019: West Sumatra Province*.

[146] Badan Pusat Statistik (2022). *Sumatera Barat Province in Figures*.

[147] Government of Indonesia (2019). Regional Regulation 11/2019 concerning the General Plan of Regional Energy 2019-2050.

General Plan (RUEN)[148], which has stipulations for increasing the renewable energy mix in the country, with milestones in 2025 and 2050. With a baseline of 19.6% in 2015, West Sumatra aims to reach 51.7% by 2025 and 70.9% by 2050, one of the most ambitious among Indonesia's provinces.

While the National Energy General plan sets forth policies that provincial governments must follow, Regional Energy General Plans count on energy development proposals from local communities that are then raised to the provincial level and eventually serve as input for updating the National Energy General Plan. West Sumatra has created a program plan that has the following targets:

1. Formulation of the legal basis for development and utilization
2. Development of utilization areas in the form of power plants (solar cell, garbage, wind, biomass, micro-hydro, mini-hydro, water, geothermal)
3. Empowerment of local communities to support the success of energy sustainability in renewable energy installations.

With a Human Development Index (HDI) of 0.727 in 2021, West Sumatra has the 9th highest HDI in Indonesia out of 34 provinces[149]. Sawahlunto City has the 7th highest HDI within West Sumatra province, with an HDI of 0.729 in 2021, slightly higher than the province average. Both are considered to have a high HDI[150]. In September 2021, the poverty rate was estimated to be 6.04% in West Sumatra, an 8.9% drop from March 2021, which was the highest poverty rate seen in the province since March 2018. In 2021, Sawahlunto experienced the lowest poverty rate within the province at 2.38%[151].

9.1.1 Energy Security

Ombilin Units 1 and 2 are in the Sumatra power system. The Sumatra system is the second power system in Indonesia with the highest share of overcapacity. The system has 11.9GW of installed capacity and its peak demand is 8.2GW.

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[148] Government of Indonesia (2017). *Presidential Regulation No. 22/2017 of 2017*.

[149] Badan Pusat Statistik (2022). *Sumatera Barat Province in Figures*.

[150] Badan Pusat Statistik (2022). *Indeks Pembangunan Manusia (IPM) Sumatera Barat Province Menurut Kabupaten/Kota [Metode Baru] 2020-2022*.

[151] Badan Pusat Statistik (2022). *Sumatera Barat Province in Figures*.

Considering the 35% reserve margin that PLN is required to maintain to secure the supply, the Sumatra system has 784MW of overcapacity. The overcapacity will decrease in time as the demand increases however, retiring the Ombilin's 200MW account for would still allow the system to withstand the retirement with over 500MW of overcapacity.

In addition, the Sumatra system is the second system in the Indonesian grid, only surpassed by Java-Bali, with the highest share of flexible generation in its energy mix. Coal-fired generation in Sumatra accounts for 31% of the annual generation, followed by flexible generation sources like geothermal, hydro, combined cycle, and gas turbine generation, which together account for 17% of the generation. Having a relatively high share of flexible generation also makes the system more resilient to the retirement of Ombilin, as they could provide fast response services to the grid to compensate the variable generation from new renewables used to displace Ombilin's generation.

Generation from IPPs in Sumatra account for 40% of the system's generation, however, most PPAs signed between PLN and IPPs have take-or-pay obligations (ToP). Due to the contractual inflexibility from ToP adds IPP's generation cannot be assumed as flexible without know details on the contractual specificities.

Ombilin Unit 1 and 2 has a five-years average capacity factor (CF) of 59% which is slightly below the median 32 CFPPs sample considered in this study which makes it suitable to be prioritized for retirement as it is among the half that has the lower utilization rate. Due to data availability, this study does not discriminate low-capacity factors that a result of technical or grid conditions.

9.1.2 Environmental

Ombilin's 12,876 Btu/kWh heat rate is the second highest heat rate of the whole sample used for this study. Ombilin is a subcritical power plant, the less efficient type of CFPP compared to supercritical and ultra-supercritical[152], it has an estimated thermal efficiency of 26%, being the second least efficient power plant among al subcritical CFPPs considered in this study, and the second most inefficient in the Sumatra system, only followed by Bukit Assam Unit 1 and 2.

[152] UN ESCAP (2015) Regional Trends Report on Energy for Sustainable Development in Asia and the Pacific 2015. From: https://thailand.mid.ru/images/ESCAP/RegionalTrends2015.pdf

Additionally, Ombilin's emission intensity of 1.42 tCO_2e/MWh, places it above the median of CFPPs located in Sumatra. This puts it among the 50% most emitting CFPPs in Sumatera. The inefficiency and the high emitting factor of the power plant makes it a good candidate for retirement, considering the environmental burden that its operation implies.

9.1.3 Contractual

Units 1 and 2 of Ombilin are owned by PLN, which suggests there is no PPA in place. No negotiations with external party are required. Due to the political interests for early retirement, it could facilitate the process for early retirement. As well, as described in the Fiscal Analysis, the case is clear for the GOI to endorse this retirement as it would reduce subsidy requirement and could potentially even increase revenues from the liberation of high-quality coal that Ombilin is currently consuming at a subsidized price. Though the framework prioritizes retirement from IPPs because of the burden the PPAs could have on PLN, this does not exclude the possibility for a PLN CFPP to be of a financial burden to PLN and the GOI, as is assumed with Ombilin Units 1 and 2.

9.1.4 Financial

Since Ombilin is owned by PLN the financial aspect should be analyzed by how financially efficient the plant is. This power plant uses high rank coal (HRC) which has higher gross calorific value. However, using HRC has financial implications, as the price cap assigned to it when sold to CFPPs is the highest (US $70/ton). This along with the high heat rate of the plant translates into high operation expenses, which contrast's West Sumatra's low BPP, which is one of the lowest in the Sumatra power system. (US $69.58/MWh). This translated to Ombilin being the CFPP with the third lowest operating profit in its system, only followed by Labuhan Anging Unit 1 and 2, and Tanjung Balai Karimun Unit 1 and 2.

9.1.5 Social

West Sumatra's poverty rate of 6.34% is below the median of the Sumatran provinces where CFPPs considered in this study are located. This suggests that the closure of the power plant would not accentuate the poverty in the province as it would in Aceh or South Sumatra where poverty rates are much higher, at 15.4% and 12.8%, respectively.

Sawahlunto city where Ombilin is located is among the cities with the highest GDP in Indonesia. When considering that this city also has one of the lowest poverty rates in the province, it is reasonable to believe that displaced workers from the retirement of the CFPP could find opportunities in Sawahlunto and avoid the need to commute to another city for new employment.

9.2 Retirement program proposal

CFPPs to be early retired:	Ombilin units 1 and 2 (200 MW)
Year to be retired:	2023 (3 years before planned retirement)
Owner of the CFPP:	PLN
Proposed financer of early retirement:	PTSMI
Case to Owner of CFPP to early retire:	
Most notably, Ombilin is highly polluting due to its low efficiency. This translates into a high heat rate, meaning it requires more coal to generate one unit of energy than other CFPPs. The more coal it consumes the more GHG it emits. The higher calorific value coal it consumes, the more expensive it is. In addition, the operation for over 20 years of the plant has caused skin and respiratory issues among Sawahlunto residents. Ombilin's early retirement will reduce GHG emissions and improve the air quality resulting in health benefits for the community. The West Sumatra electric system is able to withstand the early retirement of Ombilin due to the existing overcapacity. Even after Ombilin is retired, the system would still have 500MW of overcapacity. Plus, the good level of flexibility the Sumatra system would allow the Ombilin's generation to be replaced with new variable renewable generation. According to the RUPTL, West Sumatra has a potential for 1.1GW of renewable projects, including solar PV, biomass, geothermal and hydro. Finally, the low levels of poverty in the province suggest that the socio-economic impact of the retirement would not be so harsh on the local community. The province issued its own General Plan of Regional Energy to 2050 that aim to reach 52% of renewables in its energy mix.	

Cost Benefit Analysis for PLN
Costs: ● Transaction Costs (4% total costs) **Benefits:** ● The retirement of Ombilin is part of the early retirement program (ETP-NZE) and would contribute to meeting the national decarbonization targets by 2030: 25MtCO_2e abated compared to operation until 2040, and 4.4 MtCO_2e avoided compared to natural retirement year) ● Avoided carbon tax: 966 billion IDR (US$ 62Million) if Ombilin would operate until 2040, and 140 billion IDR (US$ 9Million) avoided if it would operate until its natural retirement year ● Reduction of compensation/subsidies: Annual compensation and subsidies for Ombilin are estimated in 319,000 million IDR (US$ 20 million which would be reduced to PLN after the retirement
Stakeholder Engagement
Internal and external stakeholder engagements is vital for the success of the retirement program. This stage focuses on setting the table for the retirement. 1) PLN and PT SMI will define expert teams (e.g. legal, finance, operation & maintenance, HR, communications) 2) CBA will be presented to PLN; it may also include socioeconomic benefits related to the retirement. and what are the next steps of the wider coal-phase out plan, beyond the retirement of Ombilin. 3) Negotiations over transaction (e.g. project schedule, preliminary post-decommissioning site use and funding mechanisms and financial instruments to be considered Once a clearer view of the retirement has been set. Communication and discussion with stakeholders should also being, e.g., regulators, and local government officials, system operators, community groups, industrial customers, etc.
Technical considerations:

- **Technical analysis of the retirement.** A technical analysis about the impact of the retirement to the grid is necessary. Ombilin accounts for 2.4% of the total generation in the system of Sumatra, and for 1.7% of the total installed capacity in its system. At a high-level analysis the system should be able to withstand the retirement due to the existing overcapacity, but a detailed power flow analysis simulating the Ombilin's retirement should also be carried out by the system operator.

  Definition of the site's final state. Alternatives to be studied after retirement should include only the suspension of the power plant, returning the site to greenfield, returning it to brownfield for future alternative projects, or the exploration of immediate repurposing, as it can be the development of industrial or commercial facilities, or on-site renewable generation. Solar PV technical potential at Ombilin's location is considerably high (1367kWh/kWp[153]). This suggests that repurposing of the site could be an option. The replacement may or may not be located in the CFPP's site but having it on Ombilin's site would allow the utilization of existing interconnection infrastructure. Currently, Ombilin is connected to a 150kV[154] transmission line and it's two units are the only ones connected to the same node, so ones the CFPP is retired the node would be free to connect the solar farm without much size restriction. As a first approach the RE potential estimated from PLN can be used as reference[155]. As a reference, the RUPTL reported a 49MW solar farm with feasibility studies that is being plan for West Sumatra proving the region has attractive solar resource. However, pre-feasibility and feasibility energy studies should be carried out to financially compare the retirement versus the replacement option.

Sawahlunto, the city where Ombilin is located, has the oldest coal mine in Southeast Asia and it has been declared a World Heritage site by UNESCO[156]. This could also suggest the reconversion to a greenfield, which would be in line with a diversification of the region's economy.

Remediation

153 Solargis (2022) Global Solar Atlas. [Online]. 2021. From: https://globalsolaratlas.info/map?c=-0.899469,100.176086,9&s=-0.664658,100.784454&m=site

154 Electricity Supply Business Plan (RUPTL) PT PLN (Persero) 2021-2030

155 Electricity Supply Business Plan (RUPTL) PT PLN (Persero) 2021-2030

156 UNESCO (2022) World Heritage Sites Lists. From: https://whc.unesco.org/en/list/

This stage should focus on defining remediation solutions that will be applied according to the agreed final land use. Solutions should include environmental and workforce remediation.

Environmental remediation should include a pre-demolition plan to secure the correct demolition waste management and the remediation of polluted soils and groundwater. The early retirement project should contribute to reduce GHG emissions and improve air quality, therefore, the environmental remediation plan should also monitor and seek the control of fugitive dust during the demolition along with securing occupational health and safety.

The decommissioning plan will include a workforce transition program that will define how many jobs will be created through repurposing, how many will be kept through the transition period, and how many will be laid off since Ombilin's shutdown at the end of 2023.

Workforce remediation can provide workers three possibilities:

- Transfer to another PLN owned power plant
- Reskilling for deployment to the solar PV repurpose project
- Voluntary separation agreements.

Early retirement could be offered to workers that had 5 or less years left for their natural retirement date. In addition, training programs should be developed to facilitate reskilling for Ombilin's workers but also for local community members.

Remuneration for plant:

The remuneration required to compensate for Ombilin's early retirement will be assessed with two main activities:

Due diligence for decommissioning. A due diligence to determine the book value of the power plant is required, along with modelling the discounted cash flow (DCF).

Funding and financial mechanism. As mapped in this study, there are financial instruments funded by MDPs and other countries that support coal-phase out. The definition of which of them should be used will depend on the results obtained from the due diligence. In addition, the finance mechanism to be used should be determined to set the decommissioning timeline. This activity is interlinked and could be affected by the decision of immediate site repurposing, described in the technical aspects. The decommissioning costs for the 200MW installed in Ombilin could be around US$ 11

Million[157]. This indicative figure gives a sense of the cost's magnitude; however, specific quotes must be requested to assess the real cost.
Retirement Process
This process includes all the steps required to reach the disconnection of Ombilin from the system (December 2023). The retirement process should include the following activities:

February 2023:	Define the team within Ombilin and PLN that will lead the project,
March 2023:	Request due diligence to determine the asset value and the early closure's cost of opportunity
	Request feasibility studies for solar farm that will replace solar farm, including
	Execute stakeholder's engagement plan
June 2023:	Request detailed power flow analysis from grid operator
	Begin activities to facilitate Ombilin's workers transition
July 2023:	Develop analysis to estimate decommissioning costs after Ombilin has been disconnected, e.g., demolition costs, waste management, soil treatment if required, etc.
August 2023:	Estimate solar PV costs (CAPEX & OPEX)
September 2023:	Present due diligence results along with the cost of the new solar farm to JETP or ETM to request for funding and financing
November 2023:	Present funding implementation plan, with dates or milestones defined which the funding will be provided
December 2023	Shutdown of Ombilin

[157] R. Cui, F. Tumiwa, A. Zhao, D. Arinaldo, R. Wiranegara, D. Cui, C. Dahl, L. Myllyvirta, C. Squire, P. Simamora, N. Hultman (August 2022). "Financing Indonesia's coal phase-out: A just and accelerated retirement pathway to net-zero." Center for Global Sustainability, University of Maryland, College Park, USA; Institute for Essential Services Reform, Jakarta.

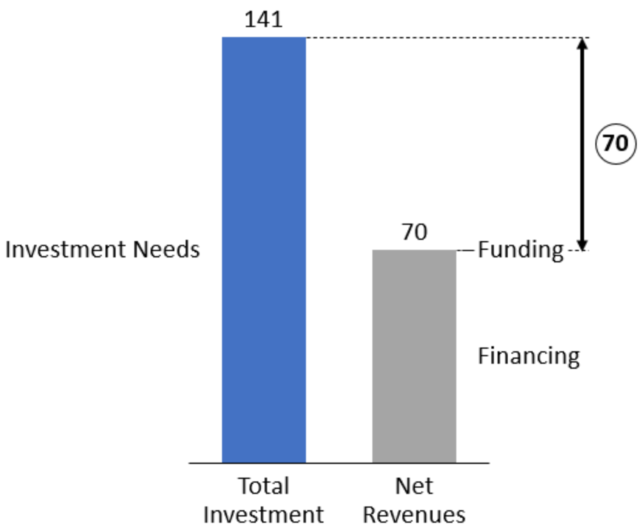
9.3 Funding and Financing

The retirement of Ombilin, subcritical CFPP, in 2023 is estimated to cost US $140.80m. This value is determined by an ADB study[158] by comparing it with similar transactions in Indonesia and the Philippines from 2012 to 2020, which then was brought to 2023 values. The low efficiency of the plant and the environmental problems it has faced, the regulatory direction in Indonesia and the fact Ombilin's lifespan would only be reduced four years compared to its natural lifespan, explains the low value.

Provided the urgent need to retire CFPPs to attempt to meet the Net Zero Targets and the problematic efficiency Ombilin has, it is sensible to recommend that Grants are considered the most adequate mechanism to enable Ombilin's early retirement. The grant would fill in the investment gap that is required to make a repurposing project commercially viable. The end objective of this grant-based mechanism is to bring together the relevant stakeholders and align the execution of a CFPP early retirement program. The objective of the grant program would be to finance projects that will retire early, and that can prove to have social programs for reskilling workers and a repurposing project for the CFPP site. The grant would finance up to 50% of the required funds, while the other half would be from banks and other investors (Figure 9.1).

[158] Regional: Opportunities to Accelerate Coal to Clean Power Transition in Selected Southeast Asia Developing Member Countries, ADB; October 2021

Figure 9.1 Grant scheme proposed



Public and private resources exist to co-finance the early retirement. It is considered plausible to gather financing from the ETM Country Platform and the JETP program to finance the project's retiring and repurposing. however, the Government of Indonesia (GOI) is also considered a key player in the investment required to early retire and repurpose the CFPP. As was discussed in the chapter 1 of this study, the GOI has the economic case to invest in early retirement since it will enable them to reduce fiscal burden from subsidies as cash will be liberated through these co-financing mechanisms. This would allow for the GOI and PLN to invest in the required infrastructure to enable renewable energy.

The application of the grant will require two CBA cash flow analyses, one with the grant and another without the grant for which Ombilin would be applying for. The financing gap between these two analyses would be covered by the grant preventing the need to make a transaction to start for early retirement.

There are three key steps that are required to prepare the funding gap:

a) Determine the funding needs for both decommissioning and repurposing including environmental and workforce remediation costs, pre-demolition and demolition costs, the replacement's project equipment costs, engineering procurement and construction costs, among others.
b) Develop a work plan for the decommissioning and repurposing project along with the disbursements of the funding.

c) Develop and present an economic analysis that considers sensitivities. The sensitivity analysis should model possible delays or budget changes. IT is suggested that the sensitivity analysis includes at least a) a 25% increase in CAPEX costs and b) a delay in the execution of both the decommissioning of the CFPP and the development and construction of the on-site renewable generation project that will replace Ombilin.

Based on common practices to enable implementation of key projects, after a due diligence, the disbursement should include up to 15% pre-financing to facilitate the agreement of the CFPP owner to engage with the early retirement program, and to ensure that the workers' compensation scheme put in place to assure a just transition. The rest of the disbursement would be done as a reimbursement of costs conducted throughout the early retirement, decommissioning, workforce program and EPC of the new sola PV plant.

9.4 Risk management and risk mitigation measures

There are risks that must be considered throughout the execution of an early retirement. Those risks can be perceived differently for each of the stakeholders involved in the retirement project. The following risk mitigation measures can support the success of the early retirement program:

1. **Conducting a risk assessment.** Identifying and evaluating potential risks that may affect the project and determining the likelihood and impact of each risk. These risks include the possibility for grant money to not result in permanent retirement of the CFPP but just being temporary offline. Other risks are cost overruns, which might compromise the result of the replacement project. Another important risk is the socio environmental impact of the closure of the CFPP, including workforce relocation on the replacement project or in other PLN power station and the removal of environmentally hazardous waste.
2. **Developing a risk management plan:** This involves outlining the strategies and actions that will be taken to mitigate or eliminate identified risks. Table 9.1lists some possible risks and examples of the strategies to mitigate them.

Table 9.1 Risks and strategies to mitigate them

	Risk	Strategies and Actions
1	Non-permanent retirement	Ensure there is a clearly planned decommissioning stage and the retirement has a starting date in which it to will be executed.
2	Environmental impact	Strategy to remove hazardous material following local environmental regulation and ensuring there is a plan for environmental damage remediation.
3	Energy security	Work with the system operator to understand the impact of the retirement the grid and the effect of the replacement project's connection to the grid.
4	Project costs overruns	Ensure there is an experienced and dedicated team of experts to evaluate feasibility of costs considering the local context and the project's specific characteristics.
5	Social rejection	Develop and execute a stakeholders' engagement plan that includes the local community groups. The plan should go hand in hand with a communication plan to report the project's advances.

3. **Establishing risk management processes and procedures:** This involves setting up processes and procedures to identify, assess, and manage risks on an ongoing basis. Beneficiary should identify how they plan to address the identified risks at the proposal stage. A description of their processes and procedures and how they plan to address specific risks.
4. **Implementing risk control measures**: This involves taking specific actions to reduce the likelihood and the impact of identified risks, such as implementing safety protocols, purchasing insurance, or implementing quality control measures.

5. **Monitoring and reviewing risks:** This involves regularly reviewing and monitoring identified risks to ensure that they are being effectively managed and controlled and determining a plan for clearly reporting the results.
6. **Conducting regular risk assessments:** This involves regularly reviewing and updating the risk assessment to ensure that it reflects the current state of the project, and to identify any new risks that may have emerged. This includes the initial identification of risks during application, and then every 4 months for revision to ensure that the studies are done in time, and permits are obtained to comply with the project's workplan on time and in budget. In the four-month updates risk matrix should be updated and it should highlight any new risks identified or materializing.
7. **Communicating risks to stakeholders:** Informing relevant stakeholders about identified risks and the steps being taken to manage them. The correct execution of the communication plan between the benefactor and the beneficiary could be able to identify when the project is running into cost overruns or delays.

Chapter 4: supply chain analysis and regional sensitivities

UNOPS
Energy Transition Partnership

Study on the Financial Implications of the Early Retirement of Coal-fired Power Plants in Indonesia

10 Economic and fiscal impacts of coal-fired power plant retirement

The retirement of coal-fired power plants (CFPPs) can have significant economic and fiscal impacts on the coal supply chain, encompassing coal mining and transportation. These effects can extend to the wholesale electricity prices, as well as the cash flow of PLN (Perusahaan Listrik Negara) and the government's fiscal flows.

These findings highlight the need for careful study and monitoring of each of these aspects to ensure that the implementation of a CFPP early retirement program is carefully managed and does not result in unintended consequences.

Table 10.1 Direct and indirect impacts of early retirement of CFPPs

Direct Impacts	Indirect Impacts
Variations in coal production: The reduction in domestic demand for coal due to CFPP retirement can lead to variations in coal production. The coal mining sector may need to adjust its production levels and capacity to meet changing demands, potentially diverting production to international markets to align with global demand for coal. **Potential job losses:** The decrease in coal mining and transportation resulting from CFPP retirement can lead to potential job losses in these sectors. Workers involved in mining and transportation of coal may face employment challenges as demand might change.	**Variation in mining companies' revenue:** The impacts of early retirement of CFPPs can compound the effects of high and low international coal demand, which will either increase mining sector revenue or decrease mining sector revenue. **Potential decrease in sub-regional revenue:** The reduction in mining activity associated with CFPP retirement can have implications for sub-regional revenue. As mining activity decreases, there is a possibility of a decrease in revenue for sub-regions that rely on the coal industry. This can impact the local economy. **Increased participation of renewable energy:** As CFPPs retire, the role for renewable energy will increase.

10.1 Short- and Long- Term Economic and Fiscal Impacts

The retirement of CFPPs is expected to have significant economic and fiscal impacts on the coal mining sector, which plays a vital role in the country's economy, as well as on PLN, the central play in the electricity sector.

Coal mining is a major contributor to the economies of several provinces, including East Kalimantan, South Sumatra, South Kalimantan, and Central Kalimantan, where most of Indonesia's coal deposits and production are located. For instance, in 2017, the coal industry accounted for up to 35% of East Kalimantan's GDP, while in South Kalimantan, it contributed between 19% and 26% of the local GDP over the past five years. The transition to cleaner energy sources can have political, social, and economic effects in these regions due to the substantial GDP contribution of the coal industry and the development disparity with other sectors[159]. The early retirement of CFPPs, particularly in regions like South Sumatra, one of the largest coal-producing regions in Indonesia and a key province in the CFPP's supply chain, could result in a decline in domestic coal demand, thereby impacting the national coal transport sector.

The retirement of CFPPs will also affect Indonesia's coal transport industry, leading to reduced demand for coal transportation services, decreased revenue, and job losses, especially during periods of low international coal prices. Companies such as PT Pelayaran Nasional Indonesia, PT Kereta Api Indonesia, PT Berlian Jasa Terminal Indonesia, and PT Samudera Indonesia Tbk are likely to be impacted. Provinces with extensive transport infrastructure, including South Sumatra and East Kalimantan, will experience the most significant effects. Regions like Samarinda in East Kalimantan, which rely on large coal mines and utilize major transportation routes like the Mahakam River[160], will need to adapt to changes in demand distribution channels.

Fiscal impacts on Indonesia's coal supply chain will primarily stem from the mining activities associated with CFPPs and the CFPPs themselves. While the transport sector has the potential to be affected by the early retirement of CFPPs, the fiscal analysis assumes that coal exports will continue during a predefined period of

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[159] Aleksandra, I. for ISER (2019) Indonesia's coal dynamics: Toward a just transition, Climate Transparency. Available at: https://www.climate-transparency.org/media/Indonesias-coal-dynamics-toward-a-just-transition

[160] Samarinda Port (2023) SHIPNEXT.From: https://shipnext.com/port/5828fb946742c90cc0eb7287

high international coal demand, gradually declining thereafter. The suppressed domestic coal demand resulting from the retirement of 32 CFPPs is marginal when compared to national coal production (1.32% over a 10-year period). As a result, the contribution of transport activities related to suppressed coal demand to fiscal flows is not significant to the national budget.

In the short term, Indonesia's early retirement of CFPPs will bring mixed economic and fiscal outcomes. On one hand, VAT collection may decline since coal, which was previously traded domestically, will be rerouted to international exports that aren't subject to VAT. At the same time, the government will need to compensate CFPP owners for the retirement. On the other hand, this shift could lead to increased income tax revenues from the coal mining sector as companies focus more on international sales.

The projection that has been developed for the current study assumes that international coal demand remains robust in the short term, and that coal mining companies can effectively capitalize on favorable pricing conditions without being constrained by domestic market obligations. The observed increase in coal exports to other markets in 2022 further supports this notion. Therefore, while immediate fiscal challenges are expected, the shift towards international markets may partially offset the impact by generating increased income tax revenue. These dynamics underscore the need for careful monitoring and assessment of the short-term economic and fiscal effects resulting from the early retirement of CFPPs in Indonesia. In the long term, royalties from coal mining companies to local governments are expected to decline as international coal demand decreases.

On the other hand, it's crucial to consider that if electricity tariffs are to remain constant, subsidies may need to increase to offset potential rises in electricity costs due to coal retirement and the introduction of new renewable energy sources. Such subsidies could burden the national budget. To ensure long-term stability for both national and provincial budgets, it would be prudent to widely adopt variable electrical tariffs and consider establishing a Just Transition Fund, which would support affected workers and regions. These measures can help mitigate the financial challenges associated with the shift away from coal and support a smooth transition towards cleaner and more sustainable energy sources.

10.2 Employment Impact of CFPP Early Retirement Program

10.2.1 Coal Mining

The retirement plan for 32 CFPPs in Indonesia will have substantial implications for employment and fiscal flows in the coal mining industry, especially in East Kalimantan and South Sumatra. Together, they account for 55% of the country's total coal production and over 76% of the coal designated for power generation.

During the low global coal demand period starting from 2028, there is a risk of over 13,000 mining jobs being lost, around 5% of those affected being women. In East Kalimantan and South Sumatra, approximately 6,880 and 4,120 mining jobs are at risk, respectively (Table 10.2). The impact on employment is significant, considering that these provinces heavily rely on coal mining. In 2021, East Kalimantan had a total of 130,564 workers engaged in mining and quarrying, with women comprising 2,815 of the workforce (2.2%)[161]. Similarly, in South Sumatra in 2022, there were 75,036 workers in mining, including 8,376 women (11%)[162].

Table 10.2 Jobs at risk in coal mining due to the retirement of the 32 CFPPs

Year	Jobs at risk in coal mining by province	
	East Kalimantan	South Sumatra
2028	1,574	943
2029	1,063	637
2030	941	564
2031	1,527	915
2034	757	454
2036	902	541
2037	23	14

161 Statistics Kalimantan Timur. 2023. Kalimantan Timur Province in Figures 2023. https://kaltim.bps.go.id/publication/2023/02/28/7a58231d5aa2f5a7b4d5c36a/provinsi-kalimantan-timur-dalam-angka-2023.html

162 Statistics Indonesia Sumatera Selatan Province. 2023. Sumatera Selatan Province in Figures 2023. https://sumsel.bps.go.id/publication/2023/02/28/e89a49138ffef974b573bc4c/provinsi-sumatera-selatan-dalam-angka-2023.html

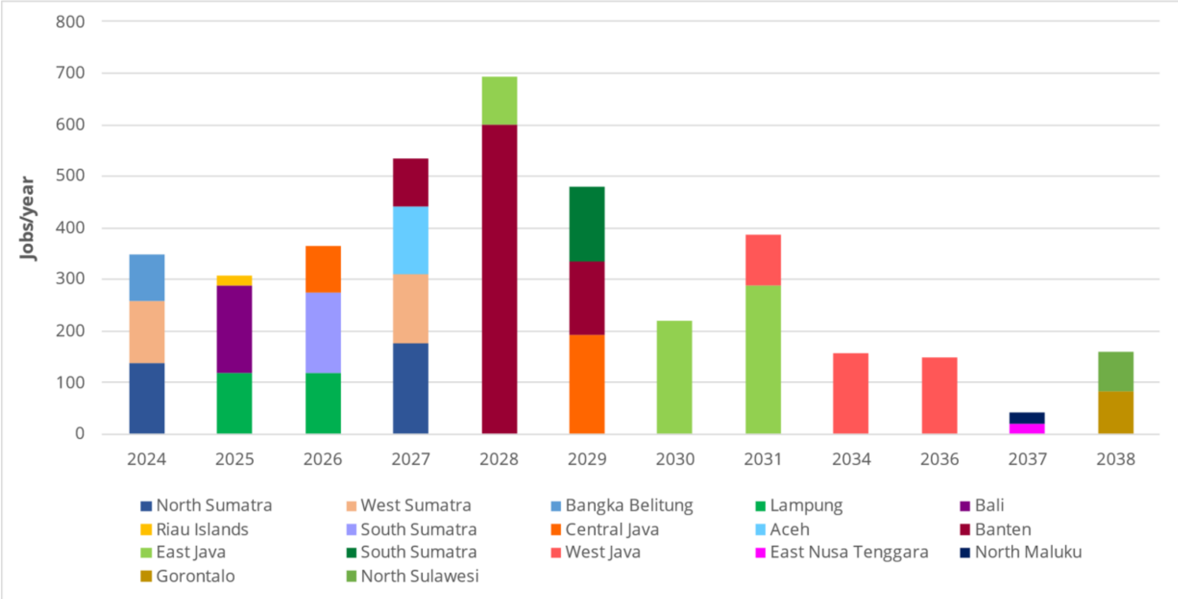
Year	Jobs at risk in coal mining by province	
	East Kalimantan	**South Sumatra**
2038	94	56
TOTAL	**6,881**	**4,124**
East Kalimantan and South Sumatra contribution to coal for power generation are 52.37% and 31.39% respectively.		

In the short term, during the high demand period, the CFPP retirement plan is expected to have minimal impact on coal mining employment, as excess coal can be exported to the international market. However, in the low demand period characterized by a 25% drop in international coal demand, there is a real concern for the loss of employment opportunities in the mining sector, particularly in North, East, and South Kalimantan, where coal infrastructure is concentrated. This poses a potential threat to the livelihoods of mining workers and their families in these regions.

10.2.2 CFPPs

In addition to the employment impact on coal mining, the retirement plan for CFPPs is expected to have a significant impact on employment at CFPPs, with the highest impact occurring in Lampung, Banten, East Java, and West Java provinces. According to the figure below the initial impact will begin with a three-year period averaging 320 jobs lost per year, followed by a high-impact period of 570 jobs lost per year for an identical duration. After 2031, the impact on CFPP employment is expected to decline to below 150 jobs lost per year. While none of the 32 sampled CFPPs are in East Kalimantan, about 300 jobs in CFPPs in South Sumatra could be at risk. As most of the workforce in the electricity supply sector are men, it is expected that approximately 3,800 jobs will be at risk due to CFPP retirement, with approximately 3,400 consisting of men and 400 of women. Figure 10.1 illustrates the jobs at risk due to CFPP closure by province.

Figure 10.1 Jobs at risk due to CFPP closure by province



10.3 Regional Fiscal Impact Sensitivities

The early retirement of CFPPs can have significant consequences for the communities and regions that have long relied on the coal industry for employment and economic growth. Among these regions, East Kalimantan and South Sumatra are particularly affected and require careful consideration and planning for a just transition. It is projected that the retirement plan for the 32 included coal-fired power plants will result in a suppressed coal demand of approximately 73.4 million tons by 2038, predominantly consisting of low-rank coal/medium-rank coal (LRC/MRC) [163] quality coal. Additionally, with the decline in global coal demand, nearly 33% of this coal will not be exported, leading to further impacts on local economies[164]. This section examines the regional sensitivities of East Kalimantan and South Sumatra and highlights initiatives and strategies aimed at achieving a just transition for the affected communities. The relevant variables considered are described on Table 10.3[165]:

[163] 4,200 to 5,000 kcal/kg GAR gross calorific value.

[164] IEA (2022) Coal in Net ZeroTransitions.From:https://iea.blob.core.windows.net/assets/4192696b-6518-4cfc-bb34-acc9312bf4b2/CoalinNetZeroTransitions.pdf

[165] The study acknowledges that CAPEX could have potential economic impacts. However, it has been excluded from the current discussion, which primarily focuses on the supply chain of the CFPPs and their impact on the regional economy. This decision was made because a significant portion of CAPEX components is directly associated with industries located outside the regional

Table 10.3 Variables considered in the analysis

Category	Variable	Supply Chain Sector
Employment	Employment	CFPPs
		Mining
Fiscal Flows	Income Tax	CFPPs
		Coal and Lignite Mining
	VAT	CFPPs
		Coal and Lignite Mining
	Royalties	CFPPs
		Coal and Lignite Mining
Coal and lignite mining industries are included in the analysis considering the more than 80% of CFPPs' cost structure are fuel costs i.e. Coal.		

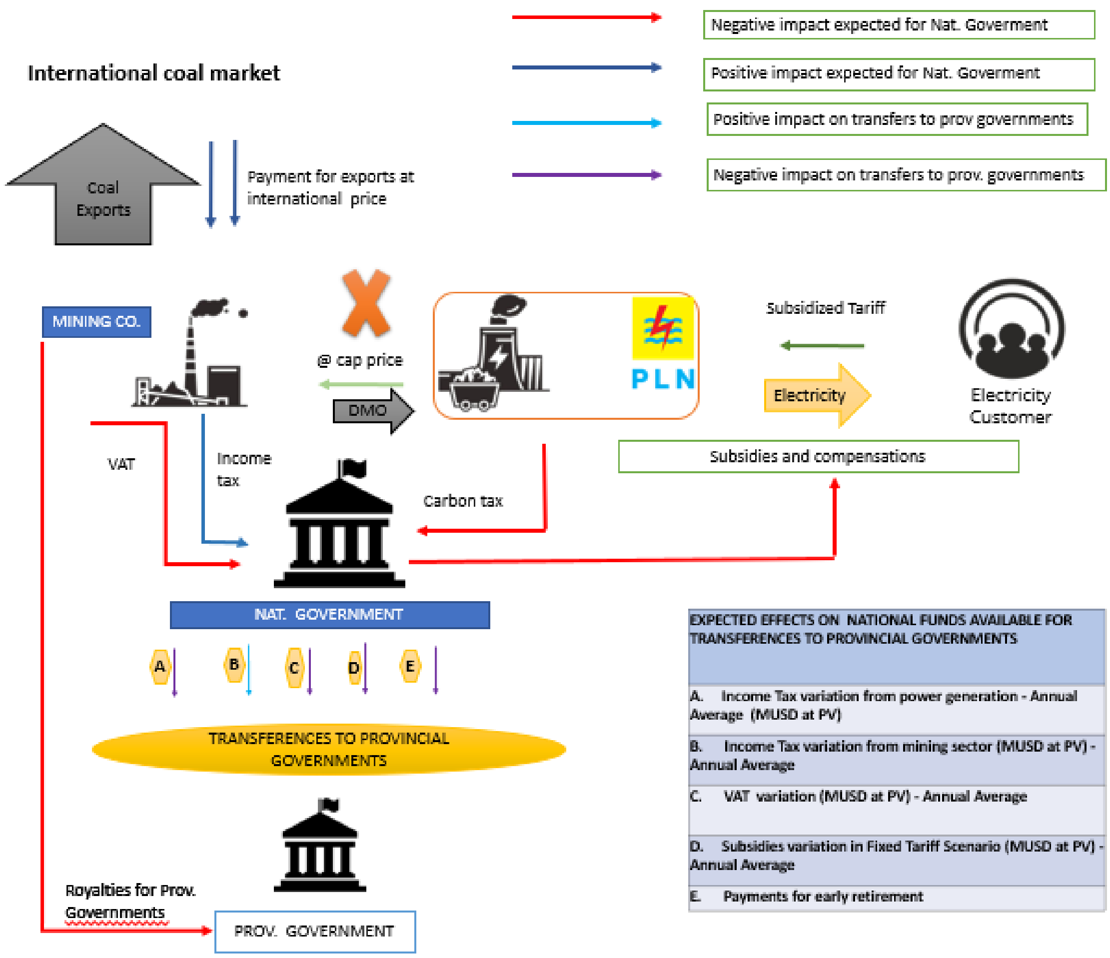
It is crucial to account for the impact of compensation payments made to CFPP owners during their early retirement. These payments can significantly influence fiscal flows, especially for provincial governments that have a vested interest in the coal industry's financial dynamics. Recognizing these payments provides a more comprehensive understanding of the economic repercussions faced by provinces like East Kalimantan and South Sumatra.

The Figure 10.2 below presents a comprehensive overview of the Regional Fiscal Analysis, focusing on the significant impacts of the CFPPs Early Retirement Plan on fiscal flows in East Kalimantan and South Sumatra. This analysis aims to assess the sensitivity of fiscal revenues and expenditures in these provinces to the retirement plan. The diagram illustrates the crucial relationship between national government finances and provincial government finances, highlighting the key

economy, particularly in terms of financial costs and direct investments. The banking industry, concentrated in Jakarta and sometimes beyond the country's borders, contributes to the financial costs, while equipment costs predominantly involve external production sources outside the regional and national economy.

aspects of fiscal management in Indonesia that will be explored and elaborated upon in this analysis.

Figure 10.2 Fiscal impact analysis scheme for affected provinces



The retirement of CFPPs in Indonesia not only affects employment opportunities in the power sector but also has significant implications for regional government revenues. In periods of high demand, the redirection of unused coal to the international market mitigates the impact on coal mining employment. However, during the low demand period, the reduced export of LRC/MRC coal due to declining international demand can have a substantial impact on both the mining sector's employment and government revenues in the subsequent years. Provinces with a high concentration of coal infrastructure, such as North, East, and South Kalimantan, are particularly susceptible to these effects.

This Fiscal Impact Analysis was undertaken using a scenario that places significant stress on provincial finances. The study incorporates several pivotal assumptions:

- The implementation of fixed tariff subsidies, anticipated to yield higher subsidies within the scope of this retirement plan.
- Distinct periods of international coal demand, with high demand spanning 2023 - 2027 and low demand from 2028 – 2040.
- The adoption of passive fiscal policies by the national government. Such policies could lead to direct repercussions on transfers to subnational governments, potentially diminishing their revenues and expenditures as a consequence of the Retirement Plan.

Grounded in these assumptions, we estimated the impacts on pertinent fiscal variables. The inputs and specific criteria driving these estimates are detailed in the table below.

Table 10.4 Inputs and assumptions for regional fiscal impact assessment

Fiscal Impact Item	Final inputs for impact calculation for every province	Specific Assumptions
A. Income Tax variation from power generation - Annual Average (MUSD at PV) A = j * k * l * m	j) Share of transfers to local governments in total expenditures of the national budget. k) Ratio of total revenues / total expenditures in national budget. l) Share of transfers from the national government in total revenues for every provincial budget (expressed as %). m) Income tax variation from power generation at national level due to Retirement plan.	The difference in profitability between RE plants and Retired CFPPs will generate a higher Income Tax in the same magnitude as this difference. (RE plants would have higher profitability due to their lower generation cost).
B. Income Tax variation from mining sector	j), k) and l) described above.	The closing of CFPPs will impact coal mining company revenue due to exported coal. This variation in coal mining

Fiscal Impact Item	Final inputs for impact calculation for every province	Specific Assumptions
(MUSD at PV) - Annual Average. B = j * k * l * n	n) Income tax variation from mining sector at national level due to Retirement plan.	revenue will affect income tax, which will consequently influence the national fund for transfers to local governments.
C. VAT variation (MUSD at PV) - Annual Average C = j * k * l * o	j), k) and l) described above. o) VAT variation at national level due to Retirement plan.	VAT is not applicable to exported coal. The early retirement of CFPPs will lead to variations in coal exports. Given that VAT is not applied to exported coal, a decrease in VAT is expected.
D. Subsidies variation in Fixed Tariff Scenario (MUSD at PV) - Annual Average. E = j * l * q	j), l) described above. q) Subsidies variation at national level due to Retirement plan.	The NZE fixed Electricity tariff scenario uses the weighted average tariff of all types of consumers in 2021 and remains unchanged. The retirement of CFPPs will necessitate additional subsidies and compensation due to the replacement by more expensive RE. A greater variation in subsidies will reduce national resources available for transfers to local government.
E. Payments for early retirement. F = j * l * r	j), l) described above. r) Payments for early retirement at national level due to Retirement plan.	Payments will be required for the early retirement program of every CFPP. In this analysis, payments are assumed to come from the Indonesian government to demonstrate the potential impact on the national budget. As a result, this new expenditure could affect national resources

Fiscal Impact Item	Final inputs for impact calculation for every province	Specific Assumptions
		available for transfers to local governments.
F. Provincial royalties' variation G = s * t * u * v	s) Not all suppressed coal demand from CFPPs are exported t) Average national coal price u) Royalties tariff for provincial governments v) Share of royalty transfers in total revenues for every provincial budget (expressed as %).	Royalty tariffs and their distribution to subnational governments will remain consistent. Coal demand that isn't exported will influence coal mining production and result in decreased royalties.

10.3.1 East Kalimantan

In the short term, the fiscal impact on East Kalimantan due to the retirement of CFPPs can be considered relatively low, with an average decrease of 2.04% in the province's annual revenues. However, without appropriate policies to mitigate this impact, the long-term effects become significant. Over the retirement period, the total potential revenue loss would equate to 39.91% of the annual provincial budget's revenues.

The primary driver behind this fiscal impact is the anticipated increase in electricity subsidies, under the assumed fixed tariff scenario, and the subsequent reduction in national resources allocated for transfers. In the long run, these impacts would amount to 35.08% of the annual provincial budget's total revenues. In contrast, all other fiscal sources of impact on the provincial budget are less substantial, each accounting for less than 3.0% of the province's budget revenues.

From this impact analysis, two primary conclusions can be drawn:

1. The National Government must coordinate with the provincial government to implement proactive policies. This is to ensure that potential decreases in revenue, especially the surge in expenditures, do not jeopardize funding

transfers to this province right from the onset of the retirement program. This is crucial as the cumulative impact could represent a significant chunk of the province's total budgeted revenue.

2. Given that the increase in electricity subsidies, under a fixed-tariffs scenario, would be the largest source of fiscal impact for both the province and the national government, it's imperative for the national government to consider adopting a dynamic tariff model.

Table 10.5 Fiscal impacts in East Kalimantan after retirement of the CFPPs (2023 – 2040)

Fiscal Impact Item	Likely Impact on National Fund for Transfers to Local Gov. (USD - PV 2020)	Likely Impact on E. Kalimantan Rev. from Transfers (USD - PV 2020)	Likely Impact on E. Kalimantan Revenues (%)
A. Income Tax variation from power generation - (MUSD at PV)	49,106,464	379,592	0.055%
B. Income Tax variation from mining sector (MUSD at PV) -	201,761,239	1,559,614	0.225%
C. VAT variation (MUSD at PV) -	-2,672,722	-20,660	-0.003%
E. Subsidies variation in Fixed Tariff Scenario (M at PV) -	-31,396,753,546	-242,696,904	-35.083%
F. Payments for early retirement	-2,561,090,291	-19,797,227	-2.862%
G. Provincial royalties variation	-	-15,480,318	-2.238%
Total impact on provincial Revenues	-	-276,055,903	-39.905%
Royalties variation on local governments (regencies)	-	-52,246,074	0.000%

10.3.2 South Sumatra

Just as with East Kalimantan, the fiscal impact on South Sumatra due to the retirement of CFPPs would be highly significant in the long term, accounting for 37.30% of annual provincial revenues. The most profound impact stems from the variation in electricity subsidies, which alone would constitute 33.36% of the annual provincial budget. Such substantial impacts would only be realized if appropriate mitigating policies weren't put in place for this province.

In the short term, the retirement of CFPPs would have relatively modest impact on the provincial budget, analogous to East Kalimantan. The province's revenues would see an average annual decrease of 1.90%, with 1.67% attributable to the changes in electricity subsidies. Although the fiscal impact on South Sumatra is slightly less than on East Kalimantan, the primary conclusions drawn remain consistent for both provinces:

1. National Government, in tandem with the provincial government, must enact proactive policies to ensure that the potential decrease in revenue, and more critically, the uptick in expenditures, does not compromise funding transfers tot eh province from the outset of the retirement program. The compounded effect would represent a notably significant portion of the provincial budget's total revenue.

2. Given that the surge in electricity subsidies, under a fixed-tariffs scenario, would be the largest source of impact for this province (and nationally), the national government should pivot towards a dynamic tariff model.

Table 10.6 Fiscal impacts in South Sumatra after retirement of the CFPPs (2023 – 2040)

Fiscal Impact Item	Likely Impact on National Fund for Transfers to Local Gov. (USD - PV 2020)	Likely Impact on S. Sumatra Rev. from Transfers (USD - PV 2020)	Likely Impact on S. Sumatra Revenues (%)
A. Income Tax variation from power generation - Annual Average (MUSD at PV)	49,106,464	330,486	0.052%
B. Income Tax variation from mining sector (MUSD at PV) - Annual Average	201,761,239	1,357,853	0.214%

C. VAT variation (MUSD at PV) - Annual Average	-2,672,722	-17,987	-0.003%
E. Subsidies variation in Fixed Tariff Scenario (MUSD at PV) - Annual Average	-31,396,753,546	-211,300,151	-33.358%
F. Payments for early retirement	-2,561,090,291	-17,236,137	-2.721%
G. Provincial royalties' variation	-	-9,371,027	-1.479%
Total impact on provincial Revenues	-	-236,236,964	-37.295%
Royalties' variation on local governments (regencies)	-236,236,964.50		

11 Specific economic impact on the electricity sector

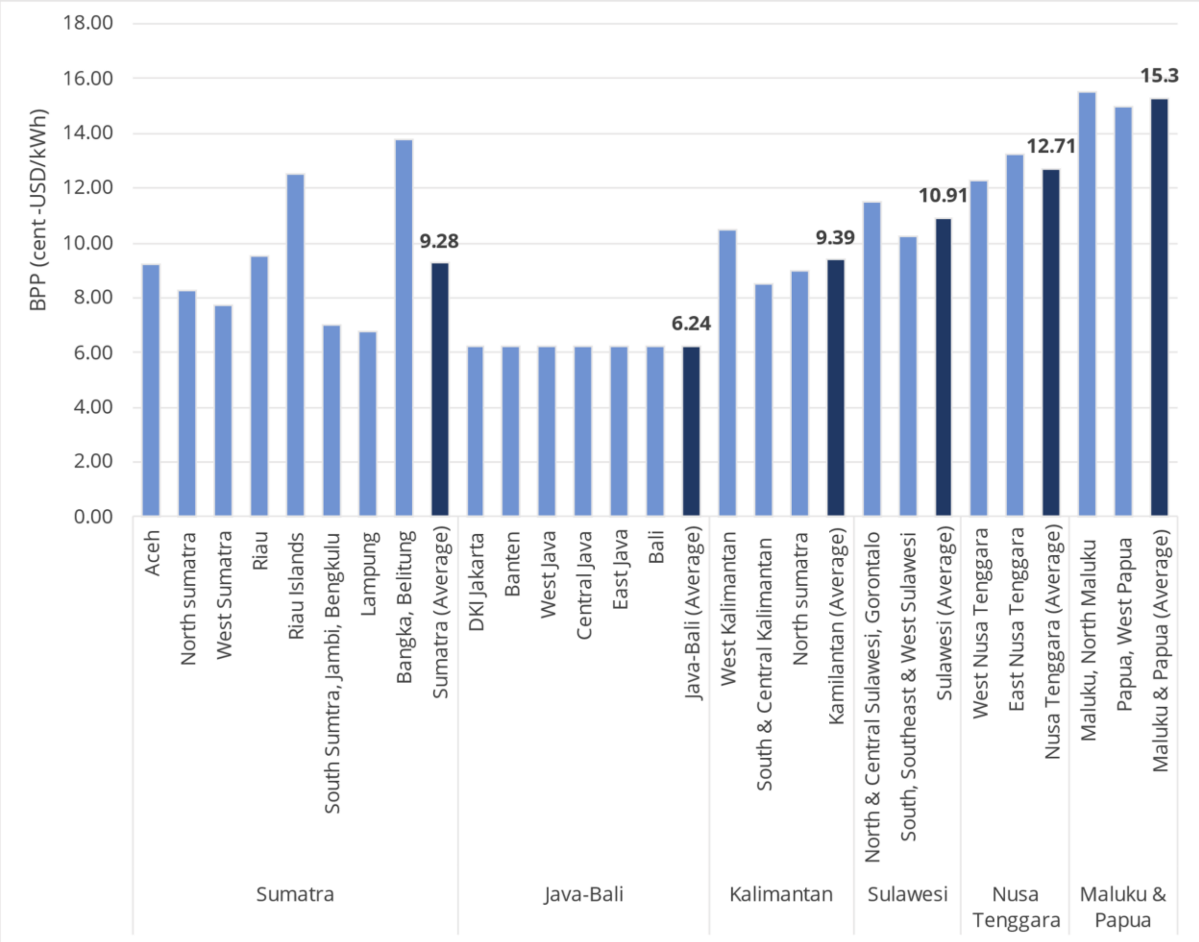
The retirement of CFPPs can have significant implications for the electricity sector, both in the short term and the long term. One key aspect is the variation in the Basic Generation Cost (Biaya Pokok Penyediaan Pembangkitan or BPP), which is the basic cost of electricity generation for a power plant. This cost varies considerably across different regions Figure 11.1, depending on factors such as availability of alternative energy sources, demand patterns, and grid infrastructure.

In the short term, the replacement of CFPPs with other energy sources may lead to an increase in wholesale electricity prices. This is because alternative energy sources may be more expensive to produce. However, the impact on wholesale electricity prices cannot be generalized, as it highly depends on regional factors. For example, Java, which is fully interconnected and relies on CFPPs for 60% of its electricity supply, has a lower BPP compared to other regions. On the other hand, regions like Bangka Belitung and Riau Island in Sumatra have higher BPPs due to limited interconnection and a greater reliance on diesel power plants.

Furthermore, the retirement of CFPPs can have both positive and negative impacts on the state-owned electricity company PT PLN (Persero). In the short term, PLN may experience an increase in electricity costs, which could put financial pressure on the company. This is primarily due to the need to procure electricity from alternative sources that may have higher costs. On the flip side, PLN may also see a decrease in electricity sales due to potential price increases, which could impact on its revenue.

In the long term, the retirement of CFPPs may lead to an increase in investment needs for PLN as it transitions to cleaner energy sources. However, it may also bring benefits in terms of reduced operational expenses associated with coal-fired power plants.

Figure 11.1 Cost of PLN in generating power and in procuring electricity for 2020 (Biaya Penyediaan Pokok - BPP), as stipulated in the MEMR Decree 169/2021

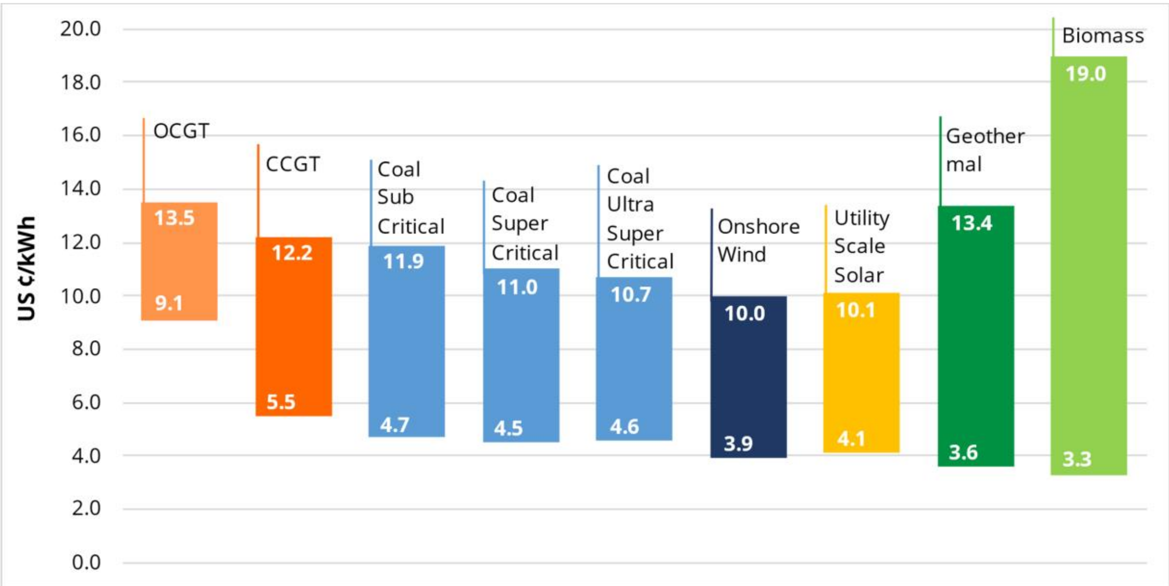


11.1 BPP Variation

The impact of the early retirement of CFPPs on the electricity sector in Indonesia, particularly on the BPP (basic electricity generation cost), is significant and has several implications.

Firstly, replacing the lost power generation from CFPPs with RE sources will require substantial RE capacity. Although RE can have competitive levelized costs of energy (LCOE) in Indonesia (Figure 11.2), CFPPs are still considered the cheapest source of bulk generation in the country, with a generation cost ranging from US$ 66 /MWh to US$95 / MWh (0.98 to 1.4 million IDR/MWh). This cost advantage of coal is primarily due to factors such as coal domestic obligations (DMO), which limit coal prices locally, and the absence of accounting for externalities like local pollution costs. Consequently, there will be variations in the BPP due to the differences in generation costs between RE and CFPP. Price volume caps can have significant economic implications. From an economic rent perspective, these caps can prevent the market from maximizing its efficiency and hinder the generation of surplus value. By limiting the quantity of goods or services that can be produced or sold, price volume caps distort resource allocation and prevent resources from being allocated to their most productive uses. This can lead to missed opportunities for economic rent to be realized. Ignoring externalities is another key economic implication of price volume caps. Allowing a polluting industry to continue operating without accounting for the negative externalities, such as environmental degradation or health impacts, does not accurately reflect the true economic cost. Ignoring externalities can lead to market inefficiencies and hinder the overall welfare and sustainability of the economy. The implementation of the national Emissions Trading System (ETS) policy for CFPPs presents an opportunity for RE electricity to become more competitive. However, the success of this policy will depend on the complementary policies implemented to support the growth of RE capacity.

Figure 11.2 Levelized cost of renewables and fossil power plants in Indonesia[166]



In the short term, the replacement of CFPPs with RE is expected to result in an increase in the cost of electricity generation. The retirement of coal plants will cause a shift in the supply curve, leading to PLN dispatching more expensive

[166] IESR (2023). Making Energy Transition Succeed: A 2023's Update on The Levelized Cost of Electricity and Levelized Cost of Storage in Indonesia. Jakarta: Institute for Essential Services Reform (IESR).

energy sources first (Figure 11.3[167]). This shift will contribute to higher electricity prices.

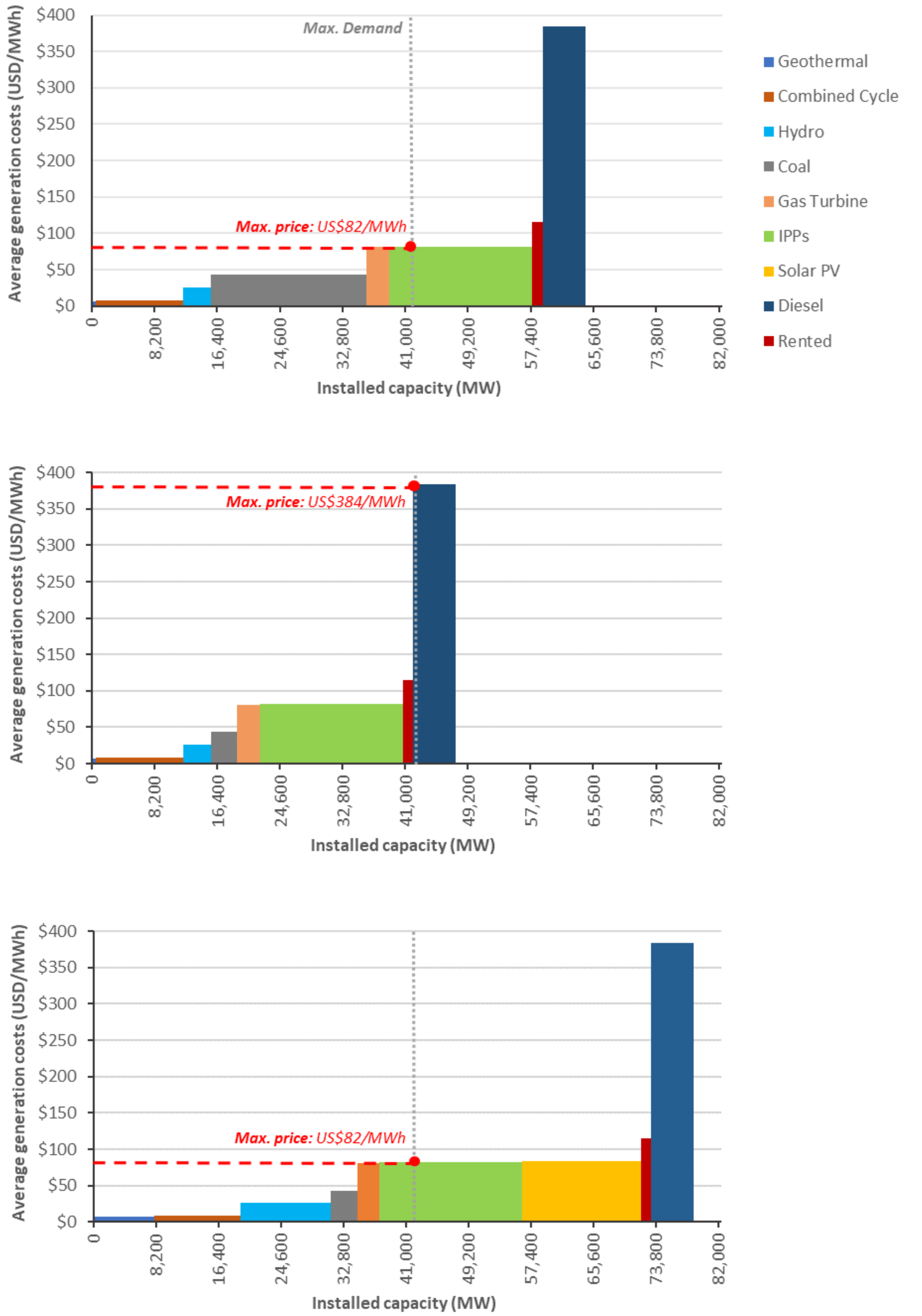
To illustrate the situation, in the unrealistic situation where 16.9 GW capacity corresponding to the 32 CFPPs considered in the early retirement scenario is retired without immediate replacement by renewables, there would be a significant increase in the electricity generation cost (Figure 11.3). The cost of generation could rise from US$ 82/MWh (1.2 million IDR/MWh) to as high as US$ 384/MWh (4.2 million IDR/MWh), representing the maximum generation cost (Figure 11.3). The weighted average generation cost would rise from US$ 80/MWh to US$ 92/MWh (1.2 to 1.4 million IDR/MWh), representing ~US$ 3.7 billion (IDR 57 trill) in costs for the Indonesian economy. High electricity costs can have significant socioeconomic impacts. Increased electricity prices can disproportionately affect households and lower-income individuals, as they spend a larger portion of their income on energy-related expenses. Higher electricity bills can strain household budgets, leading to reduced discretionary spending on other essential goods and services, such as healthcare, education, or basic needs. Additionally, high electricity costs can affect the cost of living, potentially leading to inflationary pressures and reduced purchasing power. The increased burden on households can exacerbate income inequality, as those with lower incomes may struggle to cope with rising energy expenses.

To mitigate this increase in electricity prices, it is crucial to add new renewable energy sources. Figure 11.3 illustrates that if the generation of the retired 32 CFPPs is replaced by a mix of geothermal, hydro, and solar PV (50%, 25%, and 25% respectively), the maximum generation cost would decrease. The weighted average generation cost could decrease up to US$ 76/MWh (1.1 million IDR/MWh) if this mix of renewables is deployed. PLN can proactively prepare to mitigate the impact and transform this risk into an opportunity to lower generation costs and, consequently, reduce electricity prices for consumers.

[167] PLN (2022) statistics PLN 2021. https://web.pln.co.id/statics/uploads/2022/08/Statistik-PLN-2021-29-7-22-Final.pdf

Figure 11.3 Merit order curve for PLN's owned, rented and IPP generation, (a) today, (b) after coal retirement and (c) after the retired coal generation has been replaced with renewables.

(a)



Moreover, the compensation required for early retirement to meet JETP requirements will need to be considered. This compensation cost, estimated at US$ 1 billion (IDR 15.4 trill) per year until 2040[168], is expected to be passed on to the off taker, generally PLN, through the wholesale electricity tariff, potentially impacting the BPP. It should be noted that the consumer electricity tariff in Indonesia is determined by the government, which provides subsidies and compensations to bridge the gap between the electricity generation cost from the power utility company and the consumer. Without adjusting the consumer electricity tariff, imposing the cost of early retirement on the generation costs will increase subsidy needs and add additional burden to the government.

Looking ahead, the retirement of CFPPs and the increased deployment of RE are expected to have a long-term impact on the BPP. As the costs for RE decrease, it is projected to eventually become a cheaper option for electricity generation than CFPPs. In this study, the ETP NZE scenario indicates that the BPP will reach its peak at US$ 100/MWh (1.4 million IDR/MWh) in 2030 due to the accelerated deployment of RE, particularly solar and wind energy, along with other planned developments that require substantial upfront capital investments. By 2030, the investment costs for utility-scale solar PV and onshore wind in Indonesia are expected to decrease to approximately US$ 19/MWh (0.28 million IDR/MWh) and US$ 17/MWh (0.25 million IDR/MWh), respectively. However, by 2040, the BPP is expected to decrease to US$ 88/MWh (1.3 million IDR/MWh) due to lower fuel cost associated with RE[169].

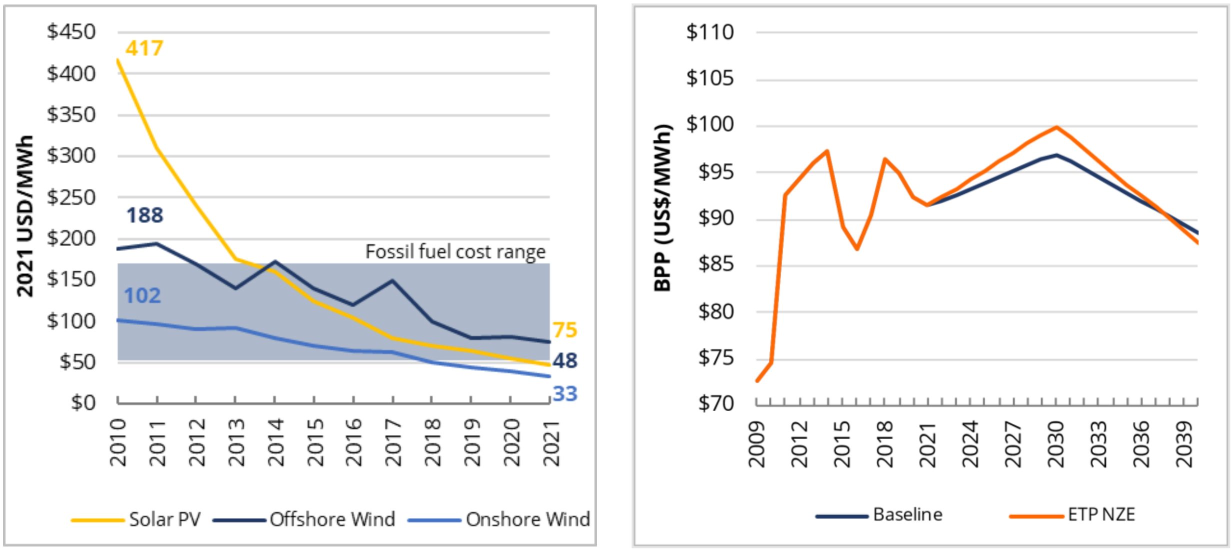
Moreover, the Indonesian government is gearing up to incorporate carbon pricing mechanisms, which are poised to further escalate the cost of electricity generation via CFPPs. This strategy will inevitably tighten the cost disparity between RE and CFPPs. While the Domestic Market Obligation (DMO) retains its relevance, the introduction of a carbon pricing mechanism—be it in the form of a carbon tax or an emissions trading system—boasts myriad benefits. A carbon pricing strategy adeptly zeroes in on pollution, spurring emission cutbacks and sidelining the more pollutant power plants. In essence, it encourages investments in low-carbon ventures by channeling the generated revenue into renewable energy subsidies and other pivotal measures pivotal for a green economy transition. Rooted in a market-driven paradigm, carbon pricing kindles innovation and introduces adaptability into emission-reduction tactics. In conclusion, these long-term impacts underscore the notion that the initial retirement of CFPPs might

[168] Our estimate is ~US$ 9bn for CFPP retirement by 2040, annualized at 8%.

[169] IEA (2022), *Coal in Net Zero Transitions*, IEA, Paris https://www.iea.org/reports/coal-in-net-zero-transitions, License: CC BY 4.0

momentarily propel the BPP upwards. However, the ultimate shift towards RE is poised to significantly reduce electricity generation costs in the subsequent years.

Figure 11.4 Global weighted average Levelized Costs of Electricity (LCOE) for utility scale PV and Wind[170] (left); BPP evolution in Baseline and ETP NZE (right)



11.2 Indirect impacts on PLN's cash flow

The early retirement of CFPPs may have a significant impact on PLN's cash flow, particularly in the short term. The reduction in coal supply could lead to an increase in generation costs and a higher cost of electricity from independent power producers (IPPs), which would negatively affect PLN's operating cash flow. Additionally, as PLN invests in new low-carbon technologies to replace the retired CFPPs, the company's investing cash flow may be affected. However, the early retirement of CFPPs, in addition to a lower operating expenditure (OPEX) generation portfolio, may liberate cash for PLN to invest in new technologies and infrastructure, which could positively impact the company's long-term financial position by reducing operational expenses. Overall, the impact of early retirement on PLN's cash flow will depend on the company's ability to manage the transition effectively and maintain a stable financial position throughout the process.

170 IRENA (2022), *Renewable Power Generation Costs in 2021*, International Renewable Energy Agency, Abu Dhabi.

11.2.1 Short-term impacts on PLN's cashflow

Increase in electricity costs

In the short term, the increase in electricity costs will impact PLN's cash flow in two ways. Firstly, as mentioned, PLN will have to pay higher prices to purchase electricity from independent power producers (IPPs). For ongoing power purchase agreements (PPAs), which have specific pricing conditions for a fixed energy volume, IPPs are requested to supply surplus energy to compensate for the retired one. It is most likely that the extra volume of energy is sold at a higher price than at the convenient price at which the PPA was signed first. As well, coal phase-out could also increase the contractual price of new PPAs. PPAs prices are usually defined so that they are more competitive than the utility's generation costs, prioritizing offers from IPPs with lower marginal prices. However, as coal is retired and PLN's overall generation costs increase (Figure 11.3), IPPs may offer PPAs with higher prices than the ones offered in the last decade, meaning PLN would now engage in more expensive contracts. In Indonesia, renewable energy auctions are one of the three procurement mechanisms, alongside direct appointment and direct selection. Although several solar PV and geothermal auctions have been announced in Indonesia, only a few have resulted in awarded bids. The success of auctions in Indonesia has been hindered by overlapping regulations and frequent changes in the legal and regulatory framework for solar PV[171,172] Geothermal auctions are often postponed or canceled due to the need for additional studies or a lack of interest from companies interested in participating in the projects[173].

Secondly, PLN's own generation costs will also increase as they start to replace the retired CFPPs with energy from existing capacity from natural gas or diesel. The lower than regional average capacity factor (CF) of natural gas and diesel suggests that they can be ramped up as opposed to geothermal where CF is over 80%. (Table 11.1). These alternative sources may be more expensive than subsidized coal, which will increase PLN's costs of goods sold. As a result, PLN's

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[171] Hamdi, E. (2019), Indonesia's Solar Policies Designed to Fail? Institute for Energy Economics and Financial Analysis (IEEFA), retrieved from https://ieefa.org/wp-content/uploads/2019/02/Indonesias-Solar-Policies_February-2019.pdf

[172] Hamdi, E. (2020), Racing Towards 23% Renewable Energy, Institute for Energy Economics and Financial Analysis (IEEFA).

[173] PWC (2018), Power In Indonesia: Investment and Taxation Guide November 2018, 6th Edition , PricewaterhouseCoopers, retrieved from https://www.pwc.com/id/en/publications/assets/eumpublications/utilities/power-guide-2018.pdf

short-term cash flow may be negatively affected due to higher costs of purchased electricity and generation costs.

Table 11.1 Estimated capacity factor by type of generation

Generation Type	Average generation costs[174] (IDR/kWh)	Average generation costs (US$ /MWh)	Indonesia/ Global CF (%)
Diesel	5,906	384	10%/42%[175] *
Solar PV	1,284	84	4%/7%[176]
Gas Turbine	1,248	81	9%/37%[177]
Coal	668	43	64%/57%[178]
Hydro	398	26	38%/39%[179]***
Combined Cycle	126	8	31%/54%[180]**
Geothermal	107	7	83%/73%[181]

* Average capacity factor for diesel in Malaysia
** Average capacity factor for combined cycle in US
*** Average capacity factor for hydro in Asia

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[174] PLN (2022) statistics PLN 2021. https://web.pln.co.id/statics/uploads/2022/08/Statistik-PLN-2021-29-7-22-Final.pdf

[175] Azizul Mohamad and Nasrul Amri Mohd Amin (no date) Simulation of a diesel generator - battery energy system for domestic for domestic applications at Pulau Tuba, Langkawi, Malaysia. School of Mechatronic Engineering, Universiti Malaysia Perlis, Perlis, Malaysia: https://www.researchgate.net/publication/337684925_Simulation_of_a_diesel_generator_-battery_energy_system_for_domestic_applications_at_Pulau_Tuba_Langkawi_Malaysia

[176] IESR (2019), Levelized Cost of Electricity in Indonesia, Institute for Essential Services Reform (IESR), Jakarta

[177] Idem

[178] Idem

[179] Natanael Bolsona, Pedro Prieto, and Tadeusz Patzek (2022) Capacity factors for electrical power generation from renewable and non-renewable sources. PNAS: https://doi.org/10.1073/pnas.2205429119

[180] Published by Statista Research Department and 25, J. (2023) U.S. energy capacity factors by source 2021, Statista. Available at: https://www.statista.com/statistics/183680/us-average-capacity-factors-by-selected-energy-source-since-1998/

[181] IESR (2019), Levelized Cost of Electricity in Indonesia, Institute for Essential Services Reform (IESR), Jakarta

Decrease in electricity sales

The decrease in electricity sales is a potential short-term impact resulting from the early retirement of CFPPs and the transition to new renewables in Indonesia. Historically, electricity prices have been kept low through subsidies, which have contributed to a relatively inelastic demand for electricity. Studies have estimated the elasticity of electricity demand in Indonesia to be -0.15 in a given year and -0.4 over a four-year period[182], indicating the effectiveness of subsidies in maintaining stable demand.

As CFPPs retire and electricity tariffs increase in the short term, higher subsidies from the government may be necessary to prevent consumers from perceiving a significant rise in tariffs. If the government is unable to meet these subsidy requirements, there is a possibility that the inelasticity of electricity demand could change, leading to a reduction in consumption by consumers in response to higher prices. To mitigate the potential impact of increased electricity prices, the government could actively promote energy efficiency programs and policies while retiring CFPPs, which has a benefit at an end consumer level and at a grid level[183]. Additionally, it is worth noting that the projected electrification targets from PLN may experience delays if rates are postponed due to the increase in electricity prices.

These implications highlight the importance of carefully managing the retirement of CFPP, and considering the potential effects on electricity demand, consumer behavior and government subsidies. Energy efficiency and adequate support for vulnerable consumers during the transition can mitigate some of these indirect impacts.

Increase in Cash

PLN has the potential to significantly increase its cash flow through compensation mechanisms for the early retirement of CFPPs. These mechanisms can provide PLN with financial resources to invest in low-carbon technologies and enhance grid infrastructure. Various compensation options, such as grants, zero-cost

[182] Burke, P. & Kurniawati, S. Electricity subsidy reform in Indonesia: Demand-side effects on electricity use, Energy Policy, Volume 116, 2018, Pages 410-421, ISSN 0301-4215,https://doi.org/10.1016/j.enpol.2018.02.018

[183] IEA (2014) Multiple Benefits of Energy Efficiency. From: https://www.iea.org/reports/multiple-benefits-of-energy-efficiency/energy-prices

financing, and pre-financing, are available to compensate CFPP owners for their future cash flow.

Based on similar transactions in the region, the estimated value for the early retirement of CFPPs in Indonesia is up to US$1.6 million per MW (14.8 billion IDR/MW) [184]. Considering this estimate, PLN could receive approximately US$11.8 billion (IDR 181 trill) for retiring the selected 32 CFPPs (16.9 GW) included in this study. These funds can then be strategically allocated towards investments in renewable energy, such as around 11 GW of solar PV[185], and strengthening the grid infrastructure to accommodate a larger share of variable energy sources.

This increase in cash flow not only benefits PLN in the short term but also positions the company to proactively prepare for the long-term energy transition. By supporting the development of sustainable and resilient energy infrastructure, PLN can contribute to a greener and more sustainable future. This investment in low-carbon technologies and grid reinforcement will play a crucial role in enabling the integration of renewable energy sources and facilitating a smooth transition to a more sustainable energy system.

11.2.2 Long-term impacts on PLN's cashflow

Increase in investment needs

The early retirement of CFPPs will have a profound long-term impact on PLN's investment and financing cash flow, as the company will need to make substantial investments in new energy sources and the necessary infrastructure to support them. With the government's target of achieving 23% renewable energy in Indonesia's energy mix by 2025, an annual investment of US$8 billion (IDR 123 trill) in renewable energy capacity alone will be required[186].

As variable renewable energy sources are integrated into the grid, enhancing system resilience through flexibility becomes crucial[187]. This will necessitate

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[184] Regional: Opportunities to Accelerate Coal to Clean Power Transition in Selected Southeast Asia Developing Member Countries, ADB; October 2021

[185] Based on the IEA estimated cost of construction for utility-scale solar PV of US $1.07 million per MW IEA (2022), Enhancing Indonesia's Power System, IEA, Paris https://www.iea.org/reports/enhancing-Indonesias-power-system

[186] IISD (2022) Indonesia Must Quadruple its Annual Renewable Investment Target to Reach its Climate Objectives. From: https://www.iisd.org/articles/Indonesia-annual-renewable-investment-target

[187] Jasper Donker and Xander van Tilburg (2018). AMBITION TO ACTION: Grid integration in Indonesia, Contribution of variable renewable power sources to energy and climate targets.

investments in grid infrastructure, including transmission and distribution systems, as well as interconnection technologies. Of particular concern is the Java-Madura-Bali system, which predominantly relies on 150kV transmission lines[188]. Strengthening the grid and establishing interconnections with other nations and islands can significantly enhance flexibility[189]. However, Indonesia's geographical characteristics pose challenges for achieving supply-demand balance across the country, as most islands operate separate power systems.

While the early retirement of CFPPs will entail significant investment, estimated at US$80 billion[190] (IDR 1,233 trill), to develop Indonesia's grid infrastructure by 2030, these investments are expected to yield positive impacts on efficiency and social well-being. To support the transition to a more diverse and resilient energy system, PLN should explore additional solutions such as battery energy storage systems, smart grids, and demand response programs. While PLN has already made progress in leveraging digital technology and advanced analytics in dispatching centers, further efforts will be necessary to ensure the successful deployment of renewable energy sources.

In line with this, Presidential Regulation 18/2020 on the 2020-2024 National Medium-Term Development Plan (RPJMN) has directed PLN to design a smart grid program. This program aims to establish five smart distribution networks annually in Java-Bali from 2020 to 2024, aligning with Indonesia's sustainability goals and supporting the transition towards a more sustainable energy future.

Reduced operational expenses

The retirement of CFPPs and the transition to renewable energy sources will lead to long-term savings in PLN's operational expenses. Currently, fuel and maintenance constitute a significant portion of PLN's annual operating expenses, accounting for 44% in 2020. However, as CFPPs are phased out and replaced with renewables, this share is expected to decrease substantially. Renewable energy

[188] International Energy Agency (2022). Enhancing Indonesia’s Power System, Pathways to meet the renewables targets in 2025 and beyond.

[189] The ASEAN Power Grid's connections are planned to be expanded to nearby nations and between islands. As a first phase, Java and Sumatra systems are expected to be connected by 2028.

[190] IRENA (2022). Renewable Pathway More Cost Effective than Fossil Fuels in Indonesia. From: https://www.irena.org/News/pressreleases/2022/Oct/Renewable-Pathway-More-Cost-Effective-than-Fossil-Fuels-in-Indonesia

sources not only eliminate fuel costs but also have lower operational and maintenance expenses compared to thermal power plants.

According to the US Energy Information Administration (US EIA), the fixed operation and maintenance (O&M) costs for ultra-supercritical coal power plants averaged US$49.5/kW-year (0.76 million IDR/kW-year) in 2021. In contrast, wind and solar PV with tracking had average O&M costs of US$27.6/kW-year and US$15.97/kW-year, respectively[191] (0.42 and 0.24 million IDR/kW-year, respectively). This demonstrates the cost advantage of renewable energy sources in terms of operational efficiency. Furthermore, as CFPPs age, the frequency and cost of corrective maintenance tend to increase, adding to their operational expenses.

By transitioning to a low-carbon power system, PLN can achieve significant savings in operational expenses over time. These savings arise from reduced fuel costs, lower O&M expenses, and avoiding expensive corrective maintenance as CFPPs age. This financial benefit allows PLN to allocate resources towards other strategic investments, such as expanding renewable energy capacity, grid infrastructure development, and the implementation of energy efficiency programs. Ultimately, these long-term savings contribute to the financial sustainability of PLN and support the transition to a cleaner and more cost-effective energy system in Indonesia.

[191] US EIA (2022), Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2022. From: https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf

12 Strategies for delivering a just transition

The phase-out of coal power plants presents both challenges and opportunities for the affected regions and the overall energy landscape in Indonesia. It is crucial to address the potential consequences on employment and fiscal conditions while simultaneously capitalizing on the potential benefits of transitioning to cleaner and more sustainable energy sources.

The recommendations outlined in Table 12.1 aim to minimize the adverse effects on employment and fiscal flows by implementing targeted measures that prioritize the well-being of workers and the stability of the regional and national economies. By diversifying the energy mix and expanding into renewable energy sources, Indonesia can unlock new employment opportunities and stimulate economic growth while reducing its reliance on coal.

Table 12.1 Strategies matrix

Relevant Impact	Strategies	Expected results
Employment		
6,880 jobs at risk in East Kalimantan and 4,120 in South Sumatra within the coal mining industry with a total expected impact of 13,000 jobs over the CFPP retirement period.	Skill audits at mining companies and determination of vulnerable groups such as women, older workers, and foreigners as well as skills compatibility of miners with those required by other industries.	Just transition effectively applied in the coal phase-out in Indonesia, focused on leave no one behind. Solutions suited to socioeconomic baseline in each province.
3,800 jobs at risk in CFPPs over the retirement period (3,400 men, 400 women) with 300 located in South Sumatra.	Skills audit at facility level, upskilling programs with respect to forecasted skills in renewable energy (i.e., solar and wind) and counselling support for skilled workers.	
Fiscal flows		
High likely impact on transferences from national government to both	Establish a Just Transition Fund to ensure the stability of the provincial budget for	Long term stability for national and provincial budget,

Relevant Impact	Strategies	Expected results
East Kalimantan, and South Sumatra. Under a long-term scenario, and under the assumption that national government would maintain passive fiscal policies, the CFPPs Early Retirement Plan would cause a lost would be equivalent to 35% of the total revenue of an annual budget for South Sumatra and 38% for East Kalimantan. More than 90% of this likely negative impact for both provinces are explained by a likely decrease of cash transferences from national government caused by an increase in subsidies for electricity.	East Kalimantan and South Sumatra, even with the additional expenditures for projects which allow to minimize the Plan impact on Labor Force	including East Kalimantan and South Sumatra

ETP's Just Coal Transition Forum (JCTF) can support the development of the strategies described in the previous matrix. The JCTF aims to deliver coordination services, facilitate strategies, and transition projects, as well as coordinate technical assistance to build and implement capacities that support coal phase-out in Southeast Asia[192]. Relevant details about recommendations established in the previous matrix and with which JCTF could support are:

- **Conduct a comprehensive study of job qualifications and skills:** To effectively transition workers from the coal mining and CFPPs industries, it is important to identify the skills and qualifications of the affected workers. The study should also assess labor gaps with respect to high-growth industries in the same or neighboring provinces. This will help determine the types of training and upskilling programs that will be necessary to support a just transition.
- **Implement a low-cost capacity-building program:** Given the high number of workers who may exit their jobs each year, a capacity-building

[192] ETP (2022). The Just Coal Transition Forum, Concept Note. From: https://www.energytransitionpartnership.org/resource/concept-note-just-coal-transition-forum/

program backed by official mechanisms and with financial support from the government, if necessary, should be put in place. This program should focus on providing workers with the skills and knowledge required for high-growth industries in the same or neighboring provinces.

- **Promote job boards:** Utilizing job boards to help workers re-enter the labor market is an appropriate mechanism for the local conditions, where provinces exhibit an unemployment rate just above what is considered a situation of full employment (between 4.1% and 4.7%). Job boards can be a useful tool to connect workers with job opportunities and employers seeking skilled workers.
- **Establish a Just Transition Fund:** A Just Transition Fund, fed by the operation fees of new renewable energy companies and the increased income tax coming from the Coal Mining Sector, is a highly recommended policy to ensure stability in national and subnational budgets. This fund can provide enough funding for social programs, such as the proposed re-skilling program for workers from CFPPs and the mining sector and support a just transition for affected workers.

Chapter 5: Key recommendations to support the establishment of early coal phase out strategy

UNOPS
Energy Transition Partnership

Study on the Financial Implications of the Early Retirement of Coal-fired Power Plants in Indonesia

13 Key recommendations

13.1 Policy

13.1.1 Adjust electricity tariffs to support PLN's financial sustainability

To facilitate a successful energy transition, it is crucial for the Government of Indonesia to prioritize the revision of electricity tariffs as a means to ensure the financial health of PLN and bolster the country's fiscal accounts. This research underscores the essentiality of a financially robust PLN to effectively support the early retirement of coal-fired power plants (CFPPs). The study proposes a comprehensive approach to revising electricity tariffs, gradually adjusting them to accurately reflect the actual costs of electricity generation. The recommended tariff adjustments primarily target sectors such as big industry, commercial and services sectors that have the capacity to bear higher tariffs, while simultaneously maintaining subsidies for low-income households, SMEs, and agriculture. By aligning tariffs with the true cost of energy generation (without subsidies), PLN's deficit can be reduced, providing the state-owned enterprise with greater financial flexibility to invest in affordable, reliable, and clean energy sources amidst the CFPP early retirement program. To offset any potential increase in tariffs, the study recommends implementing energy efficiency programs that facilitate technology acquisition, promote the adoption of best practices, and mobilize resources for financing energy efficiency initiatives.

As CFPPs are retired, in the short term the costs of generation are expected to increase largely due to the cost advantage of coal and the subsidies it receives. This study illustrated this situation by modelling how the generation cost would increase if CFPPs are retired, and no immediate renewable replacement is available. The analysis showed that the weighted average generation cost could increase from US$ 80/MWh to US$ 92/MWh (1.2 to 1.4 million IDR/MWh). Therefore, revising the electricity tariffs during this period is crucial to ensure efficient cost recovery for PLN in the interim as the costs start reducing as renewable energy increases in the energy mix in the medium term. In the long term, phasing out subsidies entirely and reinvesting public resources in the deployment of clean and efficient technologies is essential. This will support the transition towards cleaner energy and promote economic stability in Indonesia.

The study conducted a modeling sensitivity analysis of two electricity tariff scenarios—fixed and variable tariffs—to assess the impact of subsidies required under each scenario on the state's fiscal condition. The findings revealed that the average subsidy rate for the period of 2023-2040 would be US$25.4/MWh

(391,710 IDR/MWh) under a fixed tariff scenario and US$9.47/MWh (146,043 IDR/MWh) under a variable tariff scenario. The fixed tariff scenario would result in a total subsidy expense of US$319 billion (IDR 4,919 trill) by 2040, three times higher than the variable tariff scenario. These results emphasize the importance of revising electricity tariffs. However, a more detailed analysis is necessary to understand the costs and benefits of reducing electricity subsidies for PLN, the government, and the citizens. While subsidies could be phased out for customers with payment capacity, further examination is recommended to identify viable implementation strategies for reducing subsidization in a controlled manner. By reallocating government resources towards enabling early retirement and supporting the energy transition, the government of Indonesia can mitigate risks related to fluctuations in international commodity prices, such as coal and palm oil, and reduce the need for increased subsidies to cover electricity generation cost deficits.

13.1.2 Prioritize energy efficiency policies

As has been partially captured by this study, early retirement of coal-fired power plants is likely to come with significant costs associated with replacing its electricity generation with renewable energy and the enhancement of the grid infrastructure, estimated at US$80 billion[193] (IDR 1,233 trill). However, demand-side energy efficiency can help mitigate some of these costs by reducing national energy consumption and by improving the efficiency of existing infrastructure. By implementing energy efficiency measures, Indonesia can reduce the demand for electricity and partially offset the short-term increase in the system's generation costs that may occur because of early coal phase-out.

In 2021, the peak load reached 42,802 MW, representing a 6.8% increase from the previous year[194] and it is expected to continue increasing as electrification rates in the country grow. Implementing energy efficiency measures on the demand side can help reduce power peaks, enhancing energy security, and minimizing the reliance on fast response generation, which is typically fossil fuel based. This will contribute to Indonesia's climate goals. Additionally, if energy efficiency is prioritized, the CFPP retirement plan could further benefit from the overcapacity in some systems, as identified by this chapter. These efforts could contribute to

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[193] IRENA (2022). Renewable Pathway More Cost Effective than Fossil Fuels in Indonesia. From: https://www.irena.org/News/pressreleases/2022/Oct/Renewable-Pathway-More-Cost-Effective-than-Fossil-Fuels-in-Indonesia

[194] PLN (2022) statistics PLN 2021. https://web.pln.co.id/statics/uploads/2022/08/Statistik-PLN-2021-29-7-22-Final.pdf

energy security and allow for the retirement of smaller, more inefficient CFPPs sooner.

The government should improve energy efficiency policies, regulations, and financing while retiring CFPPs. The Government should establish regulations that reflect the latest developments in efficiency policy and technology. This can include regulations that require buildings and appliances to meet certain energy efficiency standards, financial incentives such as tax credits or rebates for energy-efficient upgrades, policies that promote energy-efficient practices in the industry and the transport sector or imposing taxes on energy-inefficient technologies and products and providing incentives for efficient ones. By enhancing and promoting these policies, the government can encourage energy users to prioritize efficiency and reduce their overall energy consumption.

13.1.3 Incentivize renewable resources for electricity production over the improvement of existing coal-fired power plants

To guide their efforts, the Government of Indonesia should clearly communicate a strategic shift towards prioritizing the development of new renewable energy sources for electricity production instead of improving existing coal-fired power plants (CFPPs). The advantages of renewable energy are evident: it provides a sustainable and cost-effective alternative to coal, a significant contributor to greenhouse gas emissions and air pollution. Moreover, the utilization of renewable resources offers opportunities for economic growth, including reduced dependence on subsidies, the capture of economic benefits through exports, job creation, and decarbonization of the power sector. Several countries have already experienced the benefits of incentivizing renewables. For instance, China witnessed a 19% increase in green jobs within the wind sector from 2020 to 2021[195]. Similarly, Morocco successfully attracted over US$5 billion (IDR 77.1 trill) in investments by crafting policies that incentivized renewable infrastructure. India, too, catalyzed more than US$20 billion (IDR 308.43 trill) in private investments for new renewables[196]. Incentivizing renewable energy entails more than just reducing import taxes on technologies; it also involves creating an enabling regulatory environment with special conditions for interconnection agreements, direct power purchase agreements, favorable net metering

[195] IRENA (2022). Renewable Energy and Jobs, Annual Review 2022. From: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_856649.pdf

[196] The World Bank (2022). Renewables are the key to green, secure, affordable energy. From: https://blogs.worldbank.org/energy/renewables-are-key-green-secure-affordable-energy

conditions for household photovoltaic applications, and facilitating financial schemes and market instruments such as renewable energy certificates.

With renewables currently accounting for less than 15%, less than 1% being variable renewable energy, of the country's energy generation, achieving Indonesia's targets of 23% by 2025 and 31% by 2050 will require significant investment and incentives. However, to achieve this, the government might be inclined to establish incentives to attract investment in renewable energy. Other incentives can be applied to stimulate the development of new renewables by enabling the regulatory environment in addition to the already existent tax removal or reduction to import technologies in Indonesia to incentivize the development of new renewables e.g., special conditions for renewables in terms of interconnection agreements, direct power purchase agreements between IPPs and consumers, net metering favorable conditions for PV in household applications. The government and its agencies could benefit from capacity building on renewable energy policies and regulations. This can be achieved through training and education programs, as well as close coordination with local governments and the private sector. In addition, providing targeted information to key stakeholders can drive investment and adoption of clean energy technologies.

13.2 Technical

13.2.1 Use transmission and distribution planning to transform the fragmented power system into an integrated one

The current archipelagic and fragmented power system, primarily operating at 150kV, presents significant challenges in maintaining energy security during the closure of any power plant. The study conducted has revealed that while the Java-Madura-Bali subsystem is interconnected through 500kV and 150kV, and the Sumatra subsystem is interconnected through 275kV, the majority of the islands remain isolated systems. This fragmented structure not only hampers operational efficiency but also underscores the urgent need for substantial investments in grid infrastructure.

IRENA estimates that around US$80 billion (IDR 1,233 trill) in investment is required by 2030 to develop Indonesia's grid infrastructure[197]. By implementing an ambitious long-term retirement program for coal-fired power plants (CFPPs),

[197] IRENA (2022). Renewable Pathway More Cost Effective than Fossil Fuels in Indonesia. From: https://www.irena.org/News/pressreleases/2022/Oct/Renewable-Pathway-More-Cost-Effective-than-Fossil-Fuels-in-Indonesia

it is imperative for the government to prioritize transmission and distribution planning. This strategic approach will enable the transformation of the fragmented power system into a robust and reliable network. By integrating the power system through transmission and distribution planning, Indonesia can enhance grid stability, reduce energy losses, and improve overall system resilience. This will facilitate the retirement of CFPPs by ensuring the availability of reliable alternative power sources across the network.

Indonesia can leverage overcapacity in some sub-systems to reduce retirement costs as overcapacity would allow some subsystems to withstand, in the short-term, the retirement of CFPPs. To optimize investments, the retirement framework proposes short-term energy security analyses to be conducted at a sub-system level. The retirement plan should analyze energy security at a sub-system level and coordinate power plant closures, renewable energy deployment, and transmission investments. A load analysis should be done to model the impacts of both the early retirement of coal-fired power plants and the introduction of renewable energy projects. The impact of renewables coming online must be assessed in the load analysis to avoid congestion in the system. The results of this assessment should guide grid reinforcements and interconnections within national subsystems. Developing transmission and distribution planning strategies in parallel with the early retirement program is crucial to improving the system's flexibility and reliability.

It would be beneficial for the government to establish guidelines for optimizing the use of transmission and distribution systems. This includes establishing technical guidelines and transmission fees for power wheeling, implementing regulations for on-site renewable energy installation, and creating transparent guidelines for net metering schemes. The National Energy Council (DEN) is best placed to oversee the drafting and coordination of the National Plan for Indonesia's Power Sector.

13.3 Financial

13.3.1 Establish a zero-interest financing instrument to early retire CFPPs

Financial contributions from philanthropies, international assistance in the form of grants or zero-cost financing, and other non-interest-bearing financial mechanisms from Limited Partners (LPs) have become indispensable in pushing forward environmental endeavors. Such zero-interest rates present a compelling proposition to hasten the energy transition, stimulate economic growth and job creation, ensure long-term planning stability, and underline a genuine commitment to sustainable development. In the current high-interest environment, immediate financing options are crucial for the early retirement of coal-fired power plants. The anticipated substitute cash flow from clean energy sources often incurs significant financial costs due to the typically high capital expenditures associated with renewable energy projects. Therefore, accessing zero-cost financing becomes even more imperative to overcome these financial obstacles and facilitate a smoother transition to cleaner energy alternatives.

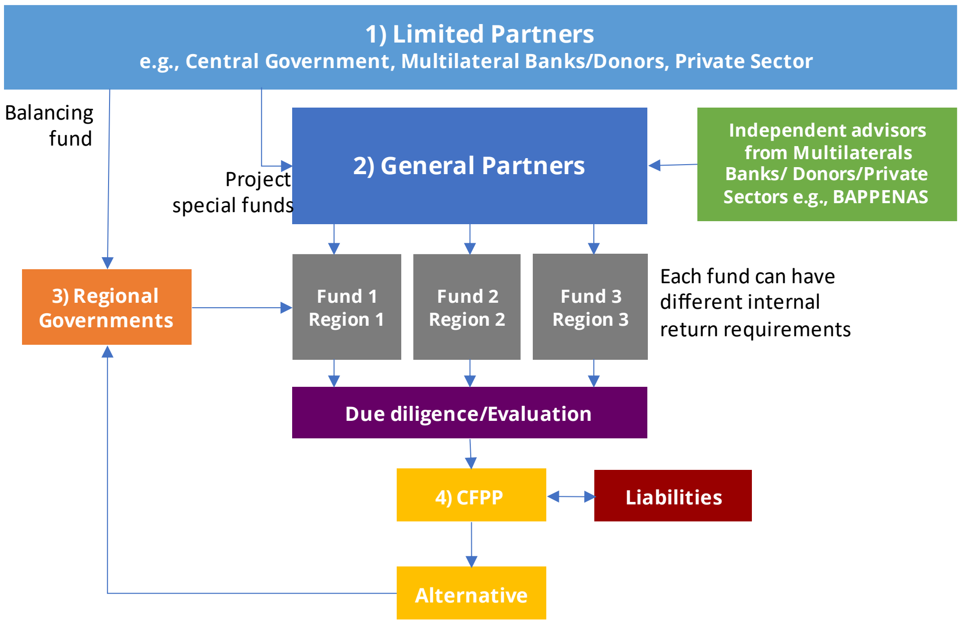
To fulfill the ambitious CFPP retirement goals, it's paramount to rally private investment by leveraging soft, zero-interest loans. Still, it's equally vital to enact potential regulatory adjustments to cap the interest exacted by the General Partners (GPs) for projects aligning with the evaluation criteria. The high upfront cost of ensuring energy security is hindering progress, so zero-interest loans are needed in the initial stages of CFPP retirement to quickly make financing of replacement generation viable, and to allow for large-scale CFPP retirement. One example is the Green Climate Fund (GCF), which supports developing countries in their efforts to mitigate climate change and adapt to its impacts. It provides financial assistance, including concessional loans, grants, and other instruments, to support projects and programs related to climate action. Usual requirements to access the funds include environmental and social assessments, financial viability studies, implementation plans with milestones and robust monitoring, reporting and verification (MRV) programs.

By involving regional governments and utilizing these financing mechanisms, the early retirement of CFPPs can be effectively supported, enabling regional governments to identify development opportunities and contribute to the sustainable growth of their respective regions. To ensure the active involvement of regional governments in decision-making and the early retirement of CFPPs, zero-interest loans should include their participation. In compliance with Government Regulation 56/2018 on Regional Loans, direct loans from regional governments to foreign parties are prohibited. However, regional governments can apply for a Regional Loan, which can be sourced from the Central Government's State Budget. The State Budget consists of various funding sources, such as domestic loan forwarding, foreign loan forwarding, and other sources in accordance with laws and regulations.

To share the risk of loan repayment and overall project risk, a Public-Private Partnership (PPP) approach can be established. This allows the local government to co-own the project through the establishment of an Implementing Business Entity in the form of a Limited Liability Company. Generally, there are three types of PPP project structures: usage-based PPP, availability-based PPP, and O&M contracts.

In the loan framework, the central government can channel funds through regional governments, making the principal payment the responsibility of the regional government. The Regional Loan can be acquired by fulfilling several requirements and leveraging the various funding sources available within the State Budget. Additionally, the existing Balancing Fund, which involves the transfer of funds from the central government to regional governments through the General Allocation Fund or Special Allocation Fund, can be utilized as a penalization mechanism if the fund principal and costs are not fully recovered from replacement projects. Furthermore, it is vital to update the coverage of local government roles, placing greater emphasis on renewable energy deployment and strategic communication to local communities, ensuring they are actively engaged in and informed about these initiatives.

Figure 13.1 Finance structure proposed with LPs and GPs



PT Sarana Multi Infrastruktur (PT SMI) is the only vehicle organization that can perform the required transactions for this mechanism. The regional governments can finance the regional fund either from fiscal transfers and their sources of revenue, or possibly involving state-owned enterprises. The findings of this study show that the central government can obtain economic rents from coal exports, thereby providing an incentive to reduce inefficient coal consumption in CFPPs. However, two major challenges in this approach include renegotiating with each existing creditor in each CFPP and the cost of funds for PT SMI might make zero-interest financing a low-cost financing option for CFPP. Therefore, a leveraged buyout of the CFPPs should be considered to identify other investment opportunities with all relevant stakeholders to ensure that the principal and interest-bearing loans from the existing CFPP are paid. This will require careful coordination and collaboration between the central government, regional governments, state-owned enterprises, and other stakeholders to ensure a smooth transition and successful retirement of CFPPs. In addition, the initial process of identifying opportunities for early retirement of CFPPs through zero-cost financing has the potential to attract other types of financing, such as preferential commercial loans or even concessional public finance and grants from development agencies, for strategic projects related to renewable energy infrastructure. This can bring further benefits for the country in terms of:

(i) **Economic development as it will bring new investment.** The availability of zero-cost financing for retiring CFPPs can attract additional financial resources, including preferential commercial loans and concessional public finance from development agencies. This influx of capital can stimulate investments in strategic projects related to renewable energy infrastructure, such as wind farms, solar power plants, and geothermal projects. These investments contribute to economic growth by creating new business opportunities and attracting both domestic and foreign investment.

(ii) **Job creation from the generation sources that will replace CFPPs.** The transition from CFPPs to renewable energy sources necessitates the development and operation of new generation sources. This shift creates job opportunities across the renewable energy sector, including engineering, construction, project management, operations, and maintenance. The growth of the renewable energy industry can provide employment for skilled workers, supporting job creation and reducing unemployment rates.

(iii) **Environmental sustainability as the retirement of CFPPs will reduce Indonesia's annual GHG emissions.** By replacing CFPPs with cleaner and more sustainable renewable energy sources, such as wind and solar, the retirement process improves air quality, reduces local pollutants, and mitigates greenhouse gas emissions. This transition towards renewable energy infrastructure through zero-cost financing attracts additional funding opportunities, such as preferential commercial loans and concessional public finance, further supporting Indonesia's economic growth while promoting a healthier and more sustainable environment.

Therefore, it is crucial for the government to continue exploring and developing various financing mechanisms and engaging with relevant stakeholders to achieve the early retirement of CFPPs and accelerate the transition towards renewable energy.

PT SMI, already entrusted as the Platform Manager of the ETM Country Platform to rally grants, financial resources, knowledge, technical aid, and investment resources, can also spearhead any zero-cost financing mechanism devised to motivate and simplify CFPP early retirement. Given PT SMI's rich legacy in handling blended finance and infrastructure evolution, and its ongoing collaborations to amass resources, it is optimally poised to orchestrate the CFPP retirement financing. As the Ministry of Finance develops the regulation that will determine the process for the allocation of resources, and the financial mechanisms that will be included to support the platform, the financial structure and transaction mechanisms should be further defined.

13.3.2 Conduct thorough assessments of power purchase agreement (PPA) termination costs and debt structures to develop replicable business models and identify potential cost-saving opportunities

Currently, most PPAs signed between PLN and power generators include take-or-pay clauses, which are designed to secure revenue for the generators to cover their fixed costs. However, these clauses are especially costly for PLN due to the excess installed capacity and the imposed locked fixed expenses for a period of 15 to 20 years[198]. By closely monitoring key indicators related to financial costs and opportunities, such as PPA structures, debt/equity ratios, and interest coverage ratios, the government can identify and monitor the implementation of a strategy to phase out CFPPs. Understanding the costs associated with the early termination of PPAs is essential for establishing an effective coal phase-out strategy. In particular, there is an opportunity for PLN to benefit from ending PPAs with high-capacity factor obligations that force the curtailment of other power plants.

Terminating contracts with IPPs would allow PLN to access discounts on capacity payments, as they would no longer need to be made in advance. Although specific information on the details of PLN's PPA obligations was not available for this study, it is recommended that future PPA assessments analyze the differences and similarities between agreements, assess the reasonableness of penalization

[198] IEA (2022), Enhancing Indonesia’s Power System, IEA, Paris https://www.iea.org/reports/enhancing-Indonesias-power-system

fees, and explore opportunities for renegotiation. Developing standardized templates with the involvement of institutions like MEMR, PLN, MOSOE, MOF, and CMMIA could also streamline the renegotiation process for PPAs, ensuring a more efficient and effective transition away from coal-fired power generation.

Additionally, the CFPP ownership structure should be carefully examined and understood. This requires support from energy lawyers to identify opportunities for renegotiation of loans e.g., lowering interest rates or through principal haircuts. By understanding common loan structures in CFPPs, plants with low-interest coverage ratios or high debt-to-equity ratios can help identify those CFPPs where a reduction in the cost of capital can provide an opportunity to refinance or conduct a leveraged buyout.

13.3.3 Ensure transparency and stakeholder buy-in by actively socializing the financial design parameters of the proposed mechanism with all relevant stakeholders

To ensure stakeholder buy-in and transparency, actively socialize the financial design parameters of the proposed mechanism with all relevant stakeholders. The relevance for these stakeholders could include:

- **For national government:** The design parameters for a zero-interest loan must include, loan eligibility criteria, amount of loan, repayment schedule, criteria to measure success in terms of retirement of CFPPs and MRV mechanisms to ensure transparency and accountability,
- **For regional government:** It must evaluate whether to include loan requirements for local content and capacity building, whether it wants to prioritize sites within the region, and mandate mechanisms to ensure that benefits accrue to local communities.
- **For PLN:** The priority will be to align the loan repayment schedule with the cash flow of a RE project, and ensure that the eligibility criteria consider financially and technically viable project types e.g. size, technology and return on investment that can provide reliable and affordable electricity.
- **For CFPP employees and local communities:** Communities will want to secure a mechanism that ensures that benefits accrue to the local communities, and current CFPP employees will require capacity building to upskill and reskill to have access to new green job opportunities.

13.3.4 Ensure cost-effectiveness and transparency for financers, with third-party due diligence to reduce moral hazard and greenwashing risks

The retirement program's credibility depends on cost-effectiveness for donors, development banks, and commercial banks, which will encourage financing resources. The cost-effectiveness is defined as net costs over net impact, which must be separated per relevant stakeholder. To achieve this, an *ex-ante* robust framework, including Environment and Social Safeguards, must be established, which Indonesia has demonstrated to have relevant experience. Additionally, an *ex-post* Monitoring, Reporting, and Verification framework must be implemented and conducted utilizing best practices.

Separate and evaluate each relevant stakeholder's impact to clarify the costs and benefits. By taking these measures, financiers can make informed decisions regarding the early retirement of CFPPs, ensuring cost-effectiveness and maximizing positive impact across all relevant stakeholders. Having due diligence by a third party can reduce moral hazard and greenwashing risks and can then make the retirement program more attractive to access JETP or ETM funds.

13.4Social

13.4.1 Start early in developing sub-regional social programs to provide green job opportunities

The implementation of the early retirement program may lead to job losses, both directly and indirectly. The early retirement of the 32 CFPPs considered in this study could result in 4,000 direct jobs at CFPPs being at risk of loss by 2040. In addition, 13,000 jobs are estimated to be lost in mining activities due to lower coal demand forecasts. To minimize the impact on affected workers and communities, it is recommended that social programs be initiated well in advance of retirement. Regional governments have a pivotal role to play here. They can provide a nuanced understanding of the local job market, industry needs, and community concerns.

While certain skills may be transferrable from coal to renewable power plants, others may require effective upskilling or reskilling. These social programs can identify opportunities for relocation and provide upskilling and reskilling of the workforce across the entire CFPP supply chain, including mining, transportation, and other suppliers. This will not only help to minimize the negative impacts of retirement but also create new opportunities for job creation. More work needs to be done, leveraging ETP, the World Bank, and JTWG's (Joint Technical Working

Group) expertise and interest and taking advantage of spaces like the Just Coal Transition Platform (JCTP) to share best practices.

The government has several ongoing programs that can support employees across the CFPP value chain in their transition to new green jobs. For example, the Preemployment Card Program, launched in 2020 to support the unemployed during the pandemic, has been a successful program that can be expanded. The program offers training scholarships and support during the recruitment process, enabling beneficiaries to learn new skills, upskill and reskill[199]. In 2023, the budget of the program was set at ~US$ 350m (IDR 5 trillion), and it is expected to reach 1.5 million people[200]. The program could have an extension focused specifically on the workers that would be impacted by CFPP retirement, leveraging from the already existing structure of the Preemployment Card Program. The regional governments, with their on-the-ground knowledge and networks, can play a vital role in tailoring this program to meet the unique needs of their constituents. They can be the bridge between broad national policies and localized solutions that resonate with affected communities.

13.4.2 Separate social costs from transaction costs

To ensure a smooth and equitable transition during the CFPP retirement, it is recommended that social costs be evaluated separately from transaction costs. The compensation scheme should distinguish between those directly and indirectly impacted by the CFPPs to ensure transparency for financers and beneficiaries. For those directly impacted, a clear methodology should be used to determine compensation amounts based on seniority both in terms of age and years in the company, and additional support needed during the transition period between the CFPP's closure and new green job opportunities. For those indirectly impacted, a socio-environmental impact assessment should be conducted, and the costing methodology should be transparently defined to evaluate fair compensation. This should include the impacts of CFPPs on water and air quality, as well as the rehabilitation and restoration of affected sites. Such an approach will enhance transparency in efforts towards a just transition, thus minimizing social tensions arising from the early retirement of CFPPs.

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199 A.W. Akhlas (2020). It's official: Government, digital companies team up to launch pre-employment cards. *The Jakarta Post*. 20 March.

200 Office of Assistant to Deputy Cabinet Secretary for State (2022) Gov't to Continue Pre-Employment Card Program in 2023. From: https://setkab.go.id/en/govt-to-continue-pre-employment-card-program-in-2023/

14 Roadmap steers and suggestions with regard to policy, fiscal frameworks and resource allocation

This study sheds light on the impact the early closure of 32 CFPPs will have on the country's energy supply (~16.9GW). To meet the ETP NZE scenario, which incorporates the early coal phase-out plan endorsed by the MEMR[201] aligned with the Net-Zero Emissions Scenario developed by the IEA[202] and meets the decarbonization requirements set in the Just Energy Transition Partnership (JETP)[203], and transition to a low carbon economy, additional retirement of coal generation will be necessary between 2036 and 2040. This transition will require substantial investments in renewable energy, such as solar PV, wind and geothermal to replace the retired capacity. According to the International Energy Agency (IEA), Indonesia will need to install 25 GW of solar PV and wind energy between today and 2030 to be on track for meeting the target of the ETP NZE scenario toward 2040[204]. However, as of now RE only accounts for a small fraction of the country's electricity generation. Accelerating the penetration of RE at the required scale will require legal and regulatory reforms, along with financial mechanisms that promote competitiveness between RE technologies and conventional fossil fuel-based power technologies.

The early closure of the CFPPs will have fiscal implications for the Government of Indonesia. The magnitude and balance of these impacts will largely depend on the electricity subsidy policy adopted by Indonesia. If tariffs were to increase following the NZE variable tariff scenario, the total over-the period government's expenditure on subsidies could be reduced by 20% compared to the baseline scenario, as is further described in chapter 1. To address the increasing deficit,

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201 Ministry of Energy and Mineral Resources (2021, Nov 2) Speaking at COP26, Energy Minister Gives Indonesia's Commitment to Net Zero Emission. Head of Bureau of Communication, Public Information Services, and Cooperation. From: https://www.esdm.go.id/en/media-center/news-archives/speaking-at-cop26-energy-minister-gives-Indonesias-commitment-to-net-zero-emission.

202 IEA (2022), An Energy Sector Roadmap to Net Zero Emissions in Indonesia, IEA, Paris https://www.iea.org/reports/an-energy-sector-roadmap-to-net-zero-emissions-in-Indonesia , License: CC BY 4.0

203 The European Commission. (2022, 15 November). Joint Statement by the Government of the Republic of Indonesia and International Partners Group members on the Indonesia Just Energy Transition Plan

204 International Energy Agency (IEA). (2022). An Energy Sector Roadmap to Net Zero Emissions in Indonesia. https://www.iea.org/reports/an-energy-sector-roadmap-to-net-zero-emissions-in-Indonesia

Indonesia should implement a sustained policy to adjust electricity tariffs, reduce subsidies and align prices with the Basic Cost of Electricity Supply (BPP). This will enable resource allocation for RE investments and can allow for saved resources to be redirected to market incentives, financial mechanisms, and energy efficiency programs.

This could save governmental resources that serve to support capital investments in renewable energy and promote a competitive environment for renewable energies. At the same time, part of the saved resources could be channeled to consolidate energy efficiency policies and programs for the adoption of efficient technologies and best practices sector-wide, accompanied by fiscal and market incentives, as well as financial mechanisms for accelerating its penetration. Additionally, to guarantee an energy-efficient market of technologies, the government must impulse, in collaboration with the private sector, the adoption of Minimum Energy Performance Standards (MEPS) for appliances and systems, as well as the enabling conditions for a market of Energy Service Companies (ESCOs). This could lay the foundations for a national awareness of the socio-economic benefits of adopting energy-efficient technologies and practices.

This section provides a roadmap that outlines the necessary policy, regulatory, fiscal, and financial frameworks to be implemented by 2030. The roadmap aims to facilitate the achievement of the ETP NZE Scenario and ensure a Just Transition in the closure of the 32 CFPPs. By following these recommendations, Indonesia can pave the way for a sustainable, resilient, and low-carbon energy future.

14.1Allocation of resources for the early closure of 32 CFPPs

The retirement of 32 CFPPs in Indonesia will involve the disbursement of US$ 11,758 million (equivalent to US$ 7.6 bn at present value, IDR 117 trill) between 2024 and 2038. The results of the payment estimation for IPPs and PLN facilities and their retirement years are referenced in detail in Table 14.1 below and are consistent with the early retirement decision framework referred to in this study.

Table 14.2 lists the total disbursement amounts that the Government of Indonesia should pay to the plant owners every year between 2024 and 2038 to cover the value at retirement year for each CFPP.

Table 14.1 Payment estimations for the early retirement of 32 CFPPs in Indonesia

Owner	CFPP	Retirement year (RY)	Remaining Lifetime at RY	Value at RY (MUSD)	Value at RY (MUSD at PV)
IPP	Celukan Bawang Unit 1, 2, 3	2025	20	570.00	464.77
IPP	Cilacap 1, 2	2026	10	674.67	513.93
IPP	Cirebon 1	2031	11	622.29	337.35
IPP	Keban Agung 2	2029	15	281.74	174.99
IPP	Paiton 5, 6	2031	0	0.00	0.00
PLN	Ombilin 1, 2	2024	2	140.80	122.89
PLN	Air Anyir 1, 2	2024	20	91.83	80.14
PLN	Labuhan Angin 1, 2	2024	14	333.36	290.96
PLN	Tanjung Balai Karimun 1, 2	2025	22	20.85	17.00
PLN	Sebalang 1, 2	2025	20	293.33	239.18
PLN	Bukit Asam 1, 2	2026	-4	0.00	0.00
PLN	Tarahan 3, 4	2026	11	242.00	184.34
PLN	Nagan Raya 1, 2	2027	16	281.60	200.40
PLN	Teluk Sirih 1, 2	2027	17	291.39	207.37
PLN	Pangkalan Susu 1, 2	2027	18	528.00	375.75
PLN	Suralaya 8	2027	14	770.00	547.97
PLN	Suralaya 1, 2, 3, 4	2028	-6	0.00	0.00
PLN	Suralaya 5, 6, 7	2028	-1	0.00	0.00
PLN	Pacitan 1, 2	2028	15	756.00	502.63
PLN	Labuan 1, 2	2028	12	666.95	443.42
PLN	Adipala 1	2029	17	807.84	501.77
PLN	Rembang 1, 2	2029	12	665.28	413.22
PLN	Lontar 1, 2, 3	2029	13	1,029.60	639.51
PLN	Paiton 1, 2	2030	-7	0.00	0.00
PLN	Paiton 9	2030	12	663.77	385.17
PLN	Tanjung Awar-awar 1, 2	2031	14	718.67	389.59

PLN	Pelabuhan Ratu 1, 2, 3	2034	10	803.48	355.16
PLN	Indramayu 1, 2, 3	2036	5	435.60	168.05
PLN	Ende 1, 2	2037	8	8.21	2.96
PLN	Tidore 1, 2	2037	9	8.87	3.20
PLN	Anggrek 1, 2	2038	11	38.03	12.80
PLN	Amurang 1, 2	2038	3	13.20	4.44

Table 14.2 Programmed disbursements for the payment of early retirement of 32 CFPPs (2024-2038)

Year	Total Disbursement at retirement year (MUSD)
2024	565.99
2025	884.18
2026	916.67
2027	1,870.99
2028	1,422.95
2029	2,784.46
2030	663.77
2031	1,340.95
2032	0.00
2033	0.00
2034	803.48
2035	0.00
2036	435.60
2037	17.08
2038	51.23

14.1.2 Enabling actions for the allocation of resources for the early retirement of CFPPs in Indonesia

Establishment of the ETM Country Platform: In November 2022, the Government of Indonesia officially launched the Energy Transition Mechanism (ETM) Country Platform as a financial vehicle dedicated to fund collection and resource disbursement aimed at the early closure of CFPPs. Due to its experience in managing finance blended finance and infrastructure development, the Government has appointed PT Sarana Multi Infrastruktur (PT SMI) as the Platform Manager. At present, PT SMI is collaborating with various institutional partners to attract: 1) grants (from Bloomberg Philanthropies, Climate Works, UK MENTARI, and Global Energy Alliance for People and Planet), 2) financial resources (from ADB, WB, CIF, JBIC, HSBC, among others), 3) knowledge and technical cooperation (from USAID, GGGI, CPI, ETP, UNDP, among others), and 4) investment resources (from Indonesia's Investment Authority). The Ministry of Finance is currently developing the regulation that will determine the process for the allocation of resources, and the financial mechanisms that will be included to support the platform[205].

Customized Financial Mechanisms: As mapped in this study, there are financial instruments funded by MDBs and countries that support coal phase-out. Each CFPP being considered for closure will require specific financial instruments based on factors such as contractual obligations, net present value (NPV), and alternative technology options. Different financing and refinancing options can include compensation schemes based on carbon abatement, securitization bonds to unlock CFPP assets, investment vehicles for plant acquisition, grants for social programs and repurposing projects, and public investment to support the transition and reduce fiscal burdens.

Financial mechanisms are usually unique to the context of each CFPP considered for closure, such as the contractual specificities and obligations of the facility and the utility, and most importantly, the net present value (NPV) of the CFPP compared to the alternative technology selected as a substitute. For an NPV much lower than that of the alternative technology, a conventional loan can be an option. On the other hand, if a CFPP's NPV is much higher than that of the substitute technology, concessional public finance or even grants should be

[205] PT Sarana Multi Infrastruktur. (2022). https://ptsmi.co.id/Indonesia-launches-etm-country-platform-to-accelerate-just-and-affordable-energy-transition

considered. A brief description of the most representative financing and refinancing options for the coal phase-out is presented in chapter two.

Stakeholder Engagement and Decision Process: As mentioned previously, there are multiple financial options for a CFPP's early closure, and its success is highly dependable on the right selection and blending of mechanisms. Having in mind that a CFPP closure involves multiple stakeholders, the financial scheme selection should be socialized through an engagement and decision process involving the participation of governmental representatives, public utilities, IPPs, the mining sector, private investors, NGOs, country sponsors, and international financial institutions, among other players.

Safeguards and Accountability: An optimum financing structure for early retirement of CFPPs should ensure alignment with the government's national plans and policies, and guarantee that the value added and benefits from the transition are distributed fairly among the plant owners, taxpayers, energy consumers, and the affected communities. In line with this, the financial mechanism should also avoid overpayment of assets, greenwashing practices, and moral hazard risks upon the retirement of assets.

For the Government of Indonesia to ensure the corresponding payments to the 32 CFPP's shareholders at the planned closure dates, the following recommended actions should be taken:

Date	Action
By December 31st, 2023	Creation of the ETM Country Platform by December 31st, 2023, through the establishment of legal frameworks.
	Conclusion of regulations by the Ministry of Finance by December 31st, 2023, specifying the process for resource allocation and eligible financial mechanisms.
	Development of a Financial Plan by the ETM Country Platform, in collaboration with PLN, the Ministry of Energy and Mineral Resources, and the Ministry of Finance, by December 31st, 2023. This plan should include tailored financial proposals for each CFPP.
	Implementation of a stakeholder engagement and consultation process by the ETM Country Platform by December 31st, 2023, to socialize and gather input on the proposed financial mechanisms for CFPP early retirement and repurposing.

By following recommendations, Indonesia can effectively allocate resources and ensure a smooth transition towards the early retirement of CFPPs while promoting renewable energy development and sustainable growth.

14.2 Steers and recommendations to reduce electricity subsidies and enhance energy efficiency

The Government of Indonesia plays a crucial role in regulating electricity tariffs in the country. The existing tariff structure poses challenges as household tariffs are set below cost, commercial tariffs are the highest and industrial tariffs fall in between. This results in insufficient revenues for PLN, requiring the government through the national budget to cover PLN's costs plus an additional margin of 7%[206]. In 2019, tariffs covered around 86% of production costs, and the government subsidized in total of US$ 4 billion (IDR 61.8 trill) to fill the gap.

Indonesia has undertaken significant efforts to use energy more efficiently with an economy-wide perspective, incorporating well-designed policies and regulations, as well as economic incentives and market mechanisms for the adoption and dissemination of new technologies and best practices. However, the Energy Law enacted in 2007, which serves as the primary framework for energy efficiency initiatives, requires substantial amendments to align with international advancements in technology, policy, and regulation. Moreover, energy efficiency is crucial for Indonesia to meet its decarbonization targets as shown in the ETP NZE Scenario. With the projected growth in electricity consumption, curbing the demand through energy efficiency efforts becomes imperative. According to the International Energy Agency[207], more than 2 billion square meters of new residential floor area will be constructed between today and 2030, increasing Indonesia's residential building stock by close to four times the total land area of Jakarta. In consequence, 22 million additional air conditioners will be functioning over the next decade, underscoring the need for effective energy efficiency measures.

To address these challenges, Indonesia must review tariff pricing to reduce government subsidies, focusing on sectors and customers with payment capacity while maintaining subsidized tariffs for low-income households, small businesses, and basic public services. Simultaneously, comprehensive economy-wide energy

[206] International Renewable Energy Agency (IRENA). (2022). Indonesia Energy Transition Outlook. https://www.irena.org/publications/2022/Oct/Indonesia-Energy-Transition-Outlook

[207] International Energy Agency (IEA). (2022). An Energy Sector Roadmap to Net Zero Emissions in Indonesia. https://www.iea.org/reports/an-energy-sector-roadmap-to-net-zero-emissions-in-Indonesia

efficiency policies and programs should be established to facilitate a smooth transition to clean energy. Institutional strengthening, capacity building, and collaboration with local governments and the private sector are vital for effective fiscal and energy efficiency reforms. The medium-term objective is to eliminate electricity subsidies, enabling the redirection of public resources toward the deployment of clean and efficient technologies.

14.2.1 Supportive measures for refining electricity subsidies and enhancing energy efficiency policies

This section summarizes the challenges faced by Indonesia due to maintaining a policy to electricity tariffs, as well as the main challenges on the consumption of electricity that still prevail despite the progress already achieved by the government on energy efficiency issues. Each challenge is presented in Table 14.3 and complemented with proposed enabling actions (with recommended implementation timeframe) that could lead to a tariff reform free of subsidies and consolidate a national policy framework for the efficient use of electricity, compatible with sustained socio-economic development and the ETP NZE scenario.

Table 14.3 Challenges and enabling actions for the reduction of subsidies from electricity tariffs and the consolidation of an energy efficiency national policy in Indonesia.

No	Challenges	Enabling Actions	Timeframe
1	**Electricity Subsidies** Electricity subsidies were partly reformed in 2014 with the reintroduction of the automatic electricity tariff adjustment mechanisms that led to the elimination of subsidies in several categories of consumers. However, the mechanism was suspended in 2018, and tariffs were frozen in advance of the presidential elections. Furthermore, in 2020, the government provided electricity bill relief subsidies in order to alleviate the economic shock of the COVID-19 pandemic in around 35 million low-income households. According to IEA, fossil fuel and electricity subsidies for consumers in Indonesia in 2020 amounted to US$6.9 billion (0.6% of GDP) (IDR 106 trill). With higher prices in 2021, subsidies increased to US$19 billion (1.6% of GDP)[1] (IDR 293 trill). In October 2021, the Indonesian House of Representatives passed a law on tax regulation harmonization, that includes a carbon tax. The tax set at US$2.1/ton$CO_2$ (32,385 IDR/tCO_2) and limited to CFPPs, was initially set to commence in April	1. The Government of Indonesia could consider a pricing reform on electricity tariffs where subsidies have been eliminated for customers with proven payment capacity (from the residential, industrial, and commercial sectors), and maintain subsidies only for low-income customers (poor households, and small and medium enterprises), and basic services for poor neighborhoods such as public lighting or water pumping. In parallel, the government should establish economy-wide energy efficiency policies, regulations and financial mechanisms to award energy-efficient customers and ban inefficient technologies and practices.	2024-2028
		2. The Government of Indonesia might want to evaluate a diverse fiscal approach regarding the imposition of taxes and duties imposition to the import and use of energy-inefficient technologies and products, on top of VAT, as well as tax incentives, rebates and/or exemptions to the import, acquisition, and use of energy-efficient devices	2024-2028
		3. The Government of Indonesia could explore creating a flexible mechanism for updating its carbon tax rate, taking into account the carbon pricing of neighboring countries. This adaptation could apply to all fossil fuel-based stationary combustion sources.	2024-2027
		4. The Government of Indonesia might re-evaluate electricity subsidies to ensure tariffs better mirror the true costs of electricity (being at least equal to the BPP). Any adjustments to subsidies could prioritize	2028-2030

No	Challenges	Enabling Actions	Timeframe
	2022 but has been pushed back several times in light of rising energy commodity prices.	support for the most vulnerable, with potential reinvestments in initiatives that promote a broad shift towards cleaner and more efficient energy use.	
2	**Institutional Framework** Energy efficiency efforts are institutionally scattered within the Ministry of Energy and Mineral Resources (MEMR) and the utilities (mainly PLN). Each institution prioritizes its respective interests, resulting in a lack of coordination and duplicated efforts.	1. The Government of Indonesia could identify a focal point within the Ministry of Energy and Mineral Resources (MEMR), responsible for planning and conducting the national energy efficiency policy, programs, standards, regulations, and certification processes, considering always the latest international developments and best practices;	2024-2025
		2. To ensure robust energy efficiency standards and reliable data validation, it might be beneficial for the Government of Indonesia to collaborate with the National Standardization Agency (BSN), responsible for primary EE standards, chain-of-custody, and replication of results to ensure data validation. Include laboratory facilities to provide analytical methods and testing materials as standards for analyses done by others to ensure reliable EE data;	2024-2025
		3. The MEMR might consider formulating a National Energy Efficiency Plan to promote with an economy-wide view, the development and deployment of energy-efficient technologies and products, including those for lighting, cooling, and air conditioning applications. The program includes policies, regulations, standards, technologies, engineering applications, and market and financial mechanisms. The Plan has a timeframe of 10 years, its progress is evaluated every year, and its content is reviewed and updated every 3 years.	2024-2025

No	Challenges	Enabling Actions	Timeframe
3	**Electricity consumption in Buildings** In 2020, the commercial and residential sectors of Indonesia accounted for 21.7% of the total final energy consumption equivalent to 898 MBOE. Electricity consumption of the commercial and residential sectors contributed to around 66% of total electricity consumption, and coal's share in Indonesia's power generation energy mix was about 64%. Consequently, around 42% of electricity consumed by the commercial and household sectors came from coal-fired power plants[208]. Hence, improving energy efficiency in commercial and residential buildings is essential, both to reduce electricity demand and cut CO2 emissions. Building codes in Indonesia only cover large commercial buildings. The lack of similar measures in residential buildings and combination with lower appliance ownership, limits the coverage in buildings to 5%[3].	1. The MEMR could look into crafting Energy Efficiency code for residential and commercial buildings with cost-effective EE measures and promote its compliance with the collaboration of local governments, construction industry associations, professional engineering associations, and specialized financial institutions, among other key players. 2. In partnership with the construction sector's significant entities (Industrial Chambers, Professional Associations, and financial institutions), the MEMR could introduce an energy performance certificate (EPC) system for building and apartment owners. Economic incentives, such as tax incentives/ rebates, apply only to those entities awarded with the certification. 3. For a more sustainable approach, the MEMR might implement an evolving Minimum Energy Performance Standards (MEPS) system with attention to residential and commercial appliances (lighting, cooling, and AC, among others).	2024-2026 2024-2026 2024-2026
4	**Energy Efficiency in the Industry**	1. To widen the scope of industries practicing efficient energy management, the MEMR could lower the energy consumption	2024-2025

[208] Asian Pacific Cooperation Energy Working Group (APEC-ERW). (2022). Follow-Up Peer Review on Energy Efficiency in Indonesia. https://www.apec.org/publications/2022/06/follow-up-peer-review-on-energy-efficiency-in-Indonesia

No	Challenges	Enabling Actions	Timeframe
	Indonesian companies that consume more than 6,000 tons of oil equivalent per year (69,780 MWh) are required to conduct energy management programs and activities.[4] This is a high threshold and currently limits energy management to very large industrial consumers only.	threshold so that energy management systems are required to be implemented by a larger segment of Indonesia's industry sector. The threshold should cover at least the number of industries that represent 80% of the electricity consumption of the industrial sector. 2. The MEMR might contemplate introducing a Minimum Energy Performance Standards (MEPS) system with attention to industrial equipment (electric motors, industrial pumps, fans, cooling equipment, and AC systems), and electronic devices (computers, data centers, and audio/video). 3. To foster Energy Management Systems (EMS) among SMEs, the MEMR could roll out a program centered on the ISO 50005:2021 (Energy management systems guidelines for a phased implementation)should develop a program for the implementation of in small and medium-sized enterprises, based on ISO 50005:2021. The program includes an award/incentive mechanism based on a competitive process.	 2024-2026 2024-2026
5	**Energy Efficiency in Finance** The main barriers that persist in Indonesia for the participation of financial institutions in energy efficiency activities are 1) low internal rates of return of EE projects (less than 20%), 2) lack of funding and capital investment in EE projects, 3) ESCO's, difficulty to show profitability and low risk for EE projects.	1. In partnership with relevant financial bodies, The Government of Indonesia might explore the creation of an Energy Efficiency Fund (EEF) able to extend loans that are repaid through a dedicated entity (public agency, utility, or financial institution). The dedicated entity collects from the borrowers the savings obtained from the reduction of electricity consumption and re-invests the funds in new EE projects. For reducing administrative costs, the EEF provides capital at very low cost to Indonesian banks, which are required to provide low-interest loans to ESCO projects with maximum loan terms of several years.	2024-2028

No	Challenges	Enabling Actions	Timeframe
	ESCOs business model is considered a high-risk investment from the bank's perspective. Risk-sharing facilities such as public agencies, can reduce risk, by providing partial risk coverage when extending loans for EE projects[4]. If an energy efficiency finance scheme can be established in Indonesia, it will provide an impetus for leasing companies, EE appliances providers, or financial institutions to grow the ESCO industry[4].	The dedicated public entity provides also partial risk coverage when extending loans for EE projects, as well as EE warranties to ESCOs with limited performance records to protect investment partners against a potential poor performance of an energy performance certificate (EPC) project. The fund is partially financed by a tariff levy on electricity (equivalent to a percentage of the current tariff, to be defined by the Indonesian government). Other sources of funding come from carbon tax collection, the income tax from coal exports, and international concessional public finance and grants.	

14.3 Steers and recommendations to enhance renewable energy investments to comply with Indonesia's ETP NZE Scenario

Indonesia's renewable energy sector has significant growth potential, with an installed capacity of ~10.8 GW in 2021, accounting for less than 3% of its estimated potential (~400 GW[209]). The country aims to add 40.6 GW of generation capacity by 2030, more than half of it (20.9 GW) coming from renewable sources. By 2025, the target is to have 23% renewable energy in the national energy mix, equivalent to 24 GW of installed capacity. The planned additions will primarily be from hydro (9.3 GW), solar (4.7 GW) and geothermal (3.4 GW).

To achieve the ambitious ETP NZE Scenario, Indonesia will require substantial investments estimated at $150-200 billion annually until 2030[5]. In September 2022 Presidential Decree No. 112/2022 issued includes multiple measures to deal with the enormous effort needed to install more than 40 GW of renewable energy in the following 8 years, among them the setting of a competitive pricing regime for renewable electricity, and the establishment of tax incentives for the acquisition and operation of renewable energy technologies. The huge investment needed every year to meet the target of renewable energy installed toward 2030 will also require an enabling environment (in terms of policy, regulatory and institutional adjustments), and versatile financial mechanisms to attract large-scale continued investments. Since the coal mining companies will increase their revenues from the export of more coal available due to the closure of the 32 CFPPs, the Indonesian government should aim to create favorable conditions for them to become capital investors in renewable energy projects.

14.3.1 Enabling actions for enhancing renewable energy investment

This section summarizes the challenges that Indonesia faces in the transition from a fossil fuel-based electricity infrastructure mainly controlled by the government to a market-based sector with a level field for renewable energies to deploy and grow in a competitive environment. Each challenge is presented in Table 14.4 and complemented with proposed enabling actions (with recommended implementation timeframe) that could lead to a competitive clean electricity market, and consolidate a national policy framework for renewable energies, compatible with sustained socio-economic development and the ETP NZE scenario.

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[209] World Economic Forum. (2022). Policy Opportunities to Advance Clean Energy Investment in Indonesia. https://www.weforum.org/whitepapers/policy-opportunities-to-advance-clean-energy-investment-in-Indonesia/

Table 14.4 Challenges and enabling actions for an enabling market and investment conditions for renewable energies in Indonesia.

No.	Challenges	Enabling Actions	Timeframe
1	**Legislative implementation mechanisms** A gap between policy enactment and its effective implementation has been frequently observed and is thought to discourage renewable energy uptake. MEMR Regulation 1/2015 and 11/2021 which establishes the primary conditions for power wheeling, has not been implemented due to a lack of clear technical guidelines and clarity on the transmission fees. While existing regulations allow for 100% renewable energy installation at consumer premises, in practice the maximum amount of renewable capacity that is effectively approved ranges only 15%-20%[5].	The Government of Indonesia might consider putting in place procedures within the MEMR, to ensure that renewable energy policy and regulatory enactments will timely count with the proper guidelines for their effective implementation. It would be beneficial to focus on:	
		1. Count with clear technical guidelines and transmission fees for the power wheeling of IPPs and self-generators of renewable electricity through PLN transmission/distribution infrastructure;	2024-2025
		2. Count with guidelines for the effective implementation of the regulation in place for allowing on-site renewable energy installation for 100% of consumer needs;	2024-2025
		3. Count with guidelines for the clear and transparent implementation of the net metering scheme for renewable energy small-scale self-generation.	2024-2025
2	**Regulatory Framework**	The Government of Indonesia can consider the following approach to enhance the adoption of renewable electricity:	

No.	Challenges	Enabling Actions	Timeframe
	In Indonesia, there are discrepancies in the planning and policy documents published by the different national agencies (RUPTL (Electricity Supply Business Plan), RUEN (National Energy Generation Plan), and RUKN (National Electricity General Plan)). Those differences force investors/project developers to consider multiple scenarios to build investment plans and project pipelines.	1. Create a unified coordination body (committee) led by the MEMR, in charge of drafting the National Plan for Indonesia´s Power Sector (a unified planning instrument in substitution of the existing plans RUPTL, RUEN, and RUKN). The purpose is to increase coordination in energy policy and rulemaking, backed by effective implementation, to promote an enabling environment for the uptake of renewable energy investments;	2024-2025
	Stringent local content requirements discourage investments in renewable infrastructure projects in Indonesia. While local content requirements apply to all renewable energy technologies, the most stringent ones are for solar photovoltaics (PV), for which they have increased from 40% to 60% between 2012 and 2019[5]. As a result, project developers face the following challenges: 1. The procurement of locally manufactured panels is limited to a total national manufacturing capacity of only 500 MWp/year, according to the Indonesian Solar Module Manufacturer Association (APAMSI)[5]; 2. Locally manufactured panels have higher prices and cannot compete with those of panels manufactured abroad. 3. The quality and efficiency of domestic panels are lower compared to those available in the international market.	2. Adopt a strategy to define and periodically update the local content requirements for renewable energy investments in order to impulse projects. The strategy considers the national manufacturing capacity, supplier base, local regulations and workforce skills. Initially, local content requirements are minimal and applicable to specific areas of the value chain where appropriate capability and know-how exist.	2024-2025

No.	Challenges	Enabling Actions	Timeframe
3	**Renewable Energy Tariffs** Indonesia currently subsidizes fossil fuel-based power generation (US$5.6 billion in 2021, IDR 86.36 trill)[5]. Additionally, local coal producers have the obligation to supply 25% of their annual production to PLN at a price cap of US$70.00/ton, (1 million IDR/ton) significantly below international market prices. Indonesia has implemented renewable energy tariff caps by linking them to the average local and national electricity generation cost (BPP). Currently, the final tariffs are capped at 85% of the local BPP[5]. Since the BPP benchmark is based on subsidized fossil fuel-based generation costs, the current tariff for renewable electricity is not viable for projects to compete with fossil fuel-based infrastructure, limiting their financial viability.	The Government of Indonesia could establish the following measures to adapt the policy and regulatory frameworks for a "fair play" competition between renewable and fossil fuel-based electricity: 1. Set up standardized and streamlined processes for negotiation between PLN and the IPPs; 2. Set up open auctions, differentiated by the type of technology (renewable energies type of technology only compete among themselves) in favor of the lowest quoted generation cost to ensure more competitive renewable energy prices; 3. Introduce temporary renewable energy subsidies to the tariff mechanisms and reduce subsidies to fossil fuel-based technologies.	 2024-2025 2024-2025 2024-2028
4	**Power purchase agreement practices (PPA)**	The Government of Indonesia might consider implementing the following actions to create an electricity market structure	

No.	Challenges	Enabling Actions	Timeframe
	Indonesian regulations do not allow IPPs to enter into direct power purchase agreements with customers. This limits the ability of consumers to procure power produced from renewable sources directly. This poses a challenge, especially for commercial and industrial consumers who want to increase their GHG mitigation targets for social responsibility purposes and competitivity strategies. Indonesia does not currently have a standard PPA regime, and so agreements are negotiated on a case-by-case basis, increasing complexity, reducing transparency, and lowering investor confidence. Negotiation processes take longer time and result in high costs for project developers.	that allows for direct trade between buyers of all sizes and renewable electricity suppliers: 1. Adapt the regulatory framework to allow direct power purchase agreements between IPPs and customers through standardized and streamlined processes; 2. Adopt regulations to incentivize renewable energy power-wheeling through standardized and streamlined interconnection agreements between IPPs or self-generators, and PLN, to use the transmission/distribution infrastructure for power supply to costumers interested in consuming clean energy.	 2024-2026 2024-2026
5	**Renewable energy certificates and tracking system** Although businesses in Indonesia can buy, since 2020, renewable energy certificates (RECs) offered by PLN through a REC scheme, there is no proof that the money raised from the RECs is used to finance new renewable energy capacity, in order to preserve the additionality principle.	The Government of Indonesia can set up the following measures to enhance the transparency and additionality of the existing renewable energy certificate (RECs) system: 1. Establish a mechanism to track funds from RECs, trace their uniqueness, and the use of the funds disbursed by REC purchasers; 2. Establish the mechanism to ensure REC proceeds are invested in new renewable energy capacity to build	 2024-2025 2024-2025

No.	Challenges	Enabling Actions	Timeframe
		corporate confidence in the REC regime and promote future investments.	
6	**Renewable Energy Finance** Financial institutions in Indonesia face major barriers to scaling up finance of RE energy projects, including the lack of knowledge and information, a high-risk perception, and insufficient/ suitable financing instruments and funds. For instance, project developers have problems in meeting high collateral requirements for acquiring debt finance, due to high risk perceived by financial institutions caused by high transaction costs and unclear regulatory and policy frameworks. Since RE project lifetimes span more than 20	It would be beneficial for The Government of Indonesia led by the Financial Services Authority (OJK) and the Ministry of Finance, in coordination with public and private financial entities to implement the following measures to incentivize the investment environment in renewable energy: 1. Implement a package of fiscal mechanisms such as tax credits/rebates, accelerated depreciation to the acquisition of RE technologies, land and building tax relief, import duty relief, and tax allowances, to improve the economic viability of RE projects, and stimulate new investments; 2. Develop in collaboration with the SDG Indonesia One Fund, guarantee schemes aimed to de-risk renewable energy projects and help project developers overcome collateral requirements, and facilitate access to capital:	 2024-2026 2024-2026

No.	Challenges	Enabling Actions	Timeframe
	years, the lack of available long-term financing schemes constitutes another key barrier[210]. The government requires to assist financial institutions by offering capacity building, enhancing access to data, improving monitoring and reporting procedures, and promoting innovative financial schemes among financial institutions to deploy investments in RE projects[6].	3. Develop in close collaboration with relevant banking institutions, standardized project finance structures for renewable energy projects that could be widely replicated. A program for piloting nouvelle financial structures for RE projects is in operation; 4. Create a renewable energy finance facility that offers: 1) project structuring services for developing bankable projects, 2) access to long-term low-interest loans, and 3) innovative finance schemes. The facility's funding sources include carbon tax collection, income tax from coal exports, and international concessional public finance and grants.	2024-2026 2024-2027

[210] Organization for Economic Cooperation and Development (OECD). (2021). OECD Clean Energy Finance and Investment Policy Review of Indonesia Policy Highlights. https://www.oecd.org/env/clean-energy-finance-and-investment-policy-review-of-Indonesia-0007dd9d-en.htm

15 Follow-up studies

The list of follow-up studies to support the implementation of CFPPs early retirement has been developed based on the findings from this study, take-out from stakeholder consultations, and feedback from FGDs. The proposed follow-up studies are described in Table 15.1.

Table 15.1 List of follow-up studies

No.	Study Title	Description
1	Assessment of the Impact of CFPP Early Retirement on the Electricity System	The security and stability of the electricity system is one of the most critical considerations when early retiring CFPPs. Indonesia's electricity system has two unique characteristics that require a detailed study of the impacts of the early CFPP retirement (i) having a fragmented power system and (ii) having large power demand and supply centers in different locations with complicated interconnection between them. The proposed study could conduct an assessment covering the interconnection of the potential super grid and an impact analysis of the existing grid at regional and sub-regional level, as well as the impact of the deploying of new renewables to replace CFPPs.

No.	Study Title	Description
2	Cost recovery model for PLN	The early retirement of CFPPs will imply significant costs for PLN both from the retirement of PLN owned CFPPs and from the required grid reinforcements. The study could aim to model the cost recovery options for PLN to make the transition viable.
3	Assessment economic impact of adjusting electricity tariffs as early CFPP retirement is implemented	It is essential to carefully consider the impact of early CFPP retirement on the macroeconomics of the country, particularly in the short term. Increasing tariffs can lead to higher production costs, which may contribute to inflation and reduce the purchasing power of society, thereby impacting economic growth. However, it is crucial to address this issue to ensure the financial sustainability of PLN and reduce its reliance on government subsidies. Failure to address this issue could lead to significant fiscal impacts, which will only worsen over time. Therefore, a comprehensive and detailed study is necessary to determine how tariff adjustments should be implemented to minimize any adverse effects on the economy

No.	Study Title	Description
4	Analysis of the Decarbonization Options to replace CFPPs retired early	This study aims to identify and assess potential decarbonization alternatives for CFPP early retirement at the project level, which may include repowering, retrofitting, repurposing, etc. The study requires comprehensive data collection through preliminary audits/interviews at the facility to identify decarbonization opportunities. An inventory of potential technology suppliers needs to be developed to provide technical and cost data on the possible solutions. Optimizations will be performed based on potential power generation, emission abatement potential and the solution's costs.
5	Assessment of the Economic and Financial impacts of the Renegotiation of PPAs, using a specific CFPP as a cases study	This study aims to ensure that potential new terms of the PPAs are "fair and balanced" for the IPP and PLN, and in line with the Indonesian Government's just transition objectives including the impact of early CFPP retirement on workers, communities, and the entire mining value chain. The assessments could cover the identification of potential conditions to be modified in the PPA and the proposed hypothetical terms and conditions, financial impact analysis on the revenue, cost, subsidies, tariffs, and compensations, risk allocation analysis and fiscal impact analysis.

No.	Study Title	Description
		The assessment will provide useful information for assessing the impact of possible amendments to the PPAs at a high level on tariffs, subsidies, taxes, and compensation costs.
6	Assessment of the Socioeconomic Impacts of Early CFPP Retirement	The study aims to assess the potential socioeconomic impacts of early retiring a specific CFPP and guide the implementation of a just transition approach. This project, conducted at the project level, could complement the Strategic Environmental and Social Assessment (SESA) at the policy level and the Environmental and Social Impact Assessment (ESIA) conducted for financing purposes. A specific site should be selected based on the dependency of the surrounding communities (including small and informal businesses) on the power plant's activity. Besides providing insights concerning potential changes in the socioeconomic landscape, the study could inform strategies for mitigating the risks resulting from early retirement.

No.	Study Title	Description
7	Environmental Impact Assessment of Early CFPP Retirement	This study aims to assess the environmental impacts of CFPP early retirement projects, especially those followed by decommissioning to better inform stakeholders in the decision-making process. The assessment could provide strategies for managing the environmental impacts throughout the early retirement process, inform environmental benefits and impacts resulting from the retirement and it could inform action plans from implementing the decommissioning to the site remediation.

Appendices related to Chapter 1

Annex 1.1. Baseline profile projection

The baseline scenario has been profiled based upon reported official information for both the historical period (2000-2021) and the scenario timeline (2022-2040). Historical time series were built by observing the following variables.

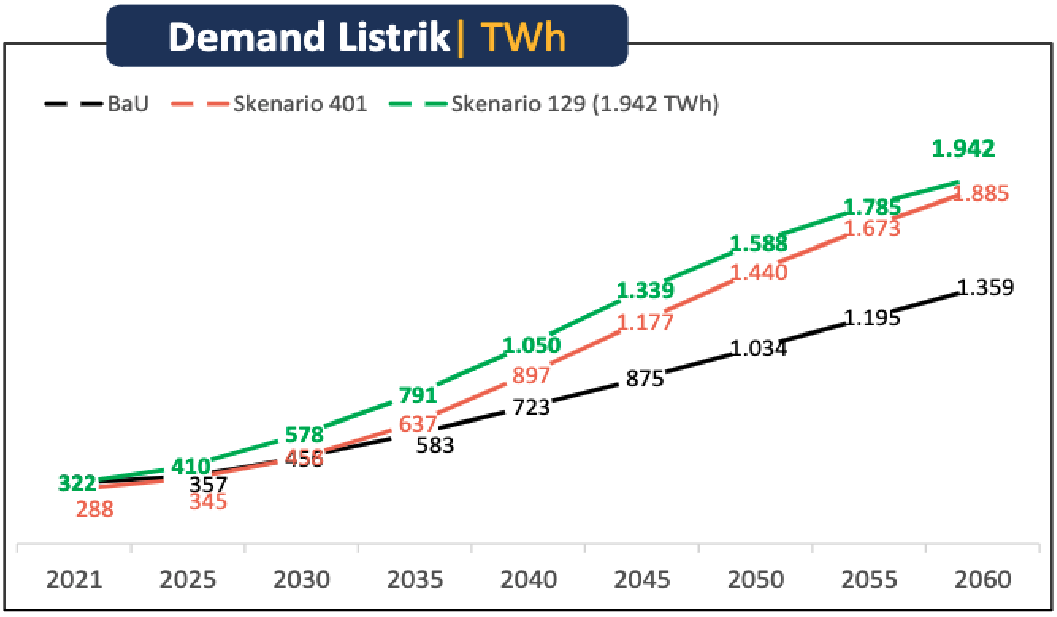
Base data	Unit	Period
PLN steam coal	GWh	(2000-2010) [a], (2011-2021) [b]
PLN purchase from IPP & PPU steam coal producers		
Domestic coal sales to power plants	Ton	
Electricity sales	GWh	
Average price coal FOB export	US$/ton	
Total electricity subsidies	Billion US$	(2012-2022) [c]

a) https://www.esdm.go.id/assets/media/content/content-handbook-of-energy-economic-statistics-of-Indonesia-2012-dcexnjb.pdf
b) https://www.esdm.go.id/assets/media/content/content-handbook-of-energy-and-economic-statistics-of-Indonesia-2021.pdf
c) https://www.statista.com/statistics/992755/Indonesia-electricity-subsidies/

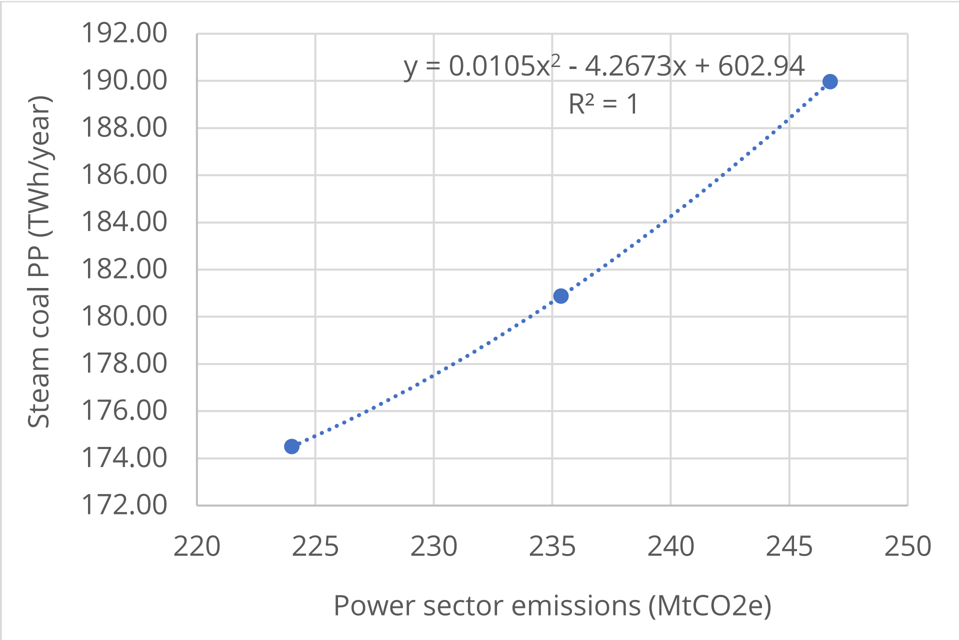
The sum of PLN steam coal production and PLN electricity purchases provides the numbers for total coal-based power plant production. Likewise, figures for electricity subsidies (US%/GWh), coal demand for power generation[211] (ton coal/GWh), share of CFPPs in the total electricity production (%) and power plant factor[212] (%) were also derived from the base data. Noteworthy, historical data also allow to establish Indonesian coal export figures.

[211] A value of 558.3 Ton coal/GWh is used, corresponding to the timeseries (2011-2021) average.
[212] A value of 56.7% is used, corresponding to the timeseries (2011-2021) average.

For the baseline scenario (2022-2040), on the other hand, the cornerstone variable corresponds to the evolving electricity demand considered by BAPPENAS and presented as Business-as-Usual scenario for discussion on later August 2022, which considers expected evolution of macroeconomics variables such as PIB and population.



With the electricity demand scenario configured, the CFPPs share of power production was established by looking at GHG emissions of the power sector. According to the International Energy Agency (IEA), "For the power sector, a peak of 349 MtCO2e is planned by 2030 in order to reach net zero emissions by 2060, up from 224 MtCO2e in 2019"[213]. Since the CFPP's electricity production in 2019 was 174.49 TWh, the following correlation can be observed which clearly depicts the contribution of CFPPs to the GHG inventory in the power sector.



By considering the expected increase in the GHG emissions in the power sector from 224 to 349 MtCO2e during the 2019-2030 period, the CFPP share in the total power production could peak at 84.8% (392 TWh) in 2030, declining linearly to 62.4% (453 TWh) in 2040. CFPP coal demand can be also established in the baseline scenario considering the historical average of 558.3 Ton coal/TWh. This is congruent with new investments announced for coal-based power generation as well as with the net zero path for 2060.

Historical information on electricity subsidies and electricity price allow to estimate the total cost of electricity delivery or BPP, with the following correlation observed between CFPP coal demand and BPP in Indonesia, a net coal exporter country where a cap price for power generation coal has been set by the government (US $70/ ton).

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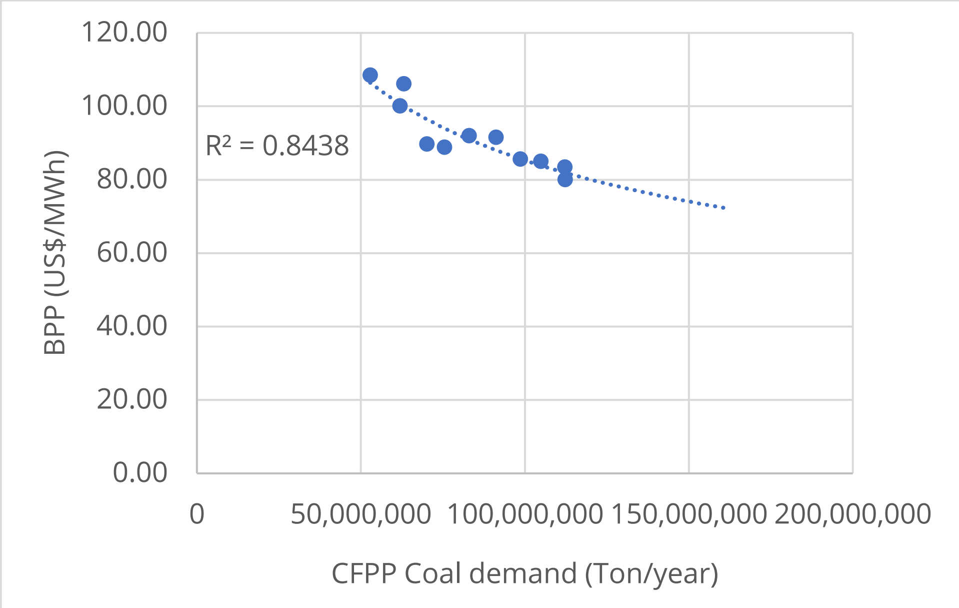
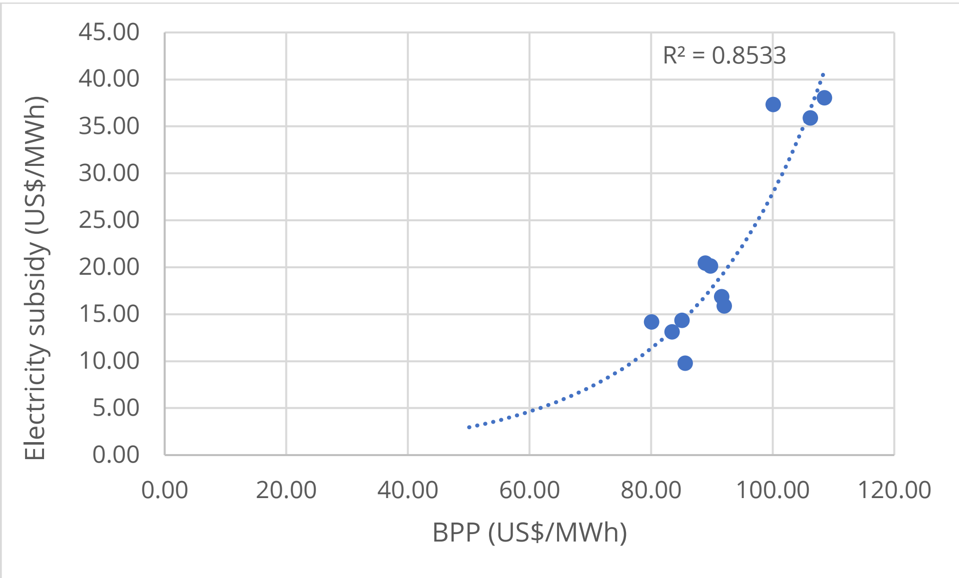
[213] International Energy Agency. 2022. Enhancing Indonesia's Power System. Pp. 16 https://www.iea.org/reports/enhancing-Indonesias-power-system



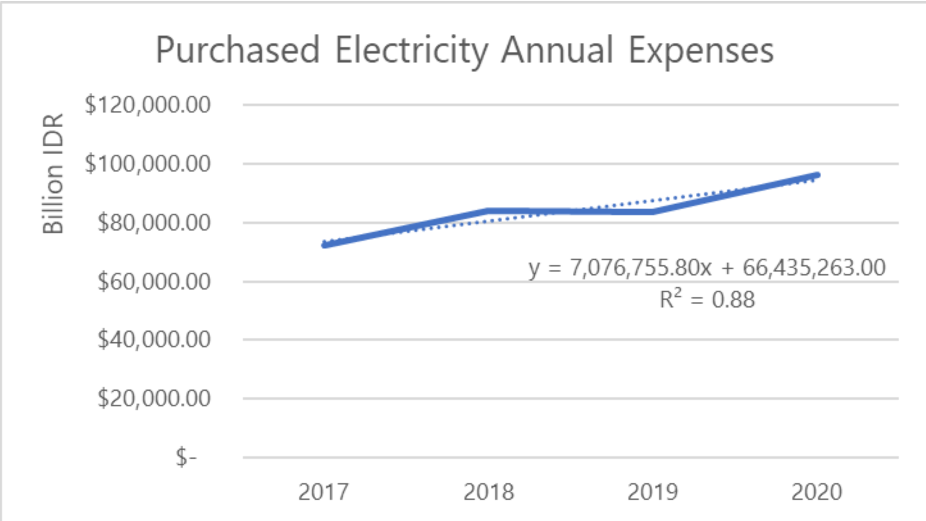
The trend suggests that the greater the CFPP coal demand, the lower BPP can be envisaged. Acknowledging that electricity subsidies are in place for PLN to cover the BPP, another notably correlation is observed in terms of electricity subsidies.



Based on this, the electricity subsidy time series has been established up to 2040.

Annex 1.2. Purchased electricity projection

The estimated PLN's future purchased electricity expense has been projected based on the historical trend. Data from 2017 to 2021 reported by PLN in its annual report was used[214]. The historical data was adjusted to a linear regression, as shown in the following table.



[214] PLN (2022) Annual Report: Transition to Net Zero Emissions. From: https://web.pln.co.id/stakeholder/laporan-tahunan

Annex 1.3. List of the 32 CFPPS considered in this study

The following table lists the CFPPs considered for retirement in this study and compares if they have or have not been considered in other studies.

MEMR screened CFPPs compared to other studies.

No	CFPP Name	Province	City/ Regency	Studies			
				MEMR (MW)	PLN	CMMIA	ADB
1	Celukan Bawang Unit 1,2,3	Bali	Buleleng	380	-	✓	✓
2	Cilacap Unit 1 & 2	Central Java	Cilacap	600	-	-	✓
3	Adipala Unit 1	Central Java	Cilacap	660	-	-	✓
4	Sebalang Unit 1 & 2	Lampung	South Lampung	200	✓	✓	-
5	Pacitan Unit 1 & 2	East Java	Pacitan	560	-	-	✓
6	Rembang Unit 1 & 2	Central Java	Rembang	630	-	-	✓
7	Tarahan Unit 3 & 4	Lampung	South Lampung	200	✓	✓	-
8	Nagan Raya Unit 1 & 2	Aceh	Nagan Raya	220	✓	✓	✓
9	Labuhan Angin Unit 1 & 2	North Sumatra	Central Tapanuli	230	✓	✓	✓
10	Teluk Sirih Unit 1 & 2	West Sumatra	Padang	224	✓	✓	-
11	Pangkalan Susu Unit 1 & 2	North Sumatra	Langkat	400	✓	✓	-
12	Lontar Unit 1-3	Banten	Tangerang	945	-	-	✓
13	Pelabuhan Ratu Unit 1-3	West Java	Sukabumi	1,050	-	-	✓
14	Suralaya Unit 8	Banten	Cilegon	625	-	-	✓
15	Bukit Asam Unit 1 & 2	South Sumatra	Muara Enim	130	✓	✓	-
16	Ombilin Unit 1 & 2	West Sumatra	Sawahlunto	100	✓	✓	✓
17	Suralaya Unit 1-4	Banten	Cilegon	1,800	✓	✓	-
18	Suralaya Unit 5-7	Banten	Cilegon	1,600	✓	✓	✓
19	Paiton Unit 1 & 2	East Java	Probolinggo	800	✓	✓	-
20	Paiton Unit 5 & 6	East Java	Probolinggo	1,519	-	-	✓
21	Paiton Unit 9	East Java	Probolinggo	660	-	-	✓

No	CFPP Name	Province	City/ Regency	Studies			
				MEMR (MW)	PLN	CMMIA	ADB
22	Indramayu Unit 1, 2, 3	West Java	Indramayu	990	-	-	✓
23	Cirebon	West Java	Cirebon	660	-	-	✓
24	Labuan Unit 1 & 2	Banten	Pandeglang	600	-	-	✓
25	Tanjung Awar-awar Unit 1 & 2	East Java	Tuban	700	-	-	✓
26	Keban Agung Unit 2	South Sumatra	Lahat	120	-	-	✓
27	Air Anyir Unit 1 & 2	Bangka Belitung	Bangka	60	-	-	-
28	Tanjung Balai Karimun Unit 1 & 2	Riau Islands	Karimun	14	-	-	-
29	Anggrek Unit 1 & 2	Gorontalo	North Gorontalo	55	-	-	-
30	Amurang Unit 1 & 2	North Sulawesi	South Minahasa	50	-	-	-
31	Ende Unit 1 & 2	East Nusa Tenggara	Ende	14	-	-	-
32	Tidore Unit 1 & 2	North Maluku	Tidore Islands	14	-	-	-
	Total (MW)			**16,810**	**5,505**	**5,931**	**12,837**
	Number of CFPP			**32**	**11**	**12**	**19**

Based on the CFPPs screened above, the MEMR's list, which covers all CFPPs from the studies developed by institutions, will be utilized as a basis for this study. From the screened CFPPs, this study develops a decision framework to make a priority scale and shortlist which CFPPs have a higher potential to participate in the early retirement program.

Annex 1.4. CFPP'S data for early retirement decision framework

This project considers only the 32 CFPPs listed in MEMR's *Skenario Net Zero Emission Sektor*[215]. The information presented below has been collected from public data or estimated according to the categorization of the power plant, the type of coal it uses and its location.

The list presents the data used as inputs for the early retirement framework and it has been ordered according to the results of such framework.

#	Facility/Unit Name	Energy Security			Environmental		Financial		Contractual	Social	
		System	Installed Capacity (MW)	CF (%)	Heat Rate (Btu/kWh)	Emissions Intensity (tCO2eq/MWh)	Operating Profit (Million US$)	Years to compensate if retired early. (years)	Ownership	Proximity to high-income city (km)	Poverty Rate, 2021 (%)
1	Ombilin Unit 1, 2	Sumatra	200	59%	12,876	1.42	25.12	4	PLN	0.00	6.34
2	Air Anyir Unit 1, 2	Sumatra	60	54%	11,973	1.49	32.53	22	PLN	30.80	4.79
3	Labuhan Angin Unit 1, 2	Sumatra	230	16%	11,007	1.37	20.38	16	PLN	9.20	8.75
4	Celukan Bawang Unit 1, 2, 3	Jamali	380	82%	10,832	1.27	107.65	23	IPP	80.70	4.63

[215] Directorate General of Electricity. 2022. Skenario Net Zero Emission Sektor Pembangkitan Tenaga Listrik [PowerPoint slides]

#	Facility/Unit Name	Energy Security			Environmental		Financial		Contractual	Social	
		System	Installed Capacity (MW)	CF (%)	Heat Rate (Btu/kWh)	Emissions Intensity (tCO2eq/MWh)	Operating Profit (Million US$)	Years to compensate if retired early. (years)	Ownership	Proximity to high-income city (km)	Poverty Rate, 2021 (%)
5	Tanjung Balai Karimun Unit 1, 2	Sumatra	14	60%	11,973	1.49	6.07	25	PLN	79.10	5.94
6	Sebalang Unit 1, 2	Sumatra	200	49%	11,973	1.49	38.40	23	PLN	71.40	12.15
7	Bukit Asam Unit 1, 2	Sumatra	260	37%	13,381	1.57	36.52	0	PLN	87.30	12.84
8	Cilacap Unit 1, 2	Jamali	600	64%	9,612	1.13	143.06	14	IPP	98.00	11.52
9	Tarahan Unit 3, 4	Sumatra	200	64%	12,408	1.46	47.37	15	PLN	71.40	12.15
10	Nagan Raya Unit 1, 2	Sumatra	220	51%	10,832	1.34	71.06	21	PLN	243.00	15.43
11	Teluk Sirih Unit 1, 2	Sumatra	224	56%	10,832	1.34	52.13	22	PLN	0.00	6.34
12	Pangkalan Susu Unit 1, 2	Sumatra	400	50%	9,348	1.16	119.87	23	PLN	19.90	8.75
13	Suralaya Unit 8	Jamali	625	56%	9,478	1.18	133.21	19	PLN	0.00	6.58
14	Suralaya Unit 1, 2, 3, 4	Jamali	1800	46%	10,186	1.26	597.77	0	PLN	0.00	6.58

#	Facility/Unit Name	Energy Security			Environmental		Financial		Contractual	Social	
		System	Installed Capacity (MW)	CF (%)	Heat Rate (Btu/kWh)	Emissions Intensity (tCO2eq/MWh)	Operating Profit (Million US$)	Years to compensate if retired early. (years)	Ownership	Proximity to high-income city (km)	Poverty Rate, 2021 (%)
15	Suralaya Unit 5, 6, 7	Jamali	1600	46%	9,890	1.26	448.33	5	PLN	0.00	6.58
16	Pacitan Unit 1, 2	Jamali	630	59%	9,348	1.16	145.59	21	PLN	108.00	11.00
17	Labuan Unit 1, 2	Jamali	600	70%	9,478	1.18	161.11	18	PLN	26.80	6.58
18	Keban Agung Unit 2	Sumatra	240	66%	9,348	1.10	71.95	22	IPP	60.20	12.84
19	Adipala Unit 1	Jamali	660	62%	9,348	1.16	158.62	24	PLN	98.00	11.52
20	Rembang Unit 1, 2	Jamali	630	74%	9,478	1.18	177.76	19	PLN	124.00	11.52
21	Lontar Unit 1, 2, 3	Jamali	945	70%	9,478	1.18	255.34	20	PLN	27.30	6.58
22	Paiton Unit 1, 2	Jamali	800	80%	9,890	1.23	241.34	1	PLN	73.30	11.00
23	Paiton Unit 9	Jamali	660	74%	9,478	1.18	188.58	20	PLN	73.30	11.00
24	Tanjung Awar-awar Unit 1, 2	Jamali	700	71%	9,348	1.16	193.76	23	PLN	99.90	11.00
25	Paiton Unit 5, 6	Jamali	1220	76%	9,749	1.14	341.13	8	IPP	73.30	11.00
26	Cirebon Unit 1	Jamali	660	78%	9,478	1.11	192.05	20	IPP	8.40	6.87

#	Facility/Unit Name	Energy Security			Environmental		Financial		Contractual	Social	
		System	Installed Capacity (MW)	CF (%)	Heat Rate (Btu/kWh)	Emissions Intensity (tCO2eq/MWh)	Operating Profit (Million US$)	Years to compensate if retired early. (years)	Ownership	Proximity to high-income city (km)	Poverty Rate, 2021 (%)
27	Pelabuhan Ratu Unit 1, 2, 3	Jamali	1050	68%	9,348	1.16	274.16	22	PLN	58.00	6.87
28	Indramayu Unit 1, 2, 3	Jamali	990	76%	9,478	1.18	287.25	19	PLN	54.70	6.87
29	Ende Unit 1, 2	Nusa Tenggara	14	38%	11,973	1.49	4.91	23	PLN	425.00	20.99
30	Tidore Unit 1, 2	Maluku	14	68%	11,973	1.49	10.80	24	PLN	0.00	6.89
31	Anggrek Unit 1, 2	Sulawesi	55	48%	11,766	1.46	19.26	27	PLN	63.70	15.61
32	Amurang Unit 1, 2	Sulawesi	50	60%	12,186	1.51	21.68	19	PLN	49.40	7.77

Annex 1.5. Retirement methodology

Energy security

The energy security aspect is assessed to look at how the CFPP's early retirement could affect the grid's security of energy supply. A high score suggests that the CFPP will have a lesser impact on the grid's security relatively and therefore, should be prioritized for retirement.

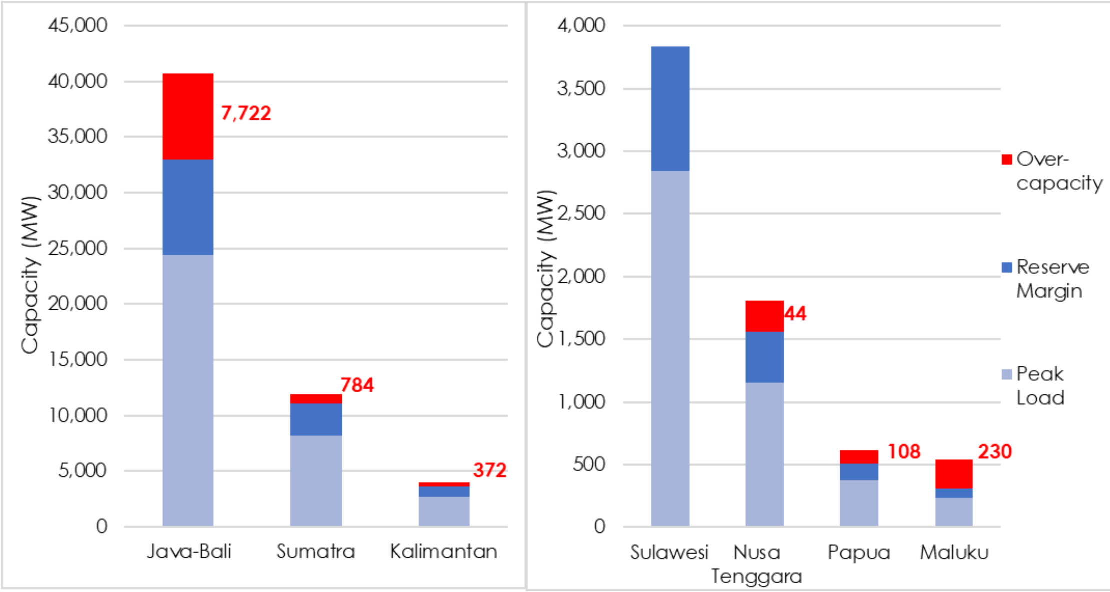
The energy security score was assessed based on three parameters as follows:

- **System/subsystem**. This criterion will assess how resilient a system would be to the retirement of CFPPs, considering (i) if the system has overcapacity and the magnitude of it, and (ii) how flexible is the system depending on the larger types of generation it has.

  The estimated overcapacity in each system is estimated with the total installed capacity in each system and the 35% reserve margin PLN is required to maintain[216]. The following figure shows the overcapacity in each system. Consequently, the higher the overcapacity in the system, the better can withstand the retirement of CFPPs.

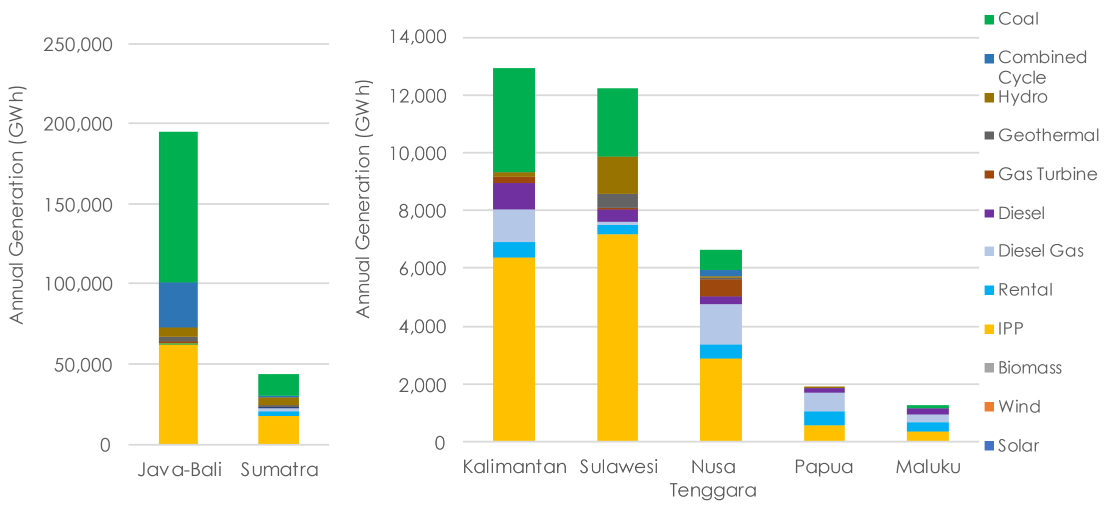
[216] International Energy Agency. 2022. Enhancing Indonesia's Power System. Pp. 81 https://www.iea.org/reports/enhancing-Indonesias-power-system

Installed capacity by system, bar graph.



On the other hand, the system's flexibility is defined by the portfolio of generation in each system. The wider the generation sources and the higher the generation from flexible and fast response sources like geothermal, combined cycle, hydro, the easier the penetration of RE displacing coal-fired generation can be.

Annual generation by source in each system, bar graphs



The installed capacity by technology in each system data has been collected from PLN's statistics public data[217].

The scores for both Overcapacity and Flexibility of each system are as follows:

Overcapacity	Score
Java-Bali	10
Sumatra	8.5
Kalimantan	7
Nusa Tenggara	5.5
Maluku	4
Papua	2.5
Sulawesi	0

Flexibility	Score
Java-Bali	10
Sumatra	6.3
Kalimantan	2.5
Sulawesi	3.8
Nusa Tenggara	2.5
Papua	0
Maluku	0

The score for the System parameter of the energy security criteria weighs Overcapacity with 60% and Flexibility with 40%. This weighing is selected considering that although both parameters are important, it should be given special notice to Overcapacity. Existing Overcapacity, and its magnitude, is the main condition within a system to consider if the retirement is feasible, showing if, regardless of the type of generation that will replace it, the system can withstand the decommissioning of the power plant. Finally, the System parameter is assessed with the following conditions:

System	Score
Jamali	10
Sumatra	8
Kalimantan	6
Nusa Tenggara	4
Maluku	2
Papua	1
Sulawesi	0

[217] PLN (2021) PLN Statistics 2020. From: https://web.pln.co.id/statics/uploads/2021/09/statistik-PLN-2020-english.pdf

- **Capacity.** To maintain the electricity supply, retired CFPPs must be replaced by other power plants. Considering the government's intention to achieve NZE and not build new fossil power plants after 2030, the replacement of the CFPP is most likely to be based on renewable energy. Accordingly, CFPPs with large capacities will be harder to replace with RE. Therefore, small capacity CFPPs are more suggested to be early retired.

  The scoring system for capacity has been determined considering the installed capacity of only the 32 CFPPs, the minimum value, P25, P75 and the maximum value. No reference external to the 32 CFPPs is considered since the retirement order is being analyzed only for that sample. The capacity score for energy security was assessed with the following conditions:

Capacity (MW)	Score
0 – 200	10
201 – 400	7.5
401 – 700	5
> 701	2.5

- **Capacity Factor (CF)**. CF directly indicates the level of CFPP utilization. The higher the CF value, the more dependent the electricity grid is on the CFPP. As such, CFPPs with high CF should not be prioritized for early retirement.

  The definition of the scoring system for the Capacity Factor has been done in the same way as the scoring for the Capacity parameter.

  The CF score was assessed with the following conditions:

CF (%)	Score
0 – 50%	10
51% - 60%	7.5
61% - 71%	5
> 72%	2.5

Installed capacity data has been collected from public reports and discussion with stakeholders, while the capacity factor data has been provided directly from stakeholders or estimated with public data.

Environmental

One of the most significant negative environmental and health impacts of CFPPs is the release of particulate matter and harmful gases in a plant's emissions.

The environmental impact of coal-fired power plants shall thus be examined through their emission of CO_2 and other harmful gases. This shall be measured through two parameters: heat rate (energy efficiency) and the CO_2eq emission intensity of each CFPPs.

The scoring system for both the heat rate and the emission intensity has been determined considering the estimated and collected values of only the 32 CFPPs: the minimum value, P25, P75 and the maximum value. No reference external to the 32 CFPPs is considered since the retirement order is being analyzed only for that sample.

- **Heat Rate (HR).** A common way to measure the energy efficiency of a power plant is through heat rate, or the amount of energy used by a power plant to generate one kWh of electricity. The higher the heat rate, the less efficient a power plant is. Thus, a less efficient power plant would require more fuel—coal, in the case of a CFPP—to produce a unit of electrical energy. The more fuel needed, the more harmful gases a plant releases, therefore, it should be prioritized for retirement.

The HR data was estimated with the thermal efficiency of the plant based on the type of power plant e.g., subcritical, or supercritical and the category it corresponded according to its installed capacity[218]

[218] MEMR, Danish Energy Agency & Danish Embassy (2021) Technology Data for the Indonesian Power Sector. From: https://ens.dk/sites/ens.dk/files/Globalcooperation/technology_data_for_the_Indonesian_power_sector_-_final.pdf

Heat Rate (Btu/kWh)	Score
> 11,973	10
9,891 – 11,973	7.5
9,479 – 9,890	5
< 9,478	2.5

- **Emission Intensity**. CFPPs can use diverse options of emission control technologies addressing CO_2, SO_2 or NO_x. Some of the most common used technologies for each are[219]:
  - **PM**: Fabric filters, electrostatic precipitators (ESPs), or scrubbers to clean the gases that pass through their smokestacks and are eventually released into the atmosphere[220].
  - **SO_2:** Post-combustion flue gas desulphurization (FGD) uses an alkaline reagent to absorb the flue gas and remove SO_2. Wet FGS, semi-dry FDG or seawater FDG can be used in CFPPs.
  - **NO_x:** Selective Catalytic Reduction (SCR and Selective Non-Catalytic Reduction (SNCR) processes can be used to reduce nitrogen oxides in exhaust gases.

However, not all power plants operate with environmental control technologies, and some operate with more than one control solution but the details of the solutions each of the 32 CFPPs uses are not available. Therefore, this parameter will assess the intensity of emission generated by each CFPP regardless of the portfolio of environmental control technologies the CFPP has.

Due to data availability, the CO_2eq emission intensity value is estimated from the type of coal each power plant uses, its annual generation and coal

[219] Coutinho, Miguel and Butt, Hamza K. 2014. Environmental Impact Assessment Guidance for Coal Fired Power Plants in Pakistan. Islamabad: IUCN Pakistan. 149 pp.

[220] EPA. 2021. [Monitoring by Control Technique - Wet Scrubber For Particulate Matter]().

consumption. The estimated coal emission factor (tCO_2eq/TJ) considers CO_2, N_2O and CH_4 emissions[221]
The higher the emission intensity of a CFPP the more it contributes to not meeting the ETP NZE scenario, therefore, its early retirement should be prioritized. The emissions intensity of each CFPP was estimated and then ranked through the following scoring system:

Emissions Intensity (tCO_2eq/MWh)	Score
> 1.46	10
1.23 - 1.46	7.5
1.16 - 1.23	5
< 1.16	2.5

Financial

Two financial criteria are proposed to prioritize access to early closure financial mechanisms for CFPPs.

The scoring system for both the operating profit and the year to be compensated if early retired has been determined considering the estimated and collected values of only the selected 32 CFPPs: the minimum value, P25, P75 and the maximum value. No reference external to the 32 CFPPs is considered since the retirement order is being analyzed only for that sample.

- **Operating profit.** This criterion analyses how financially efficient the CFPP is. The operating profit considers only fuel expense as operating expenses and operating revenue.

The operating expense is estimated from the annual coal consumption and the fuel cost of each plant depending on the type of coal it consumes[222]. The operating revenue is estimated with the annual generation of each

[221] MEMR (2019) Pedoman Penghitungan dan Pelaporan Inventarisasi Gas Rumah Kaca. From: https://www.gatrik.esdm.go.id/assets/uploads/download_index/files/56959-buku-pedoman-igrk-pembangkit-2018.pdf

[222] Price by type of coal resulting from the price cap determined by the government: (i) LRC = 27.26 US$/ton, (ii) MRC = 34.53 US$/ton, and (iii) HRC = 70 US$/ton

plant and the cost of electricity generation (BPP)[223] of the province/subsystem each CFPP corresponds to. The BPP represents the cost of PLN of procuring energy, it wights in the power generated in PLN owned power plants and the generation procured by IPPs. This criterion does not consider subsidies nor compensations and assumes that electricity regardless of who the owner is, is sold least at the generation cost.

- The lower the operating profit, the less financially efficient it is, hence, the higher the prioritization of the CFPP for retirement.

Operating Profit (Million US$)	**Score**
< 5	10
5 -32	8
32 -117	6
117 -190	4
190 -576	2

- **Years to be compensated if retired early.**

This criterion assesses the costs PLN would have to incur if the power plant is retired before its natural closure year. The length of PPAs between IPPs and PLN are usually signed to cover the whole lifespan of the power plant. Similarly, the financial structure of CFPPs owned by PLN are commonly defined according to the expected lifespan of the facility.

At this stage of the study, there is no information available about details about the contractual exit conditions of PPAs signed between IPP and PLN, nor details on the financial structure of the CFPPs owned by PLN. However, this criterion is built under the assumption that, regardless of the specific contractual or debt conditions it has, the more years left to its natural retirement the costly it will be to retire early.

The lower the number of years to be compensated if retired early, the least costly it would be, thus, it should be prioritized for retirement.

[223] Kementerian Energi Dan Sumber Daya Mineral (2021). besaran biaya pokok penyeniaan pembangkitan PT Perusahaan Listrik Negara tahun 2020. From: https://jdih.esdm.go.id/storage/document/Kepmen%20No.%20169.K.HK.02.MEM.M.2021.pdf

Years to be compensated if retired early	Score
< 8	10
9 -17	7.5
18 -25	5
> 26	2.5

Contractual

The clarity of the contractual framework is a crucial aspect in determining whether the CFPP can participate in the early retirement program or not. A clear contractual framework will ease the early retirement program evaluating the asset and penalties.

This aspect will be assessed by looking at the CFPP ownership—whether it is an Independent Power Producer (IPP) or PLN/its subsidiaries. IPP as a business entity that performed electricity transactions with PLN has a clear contractual framework, such as the *Perjanjian Jual Beli Listrik*, PJBL (Power Purchase Agreement, PPA), electricity tariff approval, etc. As for PLN-owned CFPPs, the contractual framework is unclear.

On the other hand, PLN would benefit from ending PPAs as most of them have high-capacity factor obligations that force the curtailment of other power plants. Terminating contracts with IPPs would open the possibility for PLN of accessing discounts on the capacity payments as they would have to be made in advance.

Ownership matters to facilitate the early retirement transaction. IPPs could be more interested in retiring to invest in new opportunities to diversify and gain efficiency in their portfolio. These reasons lead to believe that IPPs will be more open to negotiate early decommissioning, thus, will be more preferred to be retired.

The scoring system in the contractual aspect prioritizes CFPPs owned by IPPs over PLN's or any of its subsidiaries.

Ownership	Score
IPP	10
PLN/PLN Subsidiary	5

Societal

The societal aspect in determining the CFPPs that shall be retired early are to be assessed through the social vulnerability in the CFPP location. The social vulnerability around the retirement of a CFPP will be defined by assessing local poverty rates and the proximity of the CFPP to cities with high income.

The scoring system for both the local poverty rate and the proximity to high-income cities has been determined considering the estimated and collected values of only the selected 32 CFPPs: the minimum value, P25, P75 and the maximum value. No reference external to the 32 CFPPs is considered since the retirement order is being analyzed only for that sample.

These two parameters will be assessed as follows:

- **Proximity to high-income city:** The proximity of a city with high GDP can present opportunities to workers whose jobs are lost in early retirement. Thus, the negative impacts on employment can be offset if a CFPP is closer to, for example, a city where there are alternative jobs available. On the other hand, the farther the CFPP is from a high-income city, the more difficult it becomes for a worker to find alternative employment.

- Consideration of the closeness of a CFPP to a high-income city can also help consider impacts on indirect jobs. Assuming high income cities are more likely to have industrial hubs, it is more likely for its other suppliers, which are more likely to be in the same area as a CFPP, to find other clients. Jobs in these companies become less at risk.

This criterion is assessed by locating the top 94 cities with the highest GDP in Indonesia[224], and considering the driving distance between the province where the CFPP is located and the high-income cities, selecting the closest city.

The closer the CFPPs is to a high-income city the easier could before workers to find alternative jobs, thus, it should be prioritized for early retirement as follows:

Proximity to high income city (km)	Score
< 9	10.0
10- 60	8.0
61- 87	5.0
> 88	2.0

- **Local poverty rates.** Poverty rates can provide a picture of the impact retirement would have in the local community. The higher the poverty rates, the more harmful retirement could be. At the same time, if a CFPP community is far from an industrial hub but has access to other sectors for employment, local poverty rates—which can be expected to be low—can illustrate more resilience in the community.

The assessment of this criteria takes as reference the poverty rates of the province the CFPP is located in. Poverty rates are compiled from *Province in Figures* from the related province from 2010 to 2021 published by Badan Pusat Statistik Indonesia.

The scoring system for the poverty rates prioritizes CFPPs located in the provinces with lower poverty rates, as follows:

[224] Badan Pusat Statistik (2022). *Province in Figures 2022* for Indonesia's provinces.

Poverty	Score
< 4.6%	10
4.7% - 6.6%	8
6.7% - 8.7%	6
8.8% - 11.5%	4
> 12.6%	2

Appendices related to Chapter 2

Annex 2.1. International case studies

International policy and regulations on early CFPP retirement were identified to compare with the Indonesian case.

Past and existing policy and regulatory frameworks were identified and mapped to derive the assumptions required for the analysis of early CFPP retirement. Two international case studies—one on South Africa and another on China—complement the mapping to highlight best practices and facilitate a general framework for just early retirement. These two countries were chosen due to the similarities in CO_2 emissions or CO_2 emissions per capita, as well as their dependence on coal and coal-fired power generation. These two countries have also embarked on pathways for early retirement of coal-fired power plants. Case studies of how these two countries are managing early retirement are presented below, highlighting best practices to report a general framework from a regulatory and institutional perspective.

Comparison of relevant figures in Indonesia, South Africa, and China

	Indonesia	South Africa	China
Total CO_2 emissions[225] ($MtCO_2$) (2020)	590	452	10,668
Total CO_2 emissions world ranking[226] (2020)	10th	13th	1st
CO_2 emissions per capita[227] (tCO_2/person) (2020)	2.2	7.6	7.4

[225] Global Carbon Atlas (2020) *Country Emissions*.

[226] Global Carbon Atlas (2020) *Country Emissions*.

[227] Global Carbon Atlas (2020) *Country Emissions*.

	Indonesia	South Africa	China
CO_2 emissions per capita world ranking[228] (2020)	85th	38th	40th
CO_2 emissions per GDP[229] ($kgCO_2$/GDP) (2020)	0.19	0.70	0.44
CO_2 emissions per GDP world ranking[230] (2020)	25th	2nd	6th
Total energy supplied by coal (TJ)[231] (2019)	2,878,787	4,249,660	86,732,649
Share of coal in total energy supply (%)[232] (2019)	28.5%	72.2%	61.1%
Total electricity generated by coal (GWh)[233] (2020)	180,869	210,002	5,001,122
Share of coal in electricity generation (%)[234] (2020)	62.8%	87.7%	64.1%

[228] Global Carbon Atlas (2020) *Country Emissions*.
[229] Global Carbon Atlas (2020) *Country Emissions*.
[230] Global Carbon Atlas (2020) *Country Emissions*.
[231] International Energy Agency. *Countries and Regions*.
[232] International Energy Agency. *Countries and Regions*.
[233] International Energy Agency. *Countries and Regions*.
[234] International Energy Agency. *Countries and Regions*.

	Indonesia	South Africa	China
Number of operational coal-fired power plants (2022)[235]	84	19	1,110
Capacity of operational coal-fired power (MW) (2019)[236]	32,373	41,435	1,004,948
Capacity of coal-fired power in the pipeline (MW) (2019)	31,200	11,050	205,886

South Africa

Accounting for about 90% of South Africa's electricity generation and 72% of its total primary energy supply, coal has been a critical part of the country's economy for over 100 years. Nonetheless, market and policy signals, coupled with targets to reduce greenhouse gas emissions, indicate that the decline of the coal sector will be inevitable.[237]

South Africa needs to reorient its economy so that it serves its people more inclusively and equitably. At the same time, it needs to ensure that it can meet society's needs within the ecological carrying capacity of the country and the planet.[238]

South Africa is highly coal- and energy-intensive, with an economy characterized by extremely elevated levels of poverty. More than half of the population lives in poverty and the country is the most unequal society in the world. In the long run, sustainable growth and development in South Africa will depend crucially on the

[235] Statista (2022) *Number of operational coal power plants worldwide as of January 2022, by country/territory*.

[236] Carbon Brief (2020) *Mapped: The world's coal power plants*. 26 March.

[237] Climate Investment Funds (2020) *Supporting Just Transitions in South Africa*. Just Transition Case Study.

[238] Idem.

transition away from a coal-intensive energy system and economy. How this happens, and what the transition looks like for different actors and over different time scales, is thus key to understanding the challenges and opportunities of South Africa's energy transition.[239]

Presently, about 72% of our country's primary energy needs are provided by coal. This is unlikely to change significantly in the next decade, due to the relative lack of suitable alternatives to coal as an energy source. South Africa produces an average of 224 million tons of marketable coal annually, making it the fifth largest coal-producing country in the world. Twenty-five of the country's production is exported internationally, making South Africa the third largest coal exporting country.[240]

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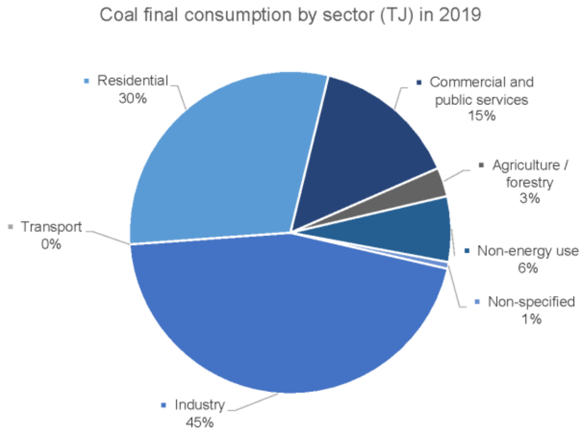
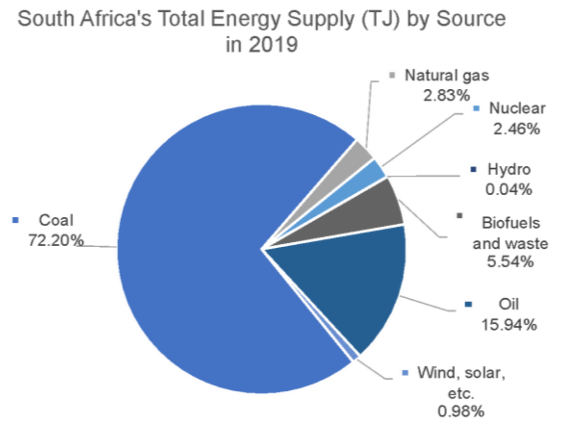
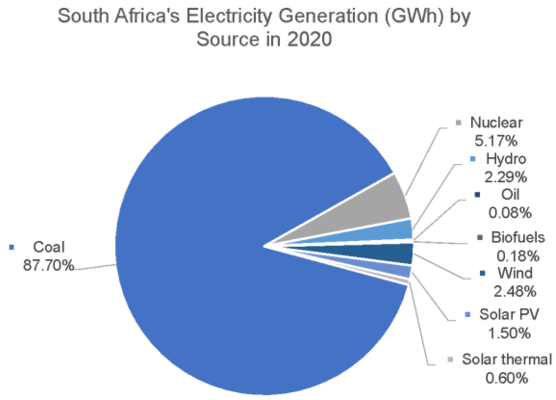
[239] J. Burton, T. Caetano, and B. McCall (2018) Coal transition in South Africa - Understanding the implications of a 2°C-compatible coal phase-out for South Africa. IDDRI & Climate Strategies.
[240] Eskom (2021) Fact Sheet: *COAL IN SOUTH AFRICA*.

Coal statistics for South Africa, pie charts







South Africa has also been experiencing an energy crisis since late 2007 when the national utility, Eskom, began using load-shedding to address the issue of electricity demand exceeding supply. Operational and structural issues have both contributed to the crisis. [241] Just in September 2022, Eskom implemented Stage 6 power cuts, or at least six hours of no power for most of the country. This was just implemented in June earlier in the year.[242]

More than 90% of the country's electricity is generated from coal by the national utility, Eskom. In recent years, several Independent Power Producers (IPPs) have entered the electricity market, predominantly generating renewable energy. The main driver of growth in IPPs is the Renewable Energy Independent Power

[241] Rathi, A. (2022) *Why South Africa Is in the Dark, Again*. 8 July.

[242] Roelf, W. (2022) South African power cuts grow, total blackout not imminent, utility chief says. *Reuters*. 18 September.

Producer Procurement Program (REIPPPP), a competitive tender process designed to incentivize renewable energy project development. The REIPPPP has successfully channeled substantial private sector expertise and investment into grid-connected renewable energy in South Africa at competitive prices.[243] It started in August 2011 when it issued an initial Request for Proposals (RFP), which drew 53 bids for 2128 MW of power generating capacity by November 2011. Ultimately 28 preferred bidders were selected offering 1416 MW for a total investment of close to US$6 billion. Major contractual agreements were signed on November 5, 2012, with most projects reaching full financial close shortly thereafter. Construction on all these projects then commenced with the first project coming online in November 2013. Subsequent rounds of bidding have occurred since then, with the sixth round of bidding having been announced for 2022.[244]

As of 2020, the REIPPPP had managed to raise US$ 15.83 billion of finance for utility-scale renewable energy projects, 80% of which originated from domestic sources. By the end of March 2019, the REIPPPP had procured 6,422 MW of capacity (3,976 MW of which had been connected to the national grid). 35,669 GWh of renewable electricity had been generated, saving 36.2 Mt of CO2 and 42.8 million kiloliters of water. 53,339 full-time equivalent (FTE) jobs were also created, 48,085 of which went to locals. The economics of energy generation has changed in South Africa, and a growing body of evidence shows that renewable energy is now the cheapest form of electricity generation locally.[245]

In 2020, South Africa ranked 4th in coal exports worldwide, exporting 82.6 million short tons of coal.[246] However, a drop in exports has been observed as of late. In 2021, the Richards Bay Coal Terminal (RBCT), the largest coal exporting facility in South Africa, exported 58.72 million tons of coal, an 11-million ton drop from exports in 2020 and an 18-million-ton deficit from its 77-million-ton target for the year. Coal exports in 2021 were at their lowest since 1996.[247] RBCT is expected to

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[243] World Bank. 2014. *South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons*.

[244] Government of South Africa. Department of Mineral Resources and Energy. 2022. *Independent Power Producer Procurement Program*.

[245] Government of South Africa. 2020. *South Africa's Low-Emission Development Strategy 2050*.

[246] The Global Economy (2022) *Coal exports - Country rankings*.

[247] M. Creamer (2022) South Africa's RBCT exports lowest coal tonnage since 1996. *Mining Weekly*. 25 January.

experience another drop in exports this year. This decline has been attributed to poor coal transport infrastructure within the country.[248]

Amid the European Union ban on coal imports from Russia due to the latter's invasion of Ukraine in early 2022, South Africa has been considered as an alternative source of coal for many European countries. Already, coal exports from South Africa to Europe have increased by 40% in the first five months of 2022 compared to all coal exports to Europe in all of 2021. So far, the Netherlands, Italy, France, Spain, Denmark, Poland, Germany, and Ukraine have imported coal from RBCT this year. Some only began receiving coal from RBCT after the Russian invasion of Ukraine. However, poor coal transport infrastructure may hinder the country from fully taking advantage of this opportunity.[249]

- Policy and Regulatory Framework

South Africa's updated Nationally Determined Contribution (NDC) was submitted in September 2021. Unlike other countries' NDCs, South Africa's NDC, which was first submitted in 2016, does not define mitigation targets in relation to a reference point. Mitigation targets are set as fixed GHG emission target ranges for 2025 and 2030. Sector targets are energy; industrial processes and product use (IPPU); agriculture, forestry, and other land use (AFOLU); and waste.

South Africa's GHG emission targets in the NDC

Target Year	Emission Target Range	Period of Implementation
2025	398-510 Mt CO2-eq.	2021-2025
2030	350-420 Mt CO2-eq.	2026-2030

The Department of Forestry, Fisheries & the Environment is the focal point for climate change and the development of the NDC. The department also led the process for updating the NDC, heading the five steps of the update: technical analysis, consultation within government, consultation with broader stakeholders, provincial public stakeholder workshops, and finalization in

[248] H. Reid and N. Banya (2022) Europe imports more South African coal as Russian ban looms. *Reuters*. 15 June.
[249] Idem.

government.[250] No provisions have been made for the departments responsible for NDC implementation.

The long-term decarbonization of the South African economy will focus primarily on the electricity sector; in the 2030s, a deeper transition will take place in the electricity sector, coupled with a transition in the transport sector towards low emission vehicles; while the 2040s and beyond will be characterized by the decarbonization of the hard-to-mitigate sectors. The key challenge during the implementation periods of this first NDC (2021 to 2025, and 2026 to 2030) will be the transition in the electricity sector, seeking early investment in and preparing for mitigation in harder-to-mitigate sectors, and addressing the economic and social consequences resulting from this transition in coal-producing areas. South Africa's electricity is currently mostly provided by several large coal plants located in the Mpumalanga province, where most of the country's coal resources are to be found.

- Integrated Energy Plan

Energy planning is guided by the Integrated Energy Plan (IEP). The White Paper on Energy Policy of the Republic of South Africa of 1998 identified the requirement for development of the IEP, with the National Energy Act of 2008 further defining the objectives thereof. The Energy Act also mandates the Minister of Energy to develop, review and publish the IEP.

The IEP approach analyses current energy supply and demand trends within the different sectors of the economy, across all energy carriers. It then uses this information along with assumptions about future demand and technology evolution to project the country's future energy requirements under a variety of different scenarios, including those with emissions limits and different carbon prices. Based on an analysis of the scenario outcomes, the IEP can define the future trajectories for electricity, liquid fuels and gas in the country.

The current IEP dates from 2003, and the Department of Energy has been working on updates thereof, with a draft IEP outlining various energy scenarios having been issued in 2016.[251]

[250] Government of South Africa (2021) *First Nationally Determined Contribution Under the Paris Agreement*. UNFCC

[251] Government of South Africa (2020) *South Africa's Low-Emission Development Strategy 2050*.

- Integrated Resource Plan

The Integrated Resource Plan (IRP)[252] is an electricity infrastructure development plan based on least-cost electricity supply and demand balance that considers security of supply and the environment (minimize negative emissions and water usage). It guides the evolution of the South African electricity supply sector in that it identifies the preferred electricity generation technologies to be built to meet projected electricity demand. It thus provides a mechanism for Government to drive the diversification of the country's electricity generation mix and promote the use of renewable energy and other low-carbon technologies.

First drafted in 2011, the IRP has since been updated in 2019 to reflect capacity additions and changes in assumptions such as electricity demand projection, Eskom's existing plant performance and technology costs[253]. The 2019 update includes:

- Extension of the period of analysis to look at the period to 2050 (the IRP 2010 only looked to 2030)—however the updated IRP provides a build plan only up to 2030
- Updated demand projections
- Updated technology costs

By extending the coverage to 2050, the impact of decommissioning Eskom's coal fired generation capacity on the long-term requirements for new capacity is clearer. The decommissioning schedule outlined in the IRP shows that about 10,599 MW of Eskom's coal generation capacity will be decommissioned by 2030 and will increase to 35,000 MW by 2050. For reference, the installed capacity in 2018 was 37,149 MW.[254]

At the same time, however, the IRP has made provisions to install 1500 MW of coal power by 2030 through two new 750MW coal-fired power plants in 2023 and 2027. In 2021, the Department of Mineral Resources and Energy (DMRE) appeared intent on starting a new procurement process that was to begin the first quarter of 2022.[255] This does not consider two 4800 MW coal-fired power plants—Medupi

[252] Government of South Africa (2019) *Integrated Resource Plan*.

[253] Idem.

[254] Government of South Africa (2020) *South Africa's Low-Emission Development Strategy 2050*.

[255] C. Yelland (2021) Big holes emerge in SA's Integrated Resource Plan for Electricity. *ESI Africa*. 15 November

and Kusile—that are still currently under construction after being approved in 2007.[256]

- Financing support

According to recent studies,[257] South Africa will need to spend US$ 250 billion over the next three decades to transition towards renewable energy, out of which an estimated $24 billion to close the coal-fired power plants owned by national power utility, Eskom Holdings SOC Ltd., by 2040 and US$10 billion to compensate affected coal workers and to rehabilitate the environment at idled coal mines. The balance US$ 220 billion is planned to support 150 GW solar and wind power plants, 33 GW of battery storage, as well as other hydro and natural gas projects. These studies also suggest that most money will need to come from the private sector, although an initial boost from the public sector would be key to provide a positive investment sign to the private sector and incentivize a flow of clean energy investments. Moreover, about a third of the funding will be needed from not entirely commercial capital providers to support less financially interesting projects.

In this context, South Africa has recently announced the Just Transition Partnership (JETP),[258] a US $8.5 billion climate grants and concessional loans venture with the world's richest nations[259] to accelerate the transition away from coal. It is expected that this will be a catalyst to unlock financing from the private sector although the government must enact to amplify its funding to reach the US$ 250 billion target.

To unlock these private financing flows, the South African government has agreed, as part of the JETP, to implement key significant reforms in the national energy system which have the potential to elevate the partnership from a one-time

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[256] Burkhardt, P. (2022) *Giant New Power Plants Undermine South Africa's Emissions Pledge*. 8 July.

[257] Sguazzin, A. (2022) *South Africa Needs $250 Billion Transition Away From Coal*. Retrieved August 11, 2022, from: https://www.bloomberg.com/news/articles/2022-05-26/south-africa-needs-250-billion-to-transition-away-from-coal?leadSource=uverify%20wall

[258] European Commission (2021) *France, Germany, UK, US and EU launch ground-breaking International Just Energy Transition Partnership with South Africa*. 2 November.

[259] Business Tech (2022, July 6) *South Africa approves $8.5 billion plan to move away from coal*. Retrieved August 11, 2022, from: https://businesstech.co.za/news/energy/603460/south-africa-approves-8-5-billion-plan-to-move-away-from-coal/

injection of infrastructure funding to a sustainable pipeline for private sector investment.

Some examples of reforms already announced or implemented are the liberalization of South Africa's electricity generation market,[260] the proposal to establish a South African independent system operator to create a multi-market structure and break up Eskom's vertical monopoly,[261] as well as a set of policies such as the introduction of a regulated green finance taxonomy.[262] The intended result would be the creation of a nationwide sustainable finance ecosystem that acts as a force multiplier for JETP funds while attracting investment from private and philanthropic financiers.

Moreover, the JETP investment plan will identify key decarbonization projects, differentiating roles for public and private sector funding, depending on the investment interests that have been previously analyzed for each one of them. In this way, JETP funds will be able to be used to finance projects that support South Africa's overall energy transition but would not otherwise receive private funding.

Finally, multilateral development banks and development finance institutions (DFIs) are key actors to allow this mechanism to function properly. Through financial mechanisms such as layered debt structures, these organizations can de-risk clean energy investments and attract developers for necessary transition projects.

- Gaps and limitations

South Africa is today the 13th largest GHG emitter in the world, relying on coal for 70% of its total energy supply. The country has seen its energy transition being

[260] Kuhudzai, R.J. (2021) *South African Companies Now Allowed to Generate Up to 100 MW Without Applying for Generation License!* Retrieved August 11, 2022, from: https://cleantechnica.com/2021/06/10/south-african-companies-now-allowed-to-generate-up-to-100-mw-without-applying-for-generation-license/

[261] Ayemba. (2022, April 7). Key Aspects of The Electricity Regulation Act Amendment Bill 2022. African Mining Brief. Retrieved August 11, 2022, from https://africanminingbrief.com/2022/04/07/key-aspects-of-the-electricity-regulation-act-amendment-bill-2022/

[262] Government of South Africa. Department of the National Treasury (2022) *South African Green Finance Taxonomy*.

blocked over the years due mainly to a significant number of gaps, limitations and barriers.

1. **Financing Barriers.** The JETP and its corresponding reforms is meant to end with South Africa's vertical monopoly over the nation's energy system, which has favored Eskom's coal-fired power plants over private renewable generation, drastically reducing the potential profitability of independent clean energy investments in the past[263].
2. **Institutional barriers.** the country's energy system remains highly resistant to reform, needing significant and strong policy support to achieve the energy transition goals. However, over the years the country has faced policy and strategic barriers at national and municipality level due to an inadequate stakeholder consultation, a lack of strategic direction and commitment, and weak public commitments. A set of green policies such as the green taxonomy will be fundamental to accelerate the country's energy program.
3. **Social opposition.** Recent studies have indicated a strong social opposition among local people towards renewables in South Africa due to concerns about coal related-job losses[264] and a fear of unequal distribution of socio-economic benefits coming from renewable energy projects.
4. **A geographic concentration of coal mining and power generation.** Coal mining and coal power generation are heavily concentrated in four municipalities[265]. of a single province, Mpumalanga, where the industry is critical to workers and the broader community.
5. **Unclear job replacement opportunities.** Renewable energy projects are often far away from the regions affected by the retirement of the CFPPs and its respective coal mines. This results in unequal geographical

[263] Cassidy, C. (2022, August 30) *The Just Energy Transition Partnership with South Africa will hinge on domestic reform.* Retrieved August 11, 2022, from: https://www.atlanticcouncil.org/blogs/energysource/the-just-energy-transition-partnership-with-south-africa-will-hinge-on-domestic-reform/

[264] Mirzania, P. et al (2021, January 9) *Spatial Divergence of South Africa's energy transition and its implications for energy justice.* Retrieved August 11, 2022, from: https://climatecompatiblegrowth.com/wp-content/uploads/2021/09/3C-COP26-Policy-Brief.pdf

[265] Cahill, B. (2020, July 23) *Just Transitions: Lessons Learned in South Africa and Eastern Europe.* Retrieved August 11, 2022, from: https://www.csis.org/analysis/just-transitions-lessons-learned-south-africa-and-eastern-europe

distribution of the expected socioeconomic benefits associated with the energy transition.

6. **Unemployment and pressure from the mining industry and Unions.** The combined political power of the mining industry and its labor unions, especially the National Union of Mineworkers has been an important limitation for the country's transition to clean energy over the last years[266]. Moreover, the high rate of unemployment in South Africa triggers concern and a strong response from Unions to any program that has the potential to lead to job losses.
7. **Unsuccessful implementation of Just Transition measures.** although the country has been clear about the need of a Just Transition for years, it has failed in addressing socio-economic conflicts caused by the energy transition due to poor management, a lack of monitoring, a lack of evaluation of community needs and demands, and political interference, among other factors[267].

- Conclusion

Because both Indonesia and South Africa are highly dependent on coal-fired power and are both in the process of retiring power plants, there are plenty of lessons to be taken from South Africa's case, considering both similarities and differences between the contexts of the two countries.

It is worth noting that the relationship between energy supply and energy demand in Indonesia and South Africa are different. Whereas South Africa has been experiencing an energy crisis for almost fifteen years, Indonesia enjoys excess coal power capacity. From an energy security point of view, Indonesia is more poised to retire power plants without significantly affecting the country's energy supply. Nevertheless, both countries must deal with recent and planned construction of new coal-fired power plants, whose retirement will need to come sooner than later if both countries are to fulfill their climate goals. With independent power producers (IPPs) providing a significant amount of power to

[266] Todd, I. and McCauley, D. (2021) *Assessing policy barriers to the energy transition in South Africa.* Energy Policy, Volume 158. Article 112529

[267] Todd, I. and McCauley, D. (2021) *Assessing policy barriers to the energy transition in South Africa.* Energy Policy, Volume 158. Article 112529

Indonesia's power supply, PLN will need to devise innovative ways to deal with power purchase agreements to be able to accelerate coal retirement.[268]

South Africa's experience with increasing coal exports to Europe also sheds light on what could happen in Indonesia. Given Indonesia's position in the world as another major coal producer, the country is poised to be another source of coal for the European Union amid bans on fossil fuel imports from Russia. Indonesia typically does not export coal to Europe, but as early as April 2022, the coal mining company PT Adaro Energy Indonesia reported already having sold 300,000 tons of coal to the Netherlands and Spain. Poland reportedly ordered 53,230 tons of coal from Indonesia in the same month.[269] At the same time, Indonesia has placed bans on the export of coal for certain mines, declaring that the country was falling short of its domestic targets.[270] However, the increase in European demand for fossil fuels is projected to continue for the next several years, coinciding with the early retirement of coal-fired power plants in Indonesia that will lead to lower domestic demand. It can thus be expected that Indonesian coal that is not consumed domestically will be directed towards exports to meet international demands from Europe and Indonesia's other regular customers. Thus, the transition away from coal in Indonesia may be limited to electricity generation and other sectors in the value chain such as coal transport. Coal mines, on the other hand, will most likely witness continued operation, preserving both its finances and employment.

South Africa's pioneer energy transition program has provided a framework for countries and governments wanting to implement similar measures. As such the US $8.5 billion agreement signed with UK, US, and EU to support the transition has been an outstanding catalyzer to attract interest from the private sector to invest in the country, although it has left some lessons from which Indonesia can learn:

- First, this deal was signed with no clear investment plan, which could have accelerated the flow of private funding.

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[268] Hamdi, E. and Adhiguna, P. (2021) IEEFA: Indonesia's excess coal power capacity and PLN's debt burden are blocking their decarbonization pathway. *Institute for Energy Economics and Financial Analysis*. 18 November.

[269] D. Hutt (2022) How the EU's new energy plans impact Southeast Asia. *DW*. 27 September.

[270] The Maritime Executive (2022) *Indonesia's New Partial Ban on Coal Exports Will Impact EU and Bulkers*. 12 August.

- Second, the country did not define if this agreement was comprised of loans or grants. Grants are particularly necessary to fund social protection measures and programs like the re-training of coal miners.

Moreover, South Africa still faces a substantial number of economic, social, and political challenges to be solved. In the first place, it is essential that the government carries on the energy reforms that have been announced to attract private funding which is crucial to reach the financing targets. It is important than the commitments and policies taken by the government are transparent, realistic and meets the stakeholders' expectations.

In second place, the country needs to strengthen the institutions in charge of the energy transition, defining and implementing solid and inclusive policies and strategies at both national and municipality, which would send a positive signal to all relevant stakeholders. At this stage, the JETP is managed by a governance structure comprised of the IPG members (France, Germany, UK, US, EU) and the government of the Republic of South Africa. The Partnership's work is supported by a JETP Secretariat that provides a technical and coordination function to the Partnership, in a neutral and objective manner. At a more operational level, the JETP will establish five working groups that will be the vehicle through which key technical expertise and experience can be mobilized to inform the development of the JETP-IP. The JETP program set to be run in Indonesia can also provide the necessary governance structure to guide the energy transition.

Finally, South Africa needs to tackle the social tensions with an adequate Just Transition framework that ensures that the affected employees are being given an appropriate training to transition to alternative jobs (whether it is in the renewable energy industry or other industries that are located in the same region), that there is a clear defined investment plan for the most affected communities, and that the needs of the impacted stakeholders, including Labor Unions, are adequately taken into consideration trough a cross-sectoral dialogue. Recently, protests over fuel price rises involving student groups and labor unions have taken place in Indonesia.[271] Further impacts on the Indonesian population due to the coal transition, such as job losses, should be mitigated to avoid social unrest in the future.

[271] Strangio, S. (2022) Protests Erupt in Indonesia Over Fuel Price Rises. *The Diplomat*. 9 September.

China

Coal has been the primary energy resource in China's energy mix for decades. However, due to increasing domestic and global environmental concerns, particularly the pressure to reduce greenhouse gas (GHG) emissions, China is actively looking to phase out coal from its energy system.[272] Indeed, to comply with the Paris Agreement, China has set its ambition to end its ever-rising consumption of coal by 2060, with an expected peak in 2030 or earlier.[273]

To decarbonize the country, the government of China is actively working under the five working guidelines stated in the official document '*Working guidance for carbon dioxide peaking and carbon neutrality in full and faithful implementation of the new development philosophy*':[274]

The five working guidelines under China's 'Working guidance for carbon dioxide peaking and carbon neutrality in full and faithful implementation of the new development philosophy'.

Exercising nationwide planning	Taking a whole-of-nation approach, China will implement policies "on a categorized basis in light of local circumstance in order to encourage local authorities to act on their own initiative and take the lead in peaking carbon dioxide emissions"
Prioritizing conservation	China will continue "reducing energy and resource consumption and carbon emissions per unit of output, improve resource input-output efficiency, advocate simple, moderate, green and low-carbon living patterns, and effectively control carbon emissions at their source and point of entry"

[272] Teng Fei (2018) *Coal transition in China. Options to move from coal cap to managed decline under an early emissions peaking scenario. IDDRI and Climate Strategies*.

[273] Thorsten Burandta, Bobby Xiong, Konstantin Löffler, and Pao-Yu Oei (2019) Decarbonizing China's energy system – Modeling the transformation of the electricity, transportation, heat, and industrial sectors.

[274] Communist Party of China Central Committee and the State Council (2021) *Working Guidance For Carbon Dioxide Peaking And Carbon Neutrality In Full And Faithful Implementation Of The New Development Philosophy*.

Leveraging the strengths of the government and the market	China "will deepen reform in energy and related fields, give full play to the role of market mechanisms, and create effective incentive and restraint mechanisms"
Coordinating efforts on the domestic and international fronts	Based on its national context, China "will coordinate planning for domestic and international energy and resources and promote advanced green and low-carbon technologies and practices"
Guarding against risks	China's "efforts to reduce pollution and carbon emissions must be balanced with the need to ensure energy security, industrial chains, supply chains, and food, as well as normal daily life"

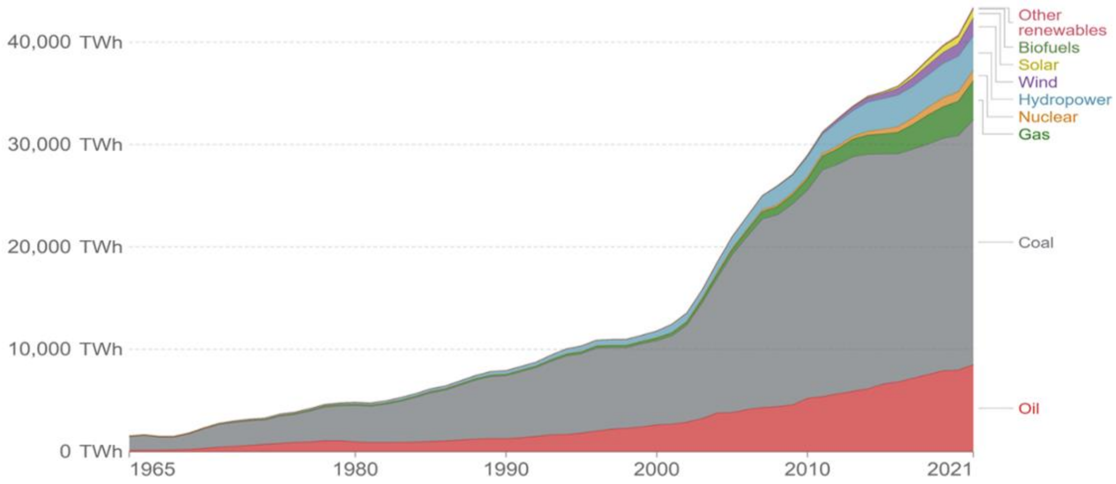
Regarding CFPPs the referred document points out that coal-fired power plants will be regulated by new "production capacity policies". Moreover, retrofitting and upgrade projects for existing coal power generators are to be pushed forward, while maximum emission reduction criteria and power overgeneration will be key aspects in the designing and implementation of new CFFPs.[275] These measures are coherent with China's commitment towards economic growth, and they also reaffirm its policy of building new CFPPs before dismantling the old ones.[276] Therefore, the retirement of coal-fired power plants remains a politically sensitive and technically, financially and socially complex issue.

China is highly dependent on coal as a primary energy source, accounting for 64% of its energy mix in 2016[277] and 54% of the total global coal electricity generation in 2021.[278] China also remains the main driver of the global increase in demand

[275] Communist Party of China Central Committee and the State Council. 2021. *Working Guidance For Carbon Dioxide Peaking And Carbon Neutrality In Full And Faithful Implementation Of The New Development Philosophy*.
[276] Christoph Nedopil, Mengdi Yue, and Ulrich Volz. (2022) *Global Practices for Financing of Early Coal Retirement for Accelerated Green Energy Transition*.
[277] Teng Fei (2018) *Coal transition in China. Options to move from coal cap to managed decline under an early emissions peaking scenario. IDDRI and Climate Strategies*.
[278] Statista. *Distribution of coal electricity generation worldwide in 2021, by country*.

for coal-fired power.[279] Being a major coal producer, up to date, this country has the largest number of coal-fired power stations of any country in the world with 1,110 operational coal power plants on the Chinese Mainland, four times the number of power stations in India, which ranked second.[280] If decommissioning of CFPP has exceeded commissioning in the rest of the world since 2018, this effect has been offset by a substantial net increase in coal-fired electricity capacity in China.[281]

China's energy consumption by source (1965 – 2021). Primary energy consumption is measured in terawatt-hours (TWh). 'Other renewables' includes geothermal, biomass and waste energy.

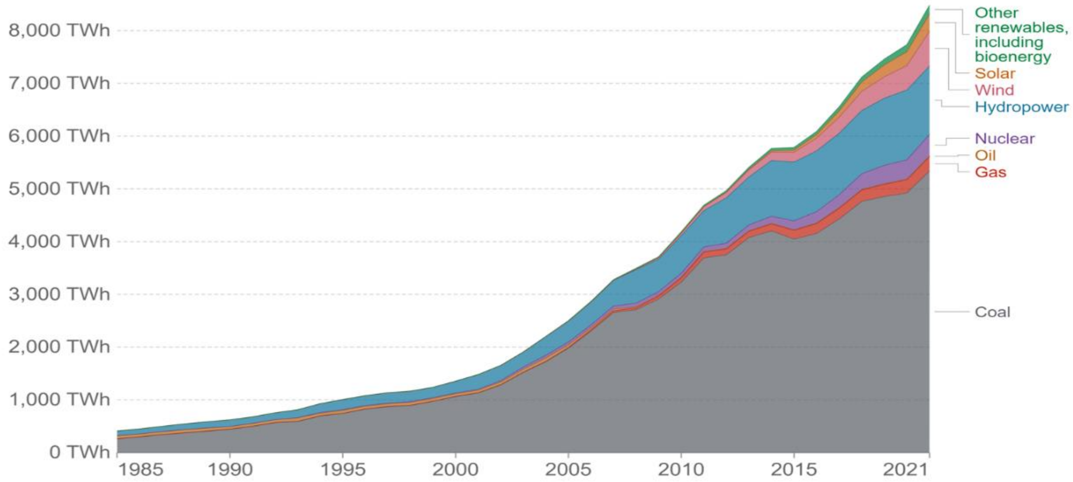


[279] Bas Heerma van Voss and Ryan Rafaty (2022) *Sensitive intervention points in China's coal phaseout*.

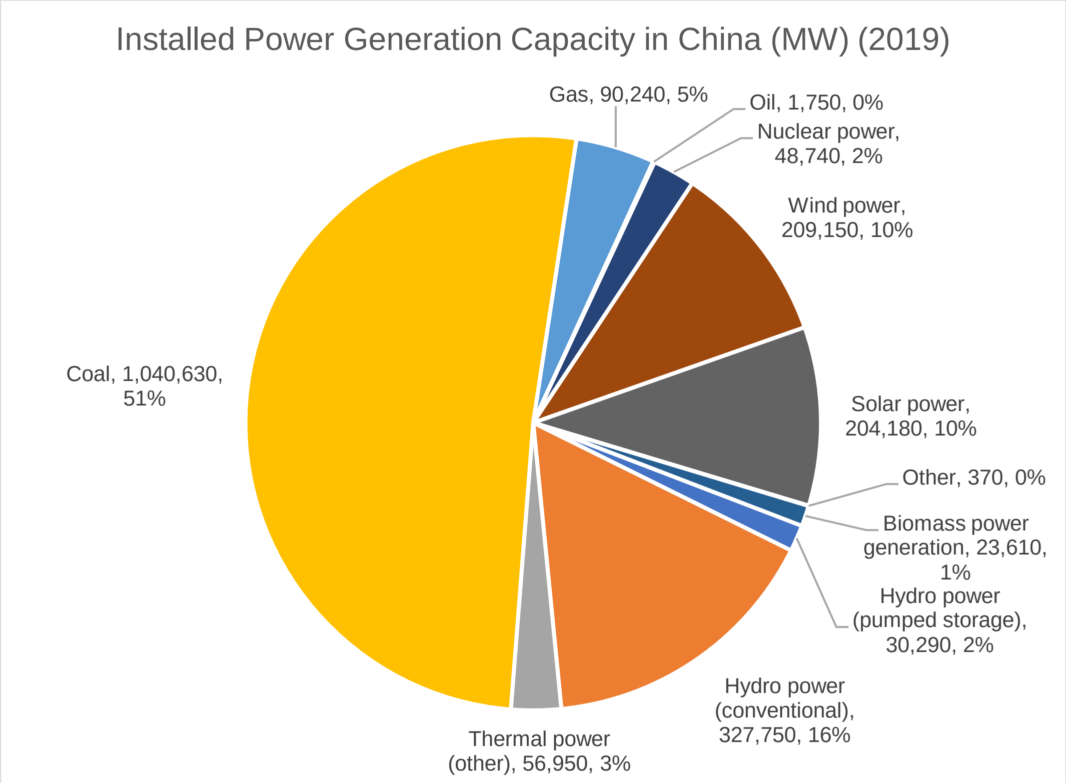
[280] Statista. *Number of operational coal power plants worldwide as of January 2022, by country/territory*.

[281] Bas Heerma van Voss and Ryan Rafaty (2022) *Sensitive intervention points in China's coal phaseout*.

China's electricity production by source (1985 – 2021). Electricity production is measured in terawatt-hours (TWh). 'Other renewables' includes biomass and waste, geothermal, wave and tidal. Source: Our World in Data, line graph



Installed power generation capacity in China in 2019. Source: China Energy Portal, pie chart[282]

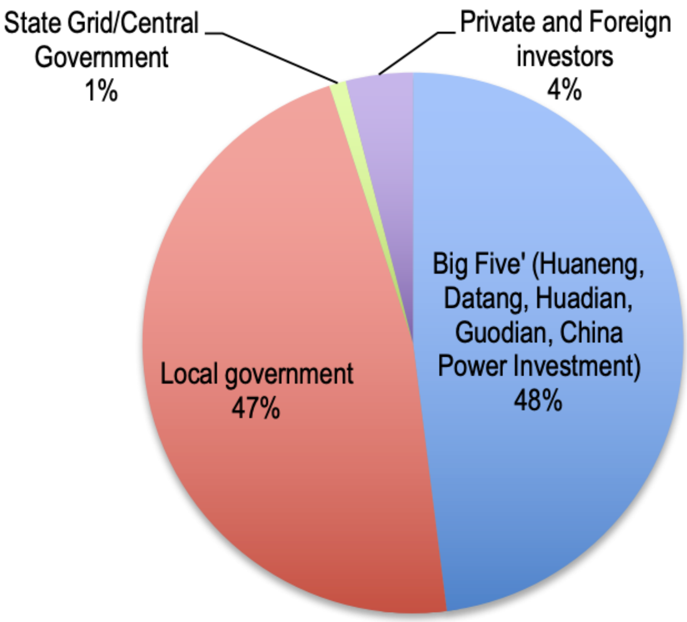


The large presence of government in the industry structure distorts incentives and limits the potential for competition. The Big Five state-owned enterprises (SOEs) account for approximately half of the total installed capacity with local governments owning an equivalent level of installed capacity. Meanwhile, private and foreign companies owned only 4% of the total generation capacity. Large fossil fuel energy SOEs receive significant subsidies from the government, including subsidies for resources (e.g. costs of land use, cost savings from government support) and credit. In addition, power generators receive subsidies for the installation of equipment to control emissions. Large government presence can blunt important economic signals and distort decisions. For example, public ownership of CFPPs may make it challenging for governments to shut plants down due to consequences for local communities. These benefits may

[282] China Energy Portal. (2021) 2020 electricity & other energy statistics (preliminary).

also encourage the construction of new plants even when not needed, running the risk of stranded assets in the long-term. [283]

Ownership of China's power generation capacity. Source: Robinson, D. and Lin, X. (2017), pie chart



Grid networks also witness barriers to competition with two grid companies controlling the whole network in China: State Grid Corporation China and China Southern Grid. These companies control their own networks and retails and operate in parallel.[284]

Such a structure favors coal-based generation in ways that raise the costs of the system. Aside from subsidies that ensure cost recovery and annual quotas, the large generators are supported by policies that do not incentivize flexibility in the operation of coal-fired plants. Moreover, fixed pricing on the demand side means that prices do not fall to reflect surplus generation. Thus, there is no incentive for consumers to increase their consumption when a surplus is available. [285]

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[283] David Robinson and Xin Li (2017) *Closing Coal in China: International experiences to inform power sector reform*.
[284] David Robinson and Xin Li (2017) *Closing Coal in China: International experiences to inform power sector reform*.
[285] David Robinson and Xin Li (2017) *Closing Coal in China: International experiences to inform power sector reform*.

In 2020, China decommissioned outdated coal power plant capacity, shutting down around 7 GW of power plants.[286] At the same time, China brought 38.4 GW of new coal-fired power into operation, more than three times what was brought on line everywhere else.[287] In 2021, the country committed to not building new coal-fired power projects overseas.[288] However, in the first quarter of 2022, the government approved the construction of 8.63 GW of coal power plants in its territory mainly due to rising energy supply worries, driven in part by a wave of power outages in 2021. China will start cutting its coal consumption only after 2025, meaning that 150 GW of new coal power capacity could be built before then. This dynamic leads China to a path of phase-down rather than phase-out coal use in its energy system.[289]

In 2021, to assist in determining which power plants to retire, Cui et al. devised a framework for assessing the 1037 coal plants that were operating at the time under China, balancing the high ambition of a coal phaseout with the country's needs. The framework was based on comprehensive technical, economic, and environmental criteria, develop as a metric for prioritizing plants for early retirement. The following figure provides an illustration of the methodology used. The study found that 18% of plants consistently scored poorly across all three criteria and were thus prime candidates for early retirement.[290]

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[286] Sino-German Energy Partnership (2022) *China Energy Transition Policies 2020*.

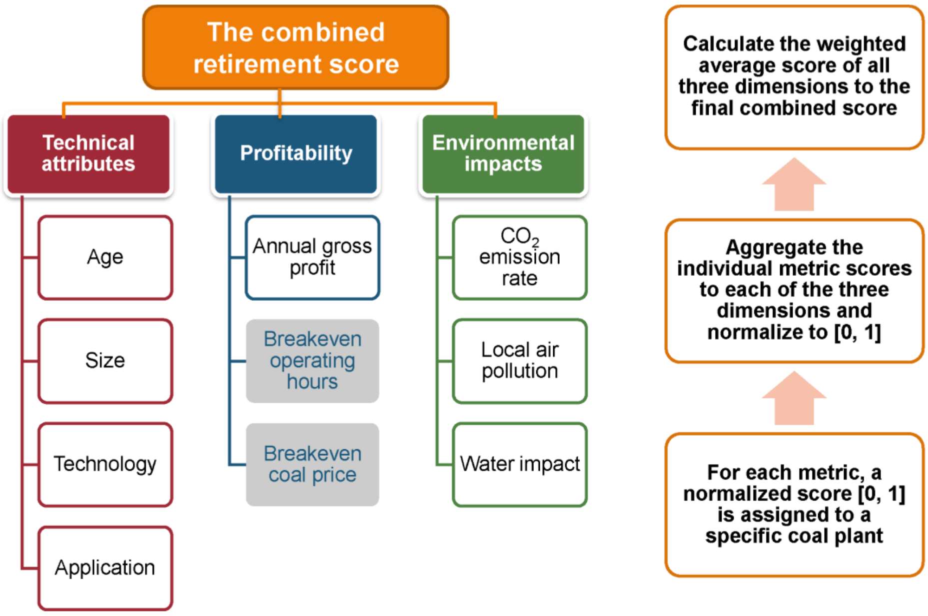
[287] Michael Standaert (2021) *Despite Pledges to Cut Emissions, China Goes on a Coal Spree*.

[288] Alex Clark, Christoph Nedopil and Cecilia Springer (2022) *China and the Prospect of Early Retirement of Coal Plants in the Global South*.

[289] David Stanway (2022) *China coal plant approvals surge as energy security trumps climate – Greenpeace*.

[290] Cui, R.Y. et al. (2021) A plant-by-plant strategy for high-ambition coal power phaseout in China. *Nature Communications*. 12, 1468.

Methodology of calculating the combined plant-by-plant retirement algorithm: the score of technical attributes is based on the equal-weighted average of plant age, size, combustion technology, and application; the score of profitability is based on cap.



- Policy and regulatory framework

Through its INDC (2016), China committed to peak its carbon emission by 2030; to increase non-fossil sources in the total primary energy consumption to 20% by 2030; and to lower CO_2 emissions per unit of gross domestic product (GDP) by 60–65% of the 2005 level by 2030.[291] In its first NDC (2021), China increased its climate ambition, committing to reach CO_2 emissions peak before 2030 and achieve carbon neutrality before 2060. Alongside these targets, China aims to reduce its carbon intensity by over 65% from the 2005 level by 2030.[292]

Considering these self-imposed challenges, China started controlling and limiting coal use as a cornerstone policy goal, therefore taking a series of policies and measures during the last decade. In 2014, for example, the government of China issued the National Energy Development Strategy Action Plan (2014-2020), which stated that, by year 2020, the total annual coal consumption should be capped at

[291] D'Arcy Carlson, Stacy-ann Robinson, Catherine Blair, and Marjorie McDonough (2021) China's climate ambition: Revisiting its First Nationally Determined Contribution and centering a just transition to clean energy.

[292] Sebastian Ibold (2021) *China's updated NDCs and 1+N policy system for carbon neutrality*.

4.2 billion tons/yr., and among the primary energy consumption the share of coal should be below 62%.[293]

Being a major aspect of economic development, the energy sector is also a core section of each Five-Year-Plan (FYP) issued by the government of China. Aligned to China's INDC, 13th FYP (2016-2020) set the target to maintain the total coal capacity within 1100 GW by 2020. To achieve this goal, in 2016, the Chinese government set bans on new coal power plants in three industrial regions: Beijing-Tianjin-Hebei, Yangtze River Delta and the Pearl River Delta. Specifically, it cancelled plans to build 45 coal power projects with a total capacity of 29.4 GW. Furthermore, 10.8 GW of coal power plants (small and inefficient) were retired that same year. [294]

More recently, in 2020, the National Energy Administration (NEA) enacted a notice on targets and tasks for coal power retirement. The retirement plan aimed to decommission outdated and small units with a total capacity of 7.3 GW by the end of that year, unless specifically named as contingency units. The provincial administrative authorities were responsible for ensuring that the phasing-out was completed on schedule by drawing up detailed implementation and monitoring plans (including approval process). In addition, to guarantee electricity and heat supply while shutting down the coal power units, the NEA worked in close coordination with relevant industries.[295] Had these regulations been inexistent, coal capacity would have reached 1250 GW by 2020. However, this shift away from investment in coal constituted a small share of the investment in new coal capacity.[296]

Subsequently, 14th FYP (2021-2025) includes the reduction of the share of coal in primary energy consumption to below 58%. This objective is supported by the guiding opinion issued in 2020 on energy security by the National Development and Reform Commission (NDRC) and NEA. Out of five areas in which energy security improvement could take place, this document calls to accelerate the

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293 Teng Fei (2018) *Coal transition in China. Options to move from coal cap to managed decline under an early emissions peaking scenario. IDDRI and Climate Strategies*.

294 David Robinson and Xin Li (2017) *Closing Coal in China: International experiences to inform power sector reform*.

295 Sino-German Energy Partnership (2022) *China Energy Transition Policies 2020*.

296 David Robinson and Xin Li (2017) *Closing Coal in China: International experiences to inform power sector reform*.

decommissioning of old coal plants that do not meet safety and environmental protection requirements.[297] Along with this goal, the government of China reiterated its commitment to "clean coal". However, this last affirmation was perceived as a sign that China reaching its emission peak before 2030 and becoming carbon neutral by 2060 do not imply that short term stimulus of the economy through power-plant construction should suffer.[298] In fact, due to the impact of COVID-19 on the national and global economy, energy security has become a matter of concern for the Chinese government.

- Financing support

Closure of existing CFPPs, especially when they are relatively new as is the case in China, is a challenging target. Closing plants prematurely means that investors will not recover sunk investment costs, which could motivate strong opposition from them, employees, and the local community. On the contrary, closing older and inefficient plants is much easier and China has specialized in replacing old coal power plants with new ones.[299]

According to the report "Closing Coal in China" prepared by the University of Oxford, there is no information available about the impacts of the coal power plants closure on system costs and power prices in China, or about compensation to companies and employees.[300] However, since the Chinese coal-fired power sector is almost totally owned by the state (61% of installed capacity is entirely state-owned, while 33% is mostly state-owned through subsidiaries in which parent state-owned enterprises retain a controlling stake),[301] mechanisms aimed to compensate private investors will be scarcely necessary. Nevertheless, considering that the Chinese government would be the one handling almost all

[297] Sino-German Energy Partnership (2022) *China Energy Transition Policies 2020*.

[298] Bas Heerma van Voss and Ryan Rafaty (2022) *Sensitive intervention points in China's coal phaseout*.

[299] David Robinson and Xin Li (2017) *Closing Coal in China: International experiences to inform power sector reform*.

[300] idem

[301] Thomas Spencer, Nicolas Berghmans, and Oliver Sartor (2017) *Coal transitions in China's power sector: A plant-level assessment of stranded assets and retirement pathways*.

stranded assets, an auction mechanism[302] could be put in place to identify the least cost options to reduce the burden generated by stranded assets.[303]

To recover the additional costs associated with the early closure of power stations and the simultaneous investment in renewable power, China has decided to provide subsidies to these entities by incorporating these costs (i.e., subsidies) as levies in the electricity price thereby increasing them. However, these levies are not transparent: potential investors in renewable power do not know when they will receive the subsidies, which discourages private investment in renewable power.[304]

- Gaps and limitations

Economic prioritization. China's economic growth since the late 1970s has had to rely heavily on carbon-intensive industries to satisfy the needs of its growing population. Although this growth has slowed in recent years, the continued desire to establish China as a global manufacturing power means that energy consumption is expected to increase along with the projected economic growth. The government should continue to explore how to pursue such economic growth while transitioning to cleaner sources of energy.[305]

Stranded assets. The Chinese government is concerned about whether the electricity supply will be sufficient to support the country's future economic development. However, there is conclusive evidence that the existing coal capacity can supply the most ambitious growth of electricity demand at least until 2025.[306] Therefore, it would be possible to stop all new construction of CFPPs in the next five years and later reconsider this measure if the growth of electricity

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[302] In the context of CFPPs decommissioning, auction schemes are aimed to unveil competitive prices between firms that bid to supply a predetermined volume of generation capacity in the future. An independent regulator is responsible for assessing the volume of capacity required based on "accurate system adequacy margins". At the end, costs of electricity generation are passed to consumers.

[303] Teng Fei (2018) *Coal transition in China. Options to move from coal cap to managed decline under an early emissions peaking scenario. IDDRI and Climate Strategies*.

[304] David Robinson and Xin Li (2017) *Closing Coal in China: International experiences to inform power sector reform*.

[305] Carlson, D., Robinson, S., Blair, C. and McDonough, M. (2021) China's climate ambition: Revisiting its First Nationally Determined Contribution and centering a just transition to clean energy.

[306] Van Voss B.H. and Rafaty,R. (2022) *Sensitive intervention points in China's coal phaseout*.

demand is faster than expected. Otherwise, if new power plants are immediately constructed, China will run the risk of generating excess electricity and being stuck with stranded assets.[307]

- Conclusion

The Chinese government has taken important steps to address concerns about the use of coal in the context of climate change. These decisions have led to the closure of some coal-fired assets (mainly old, small, and inefficient) and the cancellation of several new coal power projects. However, far from discouraging further investment, China continues to build significant amounts of new unabated coal-fired capacity. These contradictory actions send unclear messages of what China is planning to do with coal-fired generation over the coming decades.

Coal-fired power generation also persists in Indonesia. Both China and Indonesia are now wrestling with the prospect of early retirement of CFPPs, which at first glance may seem financially unattractive due to sunk investment costs. However, China's apparent reluctance to commit to a coal phaseout may lead to stranded assets that can generate more problems in the future. With Indonesia also looking to balance its climate goals and the needs of the country, it should be careful of how it approaches this dilemma as to not run the risk of committing to stranded assets. "Phase down financing" schemes to support the simultaneous phaseout of CFPPs and promotion of renewable energy, such as what has been observed through schemes like the Energy Transition Mechanism (ETM), present viable pathways for the coal transition. Methodologies used for the prioritization of Chinese power plants to be retired early can serve to help Indonesia determine its own methodology for the retirement of its own CFPPs as well.

Accordingly, as a country with a fleet of efficient and relatively new coal-fired plants, CCUS (and other abatement) technologies are of particular interest if the Chinese government is serious about its CO_2 emission commitments. Given the continued operation of new coal-fired plants in China and the need to reduce sharply the emissions from those plants, more international cooperation in developing such technologies will be necessary. To meet its net-zero goal by 2060,

[307] Teng Fei (2018) *Coal transition in China. Options to move from coal cap to managed decline under an early emissions peaking scenario. IDDRI and Climate Strategies*.

Indonesia is also considering the use of CCS and CCUS to reduce its GHG emissions.[308]

Large government control of electricity generation in China may pose problems for transitioning from coal due to the attractive environment that the government provides for coal-powered power generation. Subsidies and policies provide distorted incentives that limit the potential for competition. Such an ownership structure, as well as the monopoly over grid networks and retailing, may conceal important economic signals and distort decisions. Indonesia should then take care of providing the appropriate environment for the phaseout of coal by enacting policies and removing subsidies as to adequately transmit economic signals that can facilitate the transition and the introduction of renewable energy.

[308] G20 Indonesia. (2022) *Energy Ministry, IEA Launch NZE Roadmap*. 2 September.

Annex 2.2. Energy transition policies, regulations, and initiatives

Document/ Initiatives	**Source/ Institutions**	**Summary**
Government Regulation No. 79/2014 on National Energy Policy (KEN)[309]	Government of Indonesia	Set out the ambition to transform, by 2025 and 2050, the primary energy supply mix with shares as follows: ● new and renewable energy at least 23% in 2025 and at least 31% in 2050 ● oil should be less than 25% in 2025 and less than 20% in 2050 ● coal should be a minimum of 30% in 2025 and 25% in 2050 ● gas should be a minimum of 22% in 2025 and 24% in 2050
National General Energy Plan (RUEN) (Presidential Regulation 22/2017)[310]	Ministry of Energy and Mineral Resources (MEMR)	The National Energy General Plan (RUEN) (Presidential Regulation No. 22/2017 of 2017) sets out the energy management plan which constitutes the application and implementation of energy policy across sectors to achieve the targets of the National Energy Policy (KEN). RUEN serves as a reference document for the development of, inter alia, national and local government planning documents General Plan of National Electricity (RUKN) and Electricity and Supply Business Plan (RUPTL).
Presidential Regulation No. 98/2021 on the Implementation of Carbon Pricing to Achieve the Nationally Determined Contribution Target and Control over	Government of Indonesia	This regulation serves as one of the critical legal bases for the implementation of carbon pricing instruments in Indonesia. It supports the realization of its mitigation targets by providing a framework for the national carbon pricing policy mix and stipulating the implementation of a carbon economic value. The regulation introduces certain mechanisms to implement carbon pricing through (i) emissions trading, (ii) result-based payment, (iii) carbon levies, and/or (iv) other mechanisms determined by the Ministry of Environment and Forestry (MOEF).

[309] Government of Indonesia (2014) *Government Regulation of the Republic of Indonesia Number 79 of 2014 on National Energy Policy*.

[310] Government of Indonesia. Ministry of Energy and Mineral Resources (2017). *National Energy General Plan (RUEN) (Presidential Regulation No. 22/2017 of 2017)*.

Document/ Initiatives	**Source/ Institutions**	**Summary**
Greenhouse Gas Emissions in the National Development		
Presidential Regulation No. 112/2022 on Acceleration of The Renewable Energy Development for Electricity Supply[311]	Government of Indonesia	This regulation was issued with the aim of increasing investment and accelerating the achievement of renewable energy mix targets in the national energy mix in accordance with the National Energy Policy (KEN) and reducing greenhouse gas emissions. This regulation stated that: ● The implementation of RUPTL by PLN must prioritize the purchase of electricity from renewable energy. ● The Minister of Energy and Mineral Resources prepares a roadmap for accelerating the termination of the CFPPs' operational period which includes the reduction of CFPPs' greenhouse gas emissions, a strategy for accelerating the termination of the CFPPs' operational period, and alignment between other policies. ● The implementation of the acceleration of the CFPP termination considers the following criteria, but not limited to: (i) capacity; (ii) age; (iii) utilization; (iv) greenhouse gas emissions; (v) economic value added; (vi) availability of domestic and foreign funding support; and (vii) availability of domestic and foreign technology support. In addition, regulations regarding the electricity purchase price from renewable energy power plants, electricity purchase implementation, power purchase agreements, and government support such as incentives in the form of fiscal and non-fiscal are also stipulated in this regulation.
Minister of Environment and Forestry (MoEF)	Ministry of Environment and Forestry	This regulation was issued as the first derivative of the Carbon Pricing Regulation (Presidential Reg. 98/2021). This

[311] President of Indonesia. (2022, September). *Peraturan Presiden Nomor 112 Tahun 2022 tentang Percepatan Pengembangan Energi Terbarukan Untuk Penyediaan Tenaga Listrik* [Presidential Regulation No. 112/2022 on Acceleration of The Renewable Energy Development for Electricity Supply]. Government of Indonesia. https://jdih.maritim.go.id/perpres-no-112-tahun-2022

Document/ Initiatives	Source/ Institutions	Summary
Reg. 21/2022 on the Governance of Carbon Pricing Implementation		document stipulates the following areas of carbon pricing governance: • The governance of Carbon Trading (covering emissions trading system and emissions offset) • Result-based Payment (RBP) • Carbon levies • Monitoring, Reporting, and Verification (MRV) of the carbon pricing implementation • The implementation of National Registry System on Climate Change Control • Certification of GHG emissions reduction • Management of carbon trading funds • Stakeholders' participation • Monitoring and evaluation
Enhanced Nationally Determined Contribution (NDC)[312]	Ministry of Environment and Forestry (MoEF)	Under the Enhanced NDC (submitted to the UNFCCC on 23 September 2022), Indonesia has committed to reducing unconditionally 31.89% of its greenhouse gases emissions against the business-as-usual (BAU) scenario by the year 2030 (base year 2010). Emissions from the energy sector shall be reduced by 12.5% against the BAU scenario. Indonesia could increase its contribution up to a 43.20% reduction of emissions by 2030, subject to the availability of international support for finance, technology transfer and development and capacity building. Emissions from the energy sector would be reduced by 15.5% against the BAU scenario. Actions in the energy sector: • Renewable Energy • Energy Efficiency • Low Carbon Emitting Fuels • Clean Coal Technology and Gas Power Plants • Post Mine Reclamation
Long-Term Strategy for Low Carbon and Climate Resilience	Ministry of Environment	Three scenarios are projected for 2050:

312 Ministry of Environment and Forestry (2022) *Enhanced Nationally Determined Contribution*. Government of Indonesia.

Document/ Initiatives	**Source/ Institutions**	**Summary**
(LTS-LCCR) 2050[313]	and Forestry (MoEF)	• CPOS (extended unconditional commitment of NDC/current policy scenario): coal will make up almost half of the total primary energy supply • TRNS (transition scenario): coal will make up about 40% of the total primary energy supply • LCCP (low carbon scenario compatible with the Paris Agreement target): coal will make up about a third of the total primary energy supply
Electricity Business Plan 2021-2030 (RUPTL 2021-2030)[314]	PLN	Set a planned coal capacity target of 44.8 GW for 2030, down by 20% from the target set by RUPTL 2019-2028 for 2028 (56 GW).
An Energy Sector Roadmap to Net Zero Emissions in Indonesia[315]	Ministry of Energy and Mineral Resources (MEMR) and the International Energy Agency (IEA)	A pathway devised by MEMR and the IEA to reach net-zero emissions by 2060. Several mitigations have been identified, among others: • development of renewable energy with a focus on solar, hydro, and geothermal energy • gradual phase down of coal-fired power plants • use of low-emission technologies such as super grid to improve connectivity and Carbon Capture, Utilization, and Storage (CCS/CCUS) • conversion to electric vehicles • use of efficient equipment for the industry, transportation, and building sectors • use of new energy such as nuclear, hydrogen, and ammonia
Energy Transition Mechanism (ETM)[316]	Asian Development Bank (ADB)	The ETM is a scalable, collaborative initiative developed in partnership with developing member countries (DMCs) that will leverage a market-based approach to accelerate the transition from fossil fuels to clean energy.

313 Ministry of Environment and Forestry (202). *Long-Term Strategy for Low Carbon and Climate Resilience 2050*. Government of Indonesia

314 PT Perusahaan Listrik Negara (PLN) (Persero) (2021) *RUPTL 2021-2030*.

315 Government of Indonesia and IEA. Ministry of Energy and Mineral Resources (2022) *An Energy Sector Roadmap to Net Zero Emissions in Indonesia*.

316 ADB (N.d.) *Energy Transition Mechanism*.

Document/ Initiatives	Source/ Institutions	Summary
		Public and private investments—from governments, multilateral banks, private sector investors, philanthropies, and long-term investors—will finance country-specific ETM funds to retire coal power assets on an earlier schedule than if they remained with their current owners. A separate fund will also be utilized to invest in the development of clean energy facilities to potentially replace retired CFPPs.
Energy Transition Mechanism (ETM)	Indonesian Investment Authority (INA) [317]	INA will participate in ETM by establishing a 51%:49% Joint Venture company (JVCO) with New Equity Partners. The JVCO will acquire majority/significant minority stakes in CFPPs from existing shareholders. The JVCO also must secure control/commitment to drive refinancing, early retirement, renegotiate PPAs and amend articles of association (if necessary). The CFPPs will get new loans from Lenders (including ADB) on more favorable terms compared to existing loans. INA has identified 3 CFPPs to participate in Phase 1 of ETM. The CFPPs were shortlisted based on size, age of CFPP, technology, and tariff structures.
Minister of Finance (MoF) Decree No. 275 of 2022	Ministry of Finance	The government has appointed state-owned enterprise PT Sarana Multi Infrastruktur (Persero)—PT SMI—as the fund manager of the Energy Transition Mechanism (ETM) Country Platform. The platform welcomes the involvement of all investors—including the Asian Development Bank (ADB), the World Bank, the Indonesian Investment Authority (INA), the Glasgow Financial Alliance for Net Zero (GFANZ), other multilateral development agencies, state, private sector, and philanthropists.
Joint Statement by the GoI and International Partners Group (IPG) members on	Indonesia Just Energy Transition Partnership (JETP)	Indonesia JETP aims to help the country pursue an accelerated and ambitious just energy transition that supports a trajectory that keeps a warming limit of 1.5 °C above pre-industrial levels within reach and includes an ambitious power sector emissions reduction pathway and

[317] Indonesia Investment Authority. Presentation Material on ETM - Focus Group Discussion 3. August 2022.

Document/ Initiatives	Source/ Institutions	Summary
the Indonesia Just Energy Transition Plan[318]		strategy based on the expansion of RE and the phase down of CFPPs; and the implementation of concrete actions achieving a just energy transition for workers and communities. A comprehensive investment plan ("JETP Investment and Policy Plan") is to be developed, aiming at joint targets for the power sector as follows: • Peaking the sector emissions by 2030 at no more than 290 MT CO_2 and achieving NZE by 2050, including with the accelerated retirement of CFPPs, conditional on international support. • Accelerating RE deployment to achieve at least 34% of all power generation by 2030. • Accelerating the early retirement of CFPPs as prioritized and identified in the investment plan. • Accelerating the widespread deployment of EE and electrification tools, technologies, and reforms. • Accelerating the development of a vibrant and competitive local industry in RE & EE. • Delivering a just energy transition. • Restricting the development of captive coal plants, in accordance with the Perpres 112/2022, and collaborating to find and implement potential zero-emission and renewable solutions for power generation facilities outside Jawa-Bali. • Freezing the existing pipeline of planned on-grid CFPPs included in the RUPTL 2021-2030 and reaffirming a full moratorium on any new on-grid CFPP in accordance with the Perpres 112/2022. • Aligning local content requirements with the roadmap for domestic renewable manufacturing capability. • Mobilizing sufficient capital to achieve the targets through a combination of instruments. • Mobilizing \$20 billion over the next three to five years through the partnership, of which \$10 billion will be mobilized by the IPG members; and at least \$10 billion of private finance will be mobilized and facilitated by the GFANZ Working Group members.

[318] The European Commission. (2022, 15 November). *Joint Statement by the Government of the Republic of Indonesia and International Partners Group members of the Indonesia Just Energy Transition Plan*.

Annex 2.3. Other financial instruments used around the world

Germany's Act to Reduce and End Coal-Fired Power Generation (Coal Phase-Out Act)

The Coal Phase-Out Act is Germany's framework to realize its commitment to phase out its coal power. It aims to gradually reduce and eventually phase out from coal power generation before 2038[319]. It thus created an adaptation fund as well as funding guidelines for energy-intensive businesses. The law also stipulates several years in which the government will evaluate if decommissioning the coal fired power plants can be moved up to 2035.

The German model uses competitive tendering, publishing seven tenders between a specific period of time- from 2020 to 2023, for closures of coal fired power plants that will take place annually until 2026[320]. Hard coal plant owners participate in voluntary auctions, submitting bids for the compensation price required to retire their plant. The tender mechanism aims to reduce the ladder of incentives to encourage acceleration of coal plant closures and helps minimize the cost of the plant closures to the German government[321]. The fist tendering phase for coal fired power plants phase-out took place in September 2020, where 11 bids were awarded a total amount of 4.8 GW, to be closed by the end of the year. A second tendering phase took place in January 2021, with a volume of 1,500 MW. The third round in April 2021, awarded a total of 2,480 MW. In August 2021, the German government decided that an earlier than 2038 phase out was possible.

Additionally, in August 2020, the Structural Support for Coal Regions Act entered in force, which will provide lignite-coal regions with financial aid of up to US $11.86

319 IEA. Act To Reduce and End Coal-Fired Power Generation. September 1, 2021. From: Act to Reduce and End Coal-Fired Power Generation – Policies - IEA

320 European Commission (2020) State aid: Commission approves competitive tender mechanism to compensate for early closure of hard coal-fired power plants in Germany. Press release. November 25, 2020. From: https://ec.europa.eu/commission/presscorner/detail/ro/ip_20_2208

321 Gagnebin, M. What's the timeline for Germany's coal phase out? July 16, 2020. From: Blog - What's the timeline for Germany's coal phase out? (agora-energiewende.de)

billion until 2038, to deal with structural changes and to secure employment. Hard-coal regions will receive financial aid of up to US $923 million [322].

The act generally bans the starting of new coal-fired plants after August 14, 2020, with an exception made for those that received a license to operate before January 29, 2020.

Engie Energía Chile

Together, IDB Invest, a member of the IDB Group, and the Clean Technology Fund (CTF), from the Climate Invested Institute, partnered to provide finance to ENGIE Energía Chile, a subsidiary of the ENGIE Group, to accelerating the decarbonization of the country's electricity matrix. IDB invest provided a US $125 million financial package that will be used to build, operate, and maintain a 151 MW wind farm, located in the region of Antofagasta [323].

The project is part of ENGIE's energy transition transformation plan in Chile, which in addition considers developing more than 1,000 MW of wind and solar initiatives over the next years. At COP 25, Engie announced the early retirement of CTM1 and CTM2 CFPPs (334 MW) by 2024 in Mejillones, Chile. Adding to the closure in 2019 of two CFPP (170 MW) also in the region of Antofagasta.[324]

The deal came from a structuring pilot financial instrument to monetize the displacement of GHG emissions in Chile when closing coal fired power plants early and replacing them with renewable energy projects. The financing structure establishes a minimum price for offsetting GHG emissions by lowering the cost in CTF's loan[325]. IDB Invest developed a methodology to calculate the cost of the GHG

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[322] IEA. Act To Reduce and End Coal-Fired Power Generation. September 1, 2021. From: Act to Reduce and End Coal-Fired Power Generation – Policies - IEA

[323] IDB Invest (2021) IDB Invest and ENGIE Chile debut the world's first pilot project to monetize the cost of decarbonization. February 3, 2021. From: IDB Invest and ENGIE Chile debut the world's first pilot project to monetize the cost of decarbonization | IDB Invest

[324] Peña, K. (2021) BID Invest y Engie cierran financiamiento del primer piloto en el mundo para monetizar costos de la descarbonización. Diario Financiero. From: https://www.df.cl/empresas/energia/bid-invest-y-engie-cierran-financiamiento-del-primer-piloto-en-el-mundo

[325] Engie (2021) BID Invest y Engie cierran financiamiento del primer piloto en el mundo para monetizar costos de la descarbonización. February 3, 2022. From: BID Invest y Engie cierran

emissions displacement. This model is expected to be replicated in Latin America and the Caribbean regions.

The financial package consists of a US$ 74 million senior loan from IDB Invest, US $15 million of blended finance from the Clean Technology Fund (CTF), and US $36 million from the Chinese Fund for Co-financing in LATAM.

The EU Just Transition Mechanism (JTM)

The JTM is a framework designed by the European commission to support national just transition efforts, providing financial resources and technical assistance to EU member states that have developed a national just transition plan. This mechanism includes a US $17.8 billion Just Transition Fund, along with US $13.5 billion in grants and loans to facilitate the implementation of the plans. It is financed by EU member states but intended to mobilize additional sources of finance[326]. The JTM operates under the following three pillars:

1. The Just Transition Fund provides mostly grant-based funding to support diversification and energy conversion, including by investing in small and medium enterprises, R&D, reskilling workers, clean energy, transformation of carbon-intensive industries, among others.
2. The Just transition scheme under InvestEU will provide US $1.77 billion for investments in wider range of low-carbon infrastructure projects. These investments will be from financial products proposed by the InvestEU partners, such as the European Investment Bank Group, and made by private and public sector entities.
3. A public sector loan facility that combines a grant from the EU budget of US $1.66 billion and a loan from the European Investment Bank which is expected to mobilize US $17.7–33.3 billion of public investments in low-carbon and social infrastructure projects.

The European Parliament and Council reached a political agreement on the three pillars and the final approval on the JTM in 2021. The approval of the JTM

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financiamiento del primer piloto en el mundo para monetizar costos de la descarbonización - Engie (engie-energia.cl)

[326] WRI. European Union's Just Transition Mechanism: Transnational Funding and Support for a Just Transition. April 1, 2021. From: [European Union's Just Transition Mechanism: Transnational Funding and Support for a Just Transition | World Resources Institute (wri.org)]

has already opened the door to support the territories most affected by the transition towards a climate neutral economy. For example, in May 2022, the Commission approved the Partnership Agreement with Czechia, granting € 6.4 billion to support the country to phase out of coal-fired power by 2033[327].

[327] European Commission (2022) Daily News 26/09/2022. From: https://ec.europa.eu/commission/presscorner/detail/en/mex_22_5784

Appendices related to Chapter 4

Annex 4.1. Analysis concept

1. Employment variation

Indicators for measuring impact on employment

Indicator Name	Definition	Level of analysis
Employment variation in CFPPs	Jobs lost / MW retired in a year per province. This indicator will be disaggregated by gender and formal sector	Every province, based on data for CFPPs installed in each province.
Employment variation in Mining Industry	Jobs lost / Variation in coal production (tons), in a year per province. This indicator will be disaggregated by Gender and Formal/Informal sectors	Every province identified as one of the coal origins for CFPPs. (Primary analysis at province level, based on mining employment and income data).
Notes: Employment variation in CFPPS is estimated directly, based on employees' number per plant. Employment variation in mining is based on i) the suppressed coal demand (no longer required by retired CFPPs) that will not be exported due to a period of low international coal demand, and ii) average labor productivity figures indicated for the industry.		

2. Government revenue variation

Indicators for measuring the impact from government revenue variation

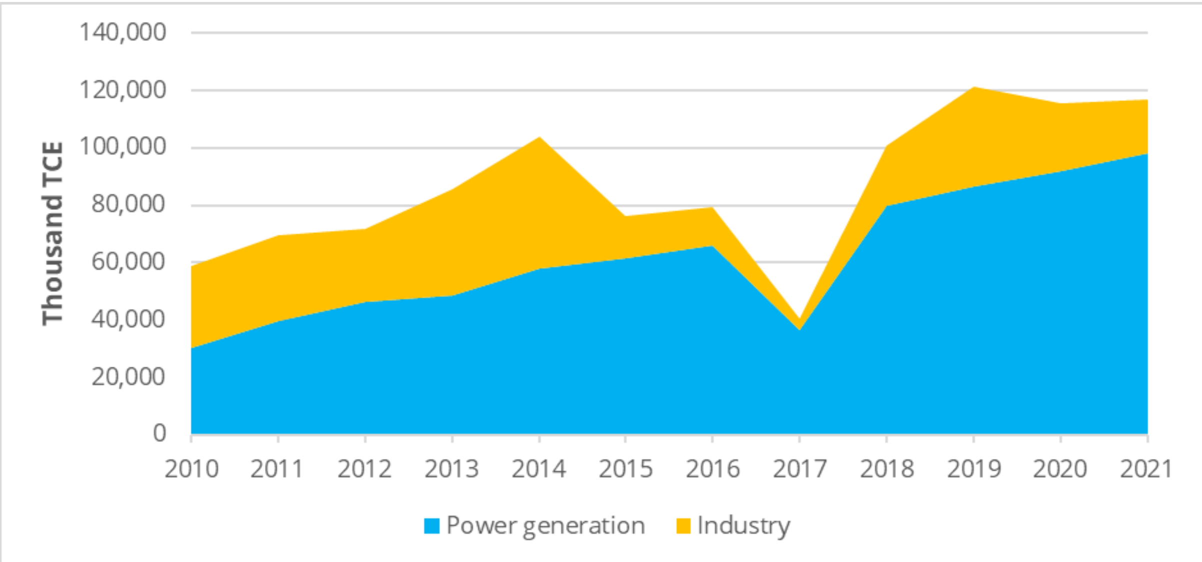
Indicator Name	Definition	Level of analysis
Income Tax variation from CFPPs	USD corporate income tax variation / MWh retired in a year per province.	Every province, based on Retirement Plan .
Corporate Income Tax variation from the mining industry	USD corporate income tax variation / Variation in coal production (tons), in a year per province.	Every province identified as one of the coal origins for CFPPs. (Primary analysis at province level, based on mining employment and income data)
VAT variation from CFPPs	USD corporate VAT variation / MWh retired in a year per province.	Every province, based on CFPPs retired from such province
VAT variation from the mining industry	USD VAT variation / Variation in coal production (tons), in a year per province.	Every province identified as one of the coal origins for CFPPs.
Royalties' Individual variation from the mining industry	USD Royalties variation / Variation in coal production (tons), in a year per province.	Every province identified as one of the coal origins for CFPPs.
Note: VAT does not apply for exports		

In the analysis, the total amount of exportable coal is estimated for every year according to the retirement plan. The difference between the cap price due to DMO and International price should be considered as an additional net income for mining companies, amplifying this way the taxable income base for the government. In terms of value added tax (VAT) on the other hand, since it is not applicable for exported goods, it is foreseeable a variation on this fiscal revenue.

Annex 4.2. Coal balance

Coal balance is determinant to quantify the impact on fiscal and employment dimensions since taxes, royalties and jobs at risk are linked to transactions of both coal as commodity and coal-based electricity. Indonesia is a coal net exporter country with broadly 72% of its production being exported and with a share of 81% and 19% of its domestic coal demand coming from power generation and industry, respectively. This means that about 92 million tons of coal are being diverted every year for power generation following an increasing trend in the last years.

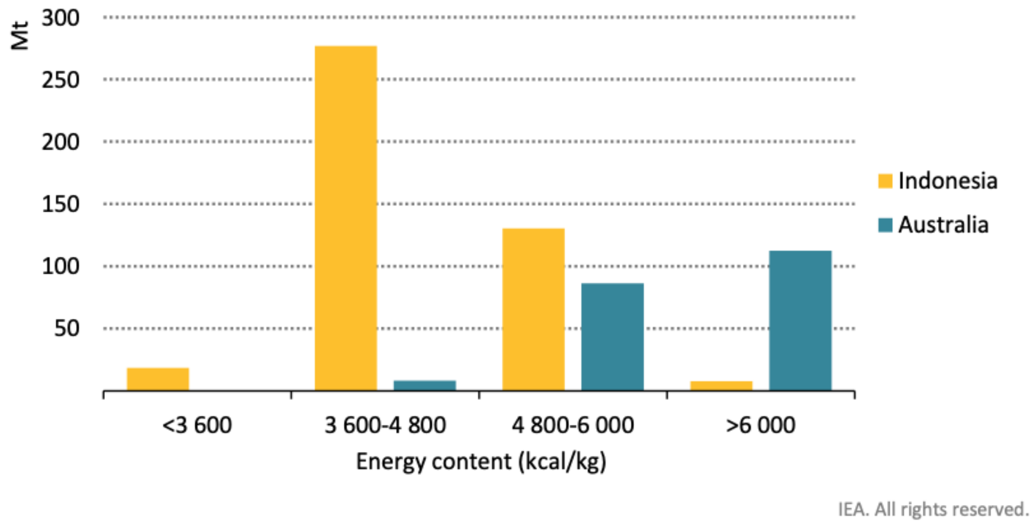
Domestic coal demand in Indonesia (2010-2021)[328]



Most of the Indonesian coal exports are in the lower quality/lower energy content segments of the market.

328 Indonesia Energy Balance 2010-2021 – Coal. Compiled from Handbook of Energy & Economic Statistics of Indonesia (2010-202).

Coal exports by energy content from Indonesia and Australia[329]



As retirement comes in place, the suppressed coal demand will change at the same time as international coal demand drops.

Suppressed coal demand not exportable

Retirement year	International coal demand drop[1] (%)	Suppressed coal demand not exported[2] (ton/year)
2024	0%	0
2025	0%	0
2026	0%	0
2027	0%	0
2028	25%	5,594,554
2029	36%	3,778,104

[329] IEA. 2022. Coal in Net Zero Transitions. Strategies for rapid, secure, and people-centred change. https://iea.blob.core.windows.net/assets/4192696b-6518-4cfc-bb34-acc9312bf4b2/CoalinNetZeroTransitions.pdf

Retirement year	International coal demand drop[1] (%)	Suppressed coal demand not exported[2] (ton/year)
2030	46%	3,345,092
2031	50%	5,426,223
2034	61%	2,692,330
2036	68%	3,207,855
2037	71%	84,255
2038	75%	337,496
TOTAL		24,465,908

Notes:

1. Drop of international coal demand taken for the 32 CFPPs to be retired.
2. Applied as a percentage of the total coal demand for each year.

Annex 4.3. Fiscal methodology

To perform a provincial sensitivity analysis for East Kalimantan and South Sumatra, their contribution to the coal demand for power generation has been determined. By concealing the percentage of coal production destined to the domestic market in each province with the national average of coal production used in power generation, it is possible to verify that 49% of the coal produced in South Sumatra and 19% of the coal produced in East Kalimantan have been feeding CFPPs across the country roughly satisfying 31% and 52% of the country's coal demand for power generation respectively[330].

The below figure gives a comprehensive introduction to the Regional Fiscal Analysis which allows to identify the most significant impacts of the early retirement to the fiscal flows for both East Kalimantan, and South Sumatra. Therefore, the analysis identifies the sensitivities of retirement in the fiscal flows. This figure presents three aspects of fiscal management in Indonesia that must be included mandatorily to carry out this analysis:

A. Fiscal revenues and expenditures affected by the CFPPs Early Retirement Plan

As it was analyzed in chapter 1: Implications of Early Retirement of Coal-fired Power Plants in Indonesia, the retirement will impact the revenues and expenditures of the government's budget, as follows:

Revenues likely impacted by the CFPPs Early Retirement Plan

- Income Tax from power generation
- Income Tax variation from mining sector
- VAT variation
- Carbon Tax

Expenditures likely impacted by the CFPPs Early Retirement Plan

- Subsidies and compensations for the electricity companies and consumers
- Payments for early retirement

[330] Resulting percentages are obtained by dividing coal destined to power generation (ton) by coal production (ton) for each province.

B. Connection between national government finances and provincial government finances

National government budget and the sub-national budgets are widely connected by the transferences that the national government delivers regularly to the subnational governments.

Therefore, if the national government suffers negative impact in their revenues and/or in their expenditures it could affect their transferences to the local governments under the steers and limits that the legal framework of the country has established.

Consequently, the Figure below presents the impact on the subnational budgets through the transferences, when changes in revenues and expenditures, mentioned above, occur.

C. Assumptions

Figure below presents the assumptions that have been considered for this analysis are: the highest impact, meaning how big the impact could be on provincial finances if the least favorable scenario takes place at national level for the retirement.

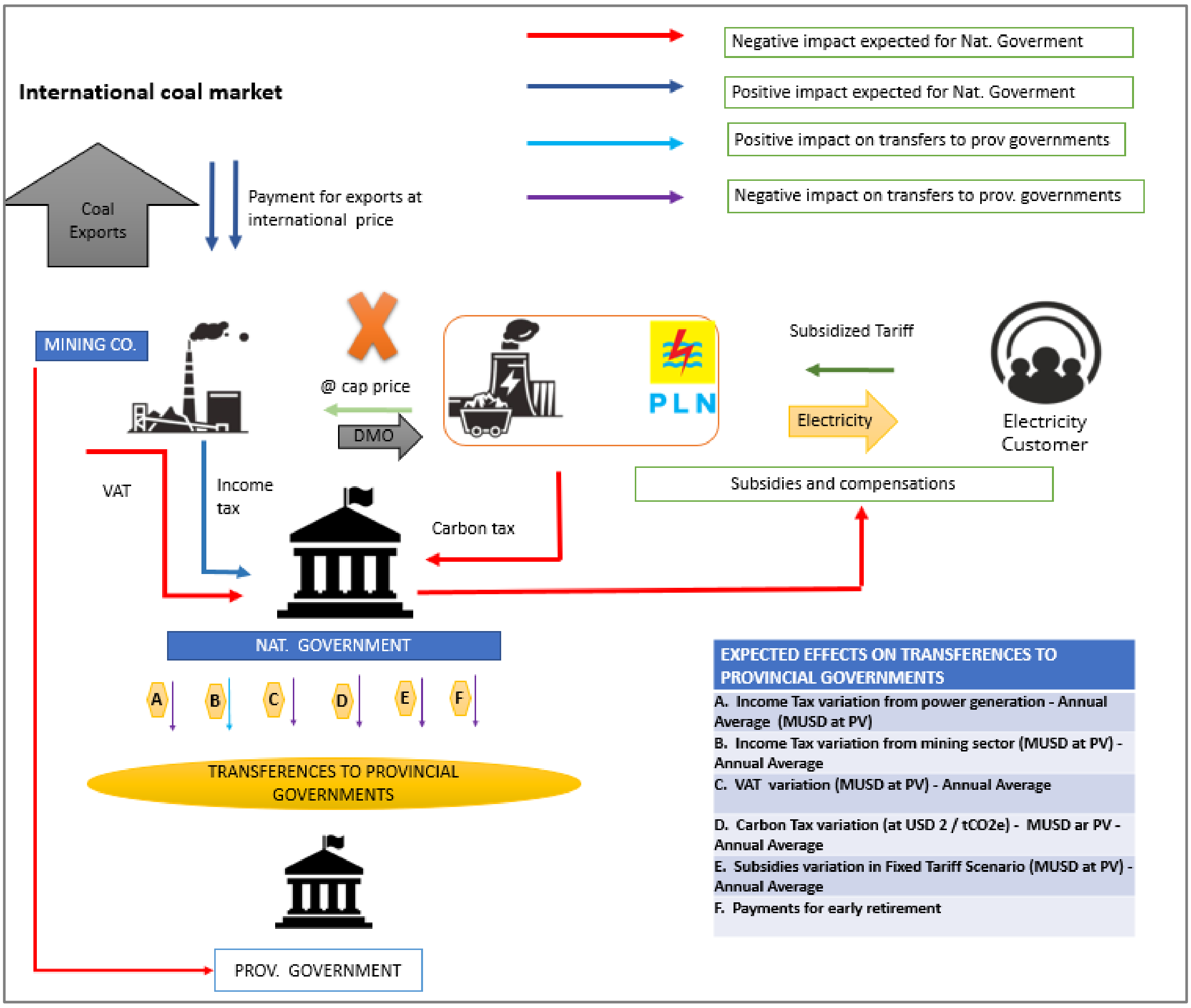
This highest impact implies two assumptions:

- Subsidies with fixed tariffs (the higher likely subsidies generated by this plan)
- A period of low international demand for coal.
- Passive fiscal policies from the national government that cause direct affectation to transferences for subnational governments if its revenues and expenditures will receive negative impacts from the retirement.

The diagram also presents the impact of the relevant and clearly identified revenue that the subnational governments receive from the CFPPs value chain: coal royalties.

In conclusion, these scheme presents a comprehensive summary of all impacts that the CFPPs Early Retirement Plan could cause directly and indirectly according to the assumptions presented and the quantifications carried out in this document as wells as in the documents corresponding to the previous chapter of this study.

Fiscal impact analysis scheme for affected provinces



Annex 4.4. Technical data on CFPPs

#	Facility/ Unit Name	Province	City/ Regency	Installed Capacity (MW)	Efficiency (%)	Fuel Type	Age (years)	Number of Worker
1	Celukan Bawang Unit 1, 2, 3	Bali	Buleleng	380	31.5%	MRC	7	167
2	Cilacap Unit 1, 2	Central Java	Cilacap	600	35.5%	MRC	16	90
3	Paiton Unit 5, 6	East Java	Probolinggo	1,220	35.0%	MRC	22	183
4	Cirebon Unit 1	West Java	Cirebon	660	36.0%	MRC	10	99
5	Keban Agung Unit 2	South Sumatra	Lahat	240	36.5%	MRC	7	144
6	Adipala Unit 1	Central Java	Cilacap	660	36.5%	LRC/ MRC	7	99
7	Sebalang Unit 1, 2	Lampung	South Lampung	200	28.5%	LRC/ MRC	7	120
8	Pacitan Unit 1, 2	East Java	Pacitan	630	36.5%	LRC/ MRC	9	95
9	Rembang Unit 1, 2	Central Java	Rembang	630	36.0%	LRC/ MRC	11	95
10	Tarahan Unit 3, 4	Lampung	South Lampung	200	27.5%	MRC	15	120
11	Nagan Raya Unit 1, 2	Aceh	Nagan Raya	220	31.5%	LRC/ MRC	9	132

#	Facility/ Unit Name	Province	City/ Regency	Installed Capacity (MW)	Efficiency (%)	Fuel Type	Age (years)	Number of Worker
12	Labuhan Angin Unit 1, 2	North Sumatra	Central Tapanuli	230	31.0%	LRC/ MRC	14	138
13	Teluk Sirih Unit 1, 2	West Sumatra	Padang	224	31.5%	LRC/ MRC	8	134
14	Pangkalan Susu Unit 1, 2	North Sumatra	Langkat	400	36.5%	LRC/ MRC	7	176
15	Lontar Unit 1, 2, 3	Banten	Tangerang	945	36.0%	LRC/ MRC	10	142
16	Pelabuhan Ratu Unit 1, 2, 3	West Java	Sukabumi	1,050	36.5%	LRC/ MRC	8	158
17	Suralaya Unit 8	Banten	Cilegon	625	36.0%	LRC/ MRC	11	94
18	Bukit Asam Unit 1, 2	South Sumatra	Muara Enim	260	25.5%	MRC	35	156
19	Ombilin Unit 1, 2	West Sumatra	Sawahlunto	200	26.5%	HRC	26	120
20	Suralaya Unit 1, 2, 3, 4	Banten	Cilegon	1,800	33.5%	LRC/ MRC	36	270
21	Suralaya Unit 5, 6, 7	Banten	Cilegon	1,600			25	240
22	Paiton Unit 1, 2	East Java	Probolinggo	800	34.5%	LRC/ MRC	29	120

#	Facility/ Unit Name	Province	City/ Regency	Installed Capacity (MW)	Efficiency (%)	Fuel Type	Age (years)	Number of Worker
23	Paiton Unit 9	East Java	Probolinggo	660	36.0%	LRC/ MRC	10	99
24	Indramayu Unit 1, 2, 3	West Java	Indramayu	990	36.0%	LRC/ MRC	11	149
25	Labuan Unit 1, 2	Banten	Pandeglang	600	36.0%	LRC/ MRC	12	90
26	Tanjung Awar-awar Unit 1, 2	East Java	Tuban	700	36.5%	LRC/ MRC	7	105
27	Air Anyir Unit 1, 2	Bangka Belitung	Bangka	60	28.5%	LRC	8	91
28	Tanjung Balai Karimun Unit 1, 2	Riau Islands	Karimun	14	28.5%	LRC	9	21
29	Anggrek Unit 1, 2	Gorontalo	North Gorontalo	55	29.0%	LRC	3	83
30	Amurang Unit 1, 2	North Sulawesi	South Minahasa	50	28.0%	LRC	11	76
31	Ende Unit 1, 2	East Nusa Tenggara	Ende	14	28.5%	LRC	7	21
32	Tidore Unit 1, 2	North Maluku	Tidore Islands	14	28.5%	LRC	7	21

Appendices related to Chapter 5

Annex 5.1. Compatibility analysis of key recommendations

Policy

No.	Recommendation	Compatibility / Relevant Issues
1	Adjust electricity tariffs to support PLN's financial sustainability	1. Aligned with the Government of Indonesia's intention to increase the efficiency of the state budget and ensure that subsidies are only given to vulnerable communities. The GoI via the National Team for the Acceleration of Poverty Reduction (TNP2K) has assessed and developed a strategy to continue electricity subsidy reform after the COVID-19 pandemic ends[331] which consequently revised the consumers' electricity tariff. 2. Energy prices have always been the subject of several protests. In April 2022, university students held demonstrations in protest of high cooking oil prices.[332] In September 2022, thousands of protesters around the country demanded the reversal of another price hike on fuel—the first since 2013. The government's decision to reduce subsidies led to petrol and diesel prices increasing by around 30%. Electricity tariff revisions need to consider the social tension circumstances. 3. GoI enacted Law 7/2022 on Harmonization of Tax Regulations which address the carbon tax mechanism last year and established Emissions Trading Systems (ETS) for CFPP in mid-February. These carbon pricing instruments will increase the electricity generation cost relative to current costs, thereby increasing the challenge to the revision. 4. Strict Local Content Requirement (TKDN) regulation makes it difficult for electricity prices from RE to be competitive. Considering that retired CFPP will be replaced by RE, TKDN poses an indirect challenge for electricity tariff revision

[331] Tim Nasional Percepatan Penanggulangan Kemiskinan (TNP2K), (2021). *Policy Paper (Naskah Kebijakan) Transformasi Subsidi Listrik di Indonesia: Tujuan dan Usulan Mekanismenya*. TNP2K.
[332] Reuters (2022). *Indonesia police fire tear gas as students protest cooking oil prices, third term for president*. 12 April.

2	Prioritize energy efficiency policies	1. The MEMR has established a National General Energy Plan (*Rencana Umum Energi Nasional*, RUEN) which takes a comprehensive approach to promoting energy efficiency across various sectors and includes the implementation of the national standards on energy-utilizing equipment. 2. The government has issued Government Regulation 33/2023 on Energy Conservation which regulates energy management on the upstream and downstream sides. Energy conservation is carried out through the implementation of energy-saving measures and/or energy-efficient technologies in energy supply and energy utilization activities—energy management; energy conservation financing, service business development, awareness raising; human resource capacity building; research and innovation; etc. 3. MEMR has established MEMR Regulation 14/2012 on Energy Management which mandates the energy management implementation. However, it only obliges energy management for activities that utilize energies of ≥6,000 TOE/year. 4. GoI has established MEMR Regulations 14/2021 on Energy Efficiency Labeling and Minimum Energy Performance Standards (MEPS) for Electrical Equipment regulations. However, the MEPS is still limited to several appliances such as rice cookers, Air Conditioners, refrigerators, and electric fans—does not cover the industrial sector yet. 5. The Ministry of Industry (MoI) has issued regulations regarding guidelines for the preparation of green industry standards (*Standar Industri Hijau*, SIH) as stipulated in the MoI Regulation 51/ 2015. Green Industry Standards are the reference for industry players in developing consensus related to raw materials, auxiliary materials, energy, production processes, products, business management, waste management and/or other aspects that aim to realize green industries. The Green Industry Standards are available for 17 types of industries. 6. GoI under MoEF has established PROPER, an industrial monitoring program that aims to encourage industrial compliance with environmental regulations. Under PROPER, industries will be classified based on their level of environmental friendliness. 7. MEMR has established an annual competition award in energy efficiency called the Subroto Award for Energy Efficiency (*Penghargaan Subroto Bidang Efisiensi Energi*, PSBE) which covers the building and industry sector.

No.	Recommendation	Compatibility / Relevant Issues
		8. MEMR has developed the Energy Efficiency Handbook for Building Design in Indonesia. 9. EE is not seen as core business and standard company investment guidelines require internal rates of return (IRR) which are too high to make EE projects viable (>20%).[333] 10. A lack of comfort with entering off-balance sheet financed projects with EE project developers due to a lack of reference projects and experience with these service providers. 11. MEMR Regulation 14/2016 on Implementation of Energy Conservation Service Business which regulates the policy framework regarding ESCOs has been revoked in 2018 due to, among others, insufficient capital or collateral for many ESCOs to meet bank collateral requirements and underdeveloped capacity to finance and conduct investment standard audits.[334] 12. Eight banks have formed the Indonesian Sustainable Finance Initiative (*Inisiatif Keuangan Berkelanjutan Indonesia*, IKBI) which is a real commitment from the banking industry to supporting green financing. Currently, the membership of IKBI has grown to 15 institutions consisting of national banks and PT SMI. They have already financed energy efficiency projects in Indonesia. 13. MEMR have developed Guidelines for Energy Efficiency Investment Financing for Financial/Banking Service Institutions in the Industrial Sector which provides references of energy efficiency technology for financial/banking services in the consideration of granting credit for energy efficiency projects in the industry sector.

[333] APEC Energy Working Group, (2017). *Energy Efficiency Finance in Indonesia Current State, Barriers and Potential Next Steps*. Asia-Pacific Economic Cooperation, APEC.

[334] Organization for Economic Cooperation and Development (OECD). (2021). OECD Clean Energy Finance and Investment Policy Review of Indonesia Policy Highlights. https://www.oecd.org/env/clean-energy-finance-and-investment-policy-review-of-Indonesia-0007dd9d-en.htm

No.	Recommendation	Compatibility / Relevant Issues
3	Incentivize renewable resources for electricity production over the improvement of existing coal-fired power plants	1. President Regulation 112/2022 on Acceleration of Renewable Energy Development for Electricity Supply regulates the ceiling prices for RE electricity which replaces the previous regime— aims to RE to reachthe same or less generation price than the national/local electricity generation price (*Biaya Pokok Penyediaan Pembangkitan*, BPP Pembangkitan). 2. Currently, the GoI is drafting a New and Renewable Energy Law, which will regulate renewable energy businesses, prices, funds, incentives, etc.[335] 3. The GoI also developing NZE energy sector roadmap which targeted to be published prior to COP28 on November 2023. 4. GoI enacted Law 7/2022 on Harmonization of Tax Regulations which address the carbon tax mechanism last year and established Emissions Trading Systems (ETS) for CFPP in mid-February. These carbon pricing instruments will increase the electricity price from fossil fuel power plants (currently limited to CFPPs) which leverage the RE electricity attractiveness. 5. Import duty exemption regulations are already established, particularly on the capital goods import in the electricity generation industry for public interest development (MoF Regulation 66/2015). 6. Strict Local Content Requirement (TKDN) regulation makes it difficult for electricity prices from RE to be competitive.

[335] Humas EBTKE. (2022). *RUU EBT, Wujud Penguatan Regulasi Pengembangan Energi Baru Terbarukan Tanah Air*. Directorate General of New Renewable Energy and Energy Conservation – Ministry of Energy and Mineral Resources (DGNREEC-MEMR).

Technical

No.	Recommendation	Compatibility / Relevant Issues
1	Use transmission and distribution planning to transform the fragmented power system into an integrated one	1. Presidential Regulation 112/2022 Article 3 states that in the implementation of accelerating the CFPP retirement, it is necessary to ensure the development of replacement plants, renewable energy (RE) power plants, by considering the conditions of electricity supply and demand. 2. The GoI currently developing CFPPs early retirement roadmap. One of the scenarios in the roadmap has considered Java-Sumatra interconnection. 3. Fragmented power system due to the archipelagic area adds challenge to renewable energy development which is site-specific. 4. Since CFPPs are the largest supplier of electricity in Indonesia (capacity shares more than 50%), the early retirement program of CFPPs needs to carefully consider energy security, reliability, and system stability. 5. Overcapacity only occurred in the Java-Bali system which consists mostly of large capacity CFPPs (>600 MW); which adds more challenge since the retirement of large CFPPs poses a risk to the energy balance.[336] 6. Power wheeling regulations were initially included in the Draft of Law on New Energy and Renewable Energy however, it has been revoked. In addition, power wheeling is considered an unbundling mechanism regulated in Law 20/2002 on electricity which has also been revoked by a decision of the Constitutional Court (MK). Through decision Number 111/PUU-XIII/2015 the Constitutional Court decided that unbundling electricity was not in accordance with the Indonesia Constitution (UUD 1945). Accordingly, the law was replaced with Law 30/2009, by eliminating the unbundling article. 7. For Rooftop Solar PV, GoI has established MEMR Regulation 26/2021 which allows the customer to install rooftop solar PV at 100% of capacity. However, in practice, PLN as the major off-taker in Indonesia restricts the installation capacity.

[336] ADB. (2022). *Opportunities to Accelerate Coal to Clean Power Transition in Selected Southeast Asian Developing Member Countries: Technical Assistance Consultant's Report*.

Financial

No.	Recommendation	Compatibility / Relevant Issues
1	Establish a zero-cost financing instrument to early retire CFPPs	1. The Ministry of Finance (MoF) is currently developing a regulation that will describe how the funds will be allocated and describe the financial instruments that will support ETM. 2. The MoF is also developing a Draft MoF Regulation related to the provision of fiscal support through a funding and financing framework to accelerate the energy transition in the electricity sector. 3. Currently, the JETP Secretariat is developing a Comprehensive Investment and Policy Plan (CIPP) document which is targeted to be completed by the end of 2023. 4. OJK has issued "Green Taxonomy 1.0", providing a classification of economic activities that support environmental protection and management efforts. However, it has not yet covered broader activities in the energy transition context, including CFPP retirement. Currently, OJK is updating the Green Taxonomy to include energy transition. 5. ETM Country Platform is expected to be funded through blended finance sourced from MDBs, governments, philanthropies, and long-term investors. This may delay its implementation since it adds to the difficulty of addressing each funder's requirements.
2	Conduct thorough assessments of Power Purchase Agreement termination costs and debt structures to develop replicable business models and identify potential cost-saving opportunities	1. GoI already have several pilot projects such as Pelabuhan Ratu CFPP which is in the due diligence stage. Lessons learned from the pilot projects can serve as a reference for future early retirement. 2. Power plants under PLN and its subsidiaries do not have a clear contractual framework, which may affect the valuation process. 3. PLN has established the Holding Subholding (HSH) which includes two generation companies—PLN Nusantara Power and PLN Indonesia Power. With the HSH, PLN's generation assets that were previously scattered will now be consolidated.[337] Asset consolidation will affect the valuation if there is a new PPA and obligations such as take-or-pay. 4. There is a risk of overvaluation of PLN's CFPP assets due to the extension of CFPPs' lifetime in the revaluation of 2015.

[337] Santika Aristi. (2022). *Holding PLN dengan 4 Sub-Holding Baru Diumumkan Menteri BUMN, Makin Lincah Jadi Perusahaan Energi Berbasis Teknologi Menyambut Masa Depan*. PT PLN (Persero).

No.	Recommendation	Compatibility / Relevant Issues
3	Socialize the selection of CFPP with relevant stakeholders	1. Following the JETP Secretariat establishment, GoI is currently developing the Comprehensive Investment and Policy Plan to access the JETP Fund. 2. ETP-UNOPS with Bappenas has developed a study on the financial implications of the CFPP early retirement program. 3. ETP-UNOPS is in the process of establishing the Just Coal Transition Forum which can become a platform to socialize the early retirement of the CFPPs program. 4. In collaboration with ADB, the Ministry of Finance is conducting a Strategic Environmental and Social Assessment (SESA) aimed at ensuring that the identification process and mitigation measures are implemented with due regard to their impact on the environment and social economy.
4	Ensure cost-effectiveness and transparency for financers, with third-party due diligence to reduce moral hazard and greenwashing risks	1. In accordance with Presidential Regulation 112/2022, MEMR is currently developing the CFPPs' Early Retirement Roadmap which addresses the potential CFPPs to be retired, RE replacement, interconnection, etc. 2. GoI already have several pilot projects such as Pelabuhan Ratu CFPP which is in the due diligence stage. Lessons learned from the pilot projects can be a reference for future early retirement. 3. PT SMI, appointed as the ETM Indonesia Country Platform Manager, has experience in managing SDG Indonesia One Fund. 4. ADB ETM has two main programs that support early retirement: the Carbon Reduction Fund (CRF) and the Carbon Energy Fund (CEF). Specifically, CEF will be focused on new clean energy investments.[338] 5. Additionally, ETP-UNOPS aims to extend smart grids[339] while Climate Investment Funds (CIF) has a Grid Reinforcement Project in Cambodia[340] that may be replicated in Indonesia. 6. Since 2022, the government has been developing a new Law on New Renewable Energy (RUU EBT) which will define the renewable energy management plan. This law will regulate the funds for RE infrastructure development. GoI is currently developing a methodology that aligns with international carbon standards to aim to obtain carbon offsets from the early retirement of CFPPs.

[338] ADB. *Energy Transition Mechanism*.

[339] UNOPS ETP. *2022 Annual Report*.

[340] Climate Investment Fund (CIF). *PROJECT ID: XSREKH074A - GRID REINFORCEMENT PROJECT*.

Social

No.	Recommendation	Compatibility / Relevant Issues
1	Start early in developing sub-regional social programs to provide green job opportunities	1. In collaboration with ADB, the Ministry of Finance is conducting a Strategic Environmental and Social Assessment (SESA) aimed at ensuring that the identification process and mitigation measures are implemented with due regard to their impact on the environment and social economy. 2. The Government of Indonesia established the Job Creation Committee through Presidential Regulation 36/2020 concerning Job Competency Development through the Pre-Employment Card Program as amended by Presidential Regulation 76/2020. The committee is responsible for formulating and developing policies for the Pre-Employment Card Program as well as controlling and evaluating the implementation of this program. The Pre-Employment Card Program is a job competency development program targeted at job seekers, workers affected by layoffs, and/or workers who need to improve their competence. 3. In practice, there is an issue that even workers who have access to the pre-employment card have no guarantee of getting another job or starting a new business. Employment opportunities are not properly provided by the government. In fact, some of the training in the Pre-Employment Card access has been criticized for being no different from what is available for free on various online information platforms.[341]

[341] Jumisih. (2002). *Menggugat Janji Manis Jaminan Kehilangan Pekerjaan*. *HukumOnline.com*. 23 April

2	Social costs separately from transaction costs (*continued*)	1. Indonesia has submitted the Investment Plan (IP) for the Climate Investment Fund (CIF) Accelerating Coal Transition (ACT) Program. The IP proposes a project pipeline that is broadly split into three key components: (i) Component 1 – Accelerated CFPP retirement; (ii) Component 2 – Governance, Just Transition and Repurposing; and (iii) Component 3 – Scale-up of RE and storage. In summary, through US$600 million (IDR 9.2 trill) in CIF ACT funding, together with US$2.2 billion (IDR 33 trill) in MDB co-financing and over US$1.3 billion in commercial co-financing, the IP aims to achieve the goals in three ACT pillars (governance, people, and infrastructure). The goals in the People pillar: up to 1,160 (i.e., 89% of) employees of retired CFPPs/coal mines with access to sustained income and up to 2,200 direct beneficiaries of social plans and economic regeneration activities, to be disaggregated by gender, and reflecting other social characteristics (age, disability status, formal vs. informal workers etc.) as well as documented information about the quality of the jobs (income, skilled/ non-skilled positions) whenever relevant and possible.[342] 2. Several programs in the CIF ACT Investment Plan related to just transition[343]: **[1] PLN RBL**: (i) strengthening PLN institutional capacity to manage a just energy transition; (ii) engagement with PLN university for workforce and skills planning (integrating efforts with PRIME STeP loan for storage and solar PV technology training); (iii) supporting communities and workers associated with the early retirement of PLN CFPP with special consideration for women and vulnerable groups. **[2] PT SMI ETM Country Platform**: ADB to use CIF ACT grant funds to design and implement just transition framework for the Indonesia ETM country platform under PT SMI. This will then feed into broader ADB engagement with the GoI on the national level just transition and related interagency collaboration. **[3] PLN/MEMR Energy Transition Program for Results (P4R)**: Development of just transition framework, support for pilot just transition projects. **[4] IPP CFPP early retirement program (private sector)**: Just transition plans, particularly to safeguard the job security of the employees of the assets retired under the program, will be developed by ADB and the associated costs will be reflected in the overall financing structure and budget during due diligence.

No.	Recommendation	Compatibility / Relevant Issues
		[5] Promoting Research and Innovation through Modern and Efficient Science and Technology Park (PRIME Step): (i) targeted R&D for new energy technologies commercialization; (ii) deployment of online and offline solar PV and battery storage training targeted to support labor transitions underway; (iii) jobs and skills study to assess supply and demand for upskilling/re-skilling in the Indonesian labor market with respect to a just energy transition; (iv) establishing Centers of Excellence for the clean energy transition. **3.** In collaboration with ADB, the Ministry of Finance is conducting a Strategic Environmental and Social Assessment (SESA) aimed at ensuring that the identification process and mitigation measures are implemented with due regard to their impact on the environment and social economy.

[342] Government of Indonesia (18 October 2020). CIF Accelerating Coal Transition (ACT): Indonesia Country Investment Plan (IP).
[343] Idem.

Annex 5.2. Bibliography of studies related to Indonesia's electricity subsidy

Title	Author Publisher	Published Year	Brief Description/Content Coverage
Case Study: What is the true cost of coal in Central Java?	Lourdes Sanchez, Lucky Lontoh, Lasse Toft Christensen; International Institute for Sustainable Development (IISD)	Oct 2017	The studies address what is the true cost of CFPPs, especially if considers externalities and subsidies. The studies also mention the LCOE of CFPPs and other RE; in the end, compare the cost structure of both power plants.
Indonesia's Coal Price Cap: A barrier to renewable energy deployment	Richard Bridle, Anissa Suharsono and Mostafa Mostafa; International Institute for Sustainable Development (IISD)	May 2019	The studies cover discussions on the coal price cap, why it is important, what that means for RE, and how to shore up PLN's finances without locking in coal
RENEWABLE ENERGY TARIFFS AND INCENTIVES IN INDONESIA: REVIEW AND RECOMMENDATIONS	ADB	September 2020	The report proposes a renewable energy (RE) subsidy mechanism to close the gap between the costs of renewable power and conventional power generation, taking into account the additional economic benefits of renewable power for Indonesia. The subsidy is proposed to be calculated as the difference between the cost of supply from a given renewable power project and the financial cost that the Perusahaan Listrik Negara (PLN, State Electricity Company) would have otherwise incurred for generation on that system in the absence of the renewable project, i.e., PLN's "avoided cost." To ensure that the Government of Indonesia does not overpay for renewable subsidies, the cost of renewable supply would be capped at its economic value, which is calculated as the economically avoided

Title	Author Publisher	Published Year	Brief Description/Content Coverage
			cost plus the social benefits of externalities.
Policy Paper (Naskah Kebijakan). Transformasi Subsidi Listrik di Indonesia: Tujuan dan Usulan Mekanismenya	National Team for the Acceleration of Poverty Reduction (TNP2K)	March 2021	The policy paper addresses the purpose of electricity subsidy reform and proposes a new subsidy mechanism including the implementation plan.
Indonesia's Energy Support Measures: An inventory of incentives impacting the energy transition	Anissa Suharsono, Murtiani Hendriwardani, Theresia Betty Sumarno, Jonas Kuehl, Martha Maulidia, and Lourdes Sanchez; International Institute for Sustainable Development (IISD)	June 2022	It is a report—an inventory—designed to identify all support measures available for the energy sector in Indonesia from FY 2016 to FY 2020. The report includes support measures given to various types or sources of energy, and it serves as a starting point for the Government of Indonesia (GoI), as well as all stakeholders, concerned citizens, and the wider public to allow them to "follow the money": to track the flow of public funding and to understand how public money is being spent on different types of energy. Through data visualization of the flow and allocation of the support measures throughout the period observed, this report also aims to shed light on government spending on fossil fuels vis-à-vis renewable energy and clean technology.

Title	Author Publisher	Published Year	Brief Description/Content Coverage
			This stocktaking report takes into account support provided over 5 years, from FY 2016 to FY 2020, for six energy sources: 1) oil and gas; 2) coal; 3) electricity; 4) renewable energy; 5) biofuels; and 6) electric vehicles (EVs) and batteries for EVs.

Appendices related to Suggested donor/development partner interventions and coordination tools and strategies for the development partner community

Donor/development partner coordination strategies

The significant amount of support that Indonesia is receiving from donors and development partners around the world to aid its energy transition will necessitate a robust system for managing the influx of potential financing opportunities and identifying the most worthwhile ones. Establishing an efficient system to channel the appropriate support to projects related to the country's energy transition will be invaluable in helping Indonesia meet its climate goals in a timely manner. Coordination tools and strategies have been devised to help address this.

Coordination between JETP and the Indonesian government

With the launch of the Just Energy Transition Partnership (JETP) in Indonesia in November 2022, another opportunity for coordination among donors and development partners towards the early retirement of CFPPs was presented. The governance structure of the JETP involves three parties the Government Decarbonization Task Force, the IPG task force, and the JETP secretariat[344]

In February 2023, the JETP Secretariat was launched, created to serve as a coordinator for internal and external stakeholders of JETP and lead planning and project development for JETP. The Secretariat will also manage the day-to-day implementation of Indonesia's energy transition to low carbon that is sustainable, just, and supportive of Indonesia's economic growth. Among those that will engage in the JETP Secretariat are Indonesian government ministries, PLN, ADB, and other development partners. The Secretariat is to be hosted in the Ministry of Energy and Mineral Resources (MEMR) and supported by the Asian Development Bank.

JETP will also establish working groups centered around five different themes: technical, policy, financing, just transition, and electrification & energy efficiency. These working groups will comprise of different development partners, each one led by a different development partner. These working groups will also be supported by PLN, MEMR, Ministry of Industry, Ministry of Finance, PT SMI, BAPPENAS, and Chamber of Commerce and Industry. These working groups are

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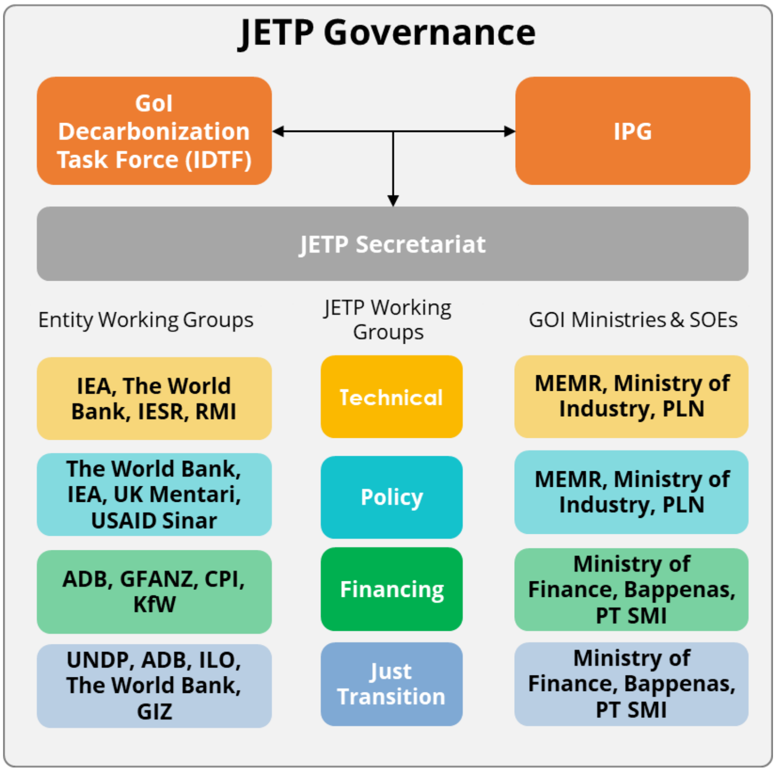
[344] OCHA Services. (2023). Programme Management Advisor (Senior Industrial Economist), Retainer, LICA-11, Jakarta. From: https://reliefweb.int/job/3977926/programme-management-advisor-senior-industrial-economist-retainer-lica-11-jakarta

still subject to modifications and could include other donors and partners as the JETP in Indonesia evolves.

JETP Working Groups

To maximize JETP's potential to realize Indonesia's just energy transition, it needs to effectively coordinate with the Indonesian government in carrying out the needed activities for the transition. Although some interactions between JETP and the Indonesian government have been mentioned, formal coordination has not been clearly defined. Multiple lines of coordination are proposed between the working groups and specific ministries or agencies of the government as described in the following figure.

Possible interactions between JETP and the government



The involvement of Indonesian government ministries in the working groups themselves should aim to engage, both at a high-level (e.g., Directorate General level, who, as a decision maker, can make quick decisions when needed) and at a working-level (e.g., Director & Deputy Director Level, who can execute the actions on the ground).

Legal basis for this coordination structure can be created through a presidential decree. This makes it not only so that responsibilities defined for a ministry or agency are binding but also that that they are granted clear authority to carry them out, especially when considering the execution of actions that may involve exercising authority over other ministries.

However, given that an energy transition will take a long time that will exceed the defined scope of JETP, an analysis of what happens after the JETP Secretariat finishes their role and responsibilities ought to be conducted to ensure that their efforts to advance the energy transition can be continued. What the government can do and how they can rally for further support ought to be analyzed well before the anticipated conclusion of the JETP Secretariat's operation.

Management of potential financing and technical assistance opportunities

Given the large number of potential opportunities for receiving financial and technical support from development partners, as demonstrated by JETP, the Indonesian government still needs a proper system for managing them. Without a proper system, the Indonesian government can face some risks that can jeopardize the success of the energy transition. The following chart describes some of these risks.

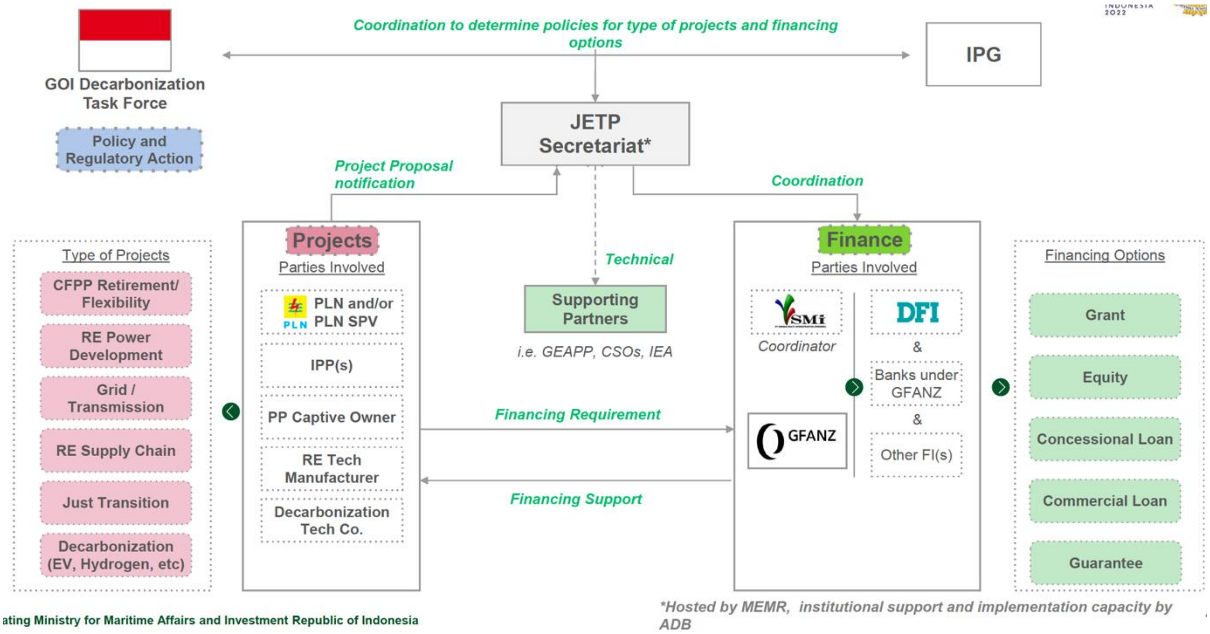
Risks of not having a system for managing developmental opportunities

Risk	Description
Inefficient use of time and resources	The influx of development agencies seeking to fund projects in Indonesia can result in a large volume of communication between these agencies and relevant ministries. This can lead to an inefficient use of staff time in ministries, as key members and other employees continually meet with development agencies. Given that not all proposed opportunities may be promising, ministry members and employees may end up misusing their time and resources that could otherwise be used on more productive endeavors, posing a risk of inefficient use of time and resources.
Redundant projects	If ministries do not have effective communication channels to coordinate ongoing projects, there is a risk of duplication or overlapping efforts. This may lead to a missed opportunity to allocate resources effectively towards areas critical to Indonesia's energy transition, potentially slowing down progress towards achieving its climate goals. Therefore, a coordinated approach to project management and communication between relevant ministries is essential to avoid redundancy and maximize the impact of resources.
Contradictory recommendations	When multiple projects are working towards the same goal, there is a risk of conflicting recommendations being presented to the government. This can create confusion and potentially lead to a lack of clarity on the best path forward

Risk	Description
	for the energy transition, which may impede progress towards achieving Indonesia's climate goals.
Disjointed progress	The success of a just energy transition is dependent on the synchronized progress of various socio-economic areas in line with an overall plan. However, a lack of coordination among relevant ministries in managing individual projects can result in disjointed progress, with some areas advancing while others lag. This uneven progress may ultimately hinder the achievement of a successful energy transition.
Poor quality of advice	To ensure that projects in different sectors contribute to the overall success of Indonesia's energy transition, it is essential to consider their interdependence and the broader socio-economic context. If projects are implemented without proper contextualization, the advice and results produced may not be relevant or useful to the government. Inadequate understanding of the relevant context can lead to ineffective outcomes and a poor quality of advice for the government.

One way to manage these opportunities is through the appointment of a "gatekeeper," who would oversee and initially assess incoming opportunities for Indonesia's energy transition, making high-level decisions regarding whether such opportunities should be channeled to the relevant ministry or rejected altogether. Some assessments that the "gatekeeper" would need to conduct include determining whether a project aligns with Indonesia's energy transition goals, assessing the project value, and determining which ministry should be involved. Ministries like MEMR, Bappenas, MoF or PT SMI could take on the "gatekeeper" position since they work closely with entities that are part of JETP's working groups. In addition, PT SMI is expected to coordinate with the JETP Secretariat for financing (Figure below).

JETP structure. The JETP Secretariat will coordinate with PT SMI regarding financing



The key tasks of the "gatekeeper" would include:

- Stay up to date with Indonesia's climate goals, energy transition roadmaps, ongoing relevant projects, milestones reached, policies, and ministerial responsibilities.
- Design and implement a methodology for assessing developmental opportunities presented, considering, inter alia, their activities, objectives, and timelines to select those that are most aligned with Indonesia's transition goals, as well as avoid potential overlap and inconsistencies.
- Channel promising developmental projects to the relevant ministries that can collaborate with the development partners leading them.
- Provide support to those executing the projects to ensure that the projects are carried out with Indonesia's specific context in mind.
- Remain in regular correspondence with development agencies to be apprised of future energy transition projects in Indonesia.
- Remain in regular correspondence with development agencies to inform them of Indonesia's goals in various aspects of the energy transition, including improving energy transmission, promoting renewable energy generation, just transition, and policy reform.

- Raise urgent issues to ministries along critical stages of the energy transition to bring their attention towards potential interventions needed for them to undertake to stay on track.

PT SMI can adopt new mechanisms to optimize their coordination and ensure the successful implementation of Indonesia's energy transition goals. By organizing a dedicated forum for development partners to share ongoing and future projects and creating a comprehensive database to track and analyze projects, PT SMI can efficiently identify gaps and overlaps in support and direct future assistance accordingly. These measures will further streamline PT SMI's activities and enhance their ability to oversee and coordinate Indonesia's energy transition initiatives.

It is evident that a coordinated and integrated approach is necessary for success. This requires the involvement of multiple stakeholders, including development agencies, relevant ministries, and a dedicated oversight entity. The “gatekeeper” for the energy transition by coordinate and streamline development activities and oversee the implementation of projects. By staying up to date on Indonesia's energy transition goals, designing an assessment methodology, and providing support to project implementers.

Another way to help manage financing and technical assistance opportunities is through an online platform. This platform would facilitate the channeling of potential financing and technical support to much needed activities in Indonesia’s energy transition, as defined by the Indonesian government. This platform would be managed by the Indonesian government and would allow different ministries to announce their needs for support in different coal retirement-related efforts, including retirement and repurposing, inviting donors and development partners to submit proposals to provide the financing and/or technical support required.

Interested donors and development partners would then be able to use the platform to submit proposals, which the Indonesian government would be able to review to determine the development partner with whom to collaborate.

There is potential for the designated “gatekeeper” to manage the operation of the online platform and to filter through the submitted proposals before they are forwarded to the ministry seeking support. This could facilitate the process by decreasing the work needed to carry out by the interested ministry in reviewing many proposals. However, to carry out this role, the gatekeeping entity should have adequate understanding of the type of support the interested ministry requires.

ENERGY
TRANSITION
PARTNERSHIP