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Indonesia Power Sector Finance Dashboard

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Recommended citation:

PLN Financial Reports (2019-2021)

PLN Statistics (2019-2021)

Related CPI works:

Global Landscape of Climate Finance (2023)

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Introduction

Background

Indonesia has set various climate targets:

- A Long-Term Strategy for 2050, with the optimistic scenario geared towards reaching net zero emissions (NZE) by 2060 or earlier.
- Enhanced-Nationally Determined Contribution, increasing the target of emission reduction from 29% (835 mio ton CO2) to 32% (912 mio ton CO2) in 2030, with particular target for energy sector at 358 mio CO2.

To reach the initial target of 29% in 2030, Indonesia will require USD 281.23 billions*, of which the government is anticipating paying only 20%.

The recently published *Comprehensive Investment and Policy Plan* (CIPP) stipulates that to achieve energy transition targets under JETP, Indonesia requires US$ 97.3 billion until 2030.

With limited financing ability, public funding should be more strategically leveraged to mobilize more private commercial finance.

*) https://mediakeuangan.kemenkeu.go.id/article/show/indonesia-berkomitmen-penuh-tangani-perubahan-iklim

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Objectives

Challenges in financing energy transition:

- **Lack of Transparency**. Finance flows from the public and private sectors are not available under a consolidated and publicly accessible platform, making it hard to see which clean sectors are getting financed and which dirty sectors are still receiving support
- **State budget support to state-owned enterprise** utility companies such as PLN also creates a distortion of incentives and disincentives within the energy market. Fossil fuel subsidies account for 9% of total state expenditure, while climate spending accounts for only 6% of total state expenditure in the past 5 years.

The objective of this report is to address the above challenges:

- to provide **a financial sector landscape that captures finance flow to clean and dirty power sectors in Indonesia**
- to **assess finance flow (investment and operational finance) to clean and dirty power sectors through state-owned electricity firm PLN.**

Data Sources

Data sources

Data period used for power sector data is 2019-2021. This period is chosen because data of detailed public spending (state budget) is only available for that period.

Data sources used in this study:

- *For Power Sector Finance Mapping*
    - *Indonesia's Climate Change Fiscal Framework, CPI*
    - Global Landscape of Climate Finance CPI
    - Ministry of Energy and Mineral's Performance Report
    - Bluebook of Bappenas (Ministry of National Development Planning)
    - IJGlobal
    - Global Energy Monitor
    - Other relevant sources such as articles from trusted media
- *For Finance Flow through PLN (PLN deep-dive analysis)*, 2019-2022 data period is used, with additional sources:
    - PLN Statistics
    - PLN Financial Report

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Data Gaps

- Our findings are based on dataset analysis of 2019-2021 data from several sources. Despite sustained efforts to improve coverage of power sector data in Indonesia, significant gaps persist for public domestic finance as well as domestic and international private flows, particularly from corporations/captive power. Findings presented should be interpreted with these constraints in mind. Data gaps include:
  - Inability to track unreported finance in captive power plants
  - Inability to get more granular data of government spending through SOEs in the form of capital injection
  - Differences in reporting practices across data sources and reporting entities.

Methodological Approach

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Financial Data Categorization

In this study, financial sources are categorized based on the following criteria:

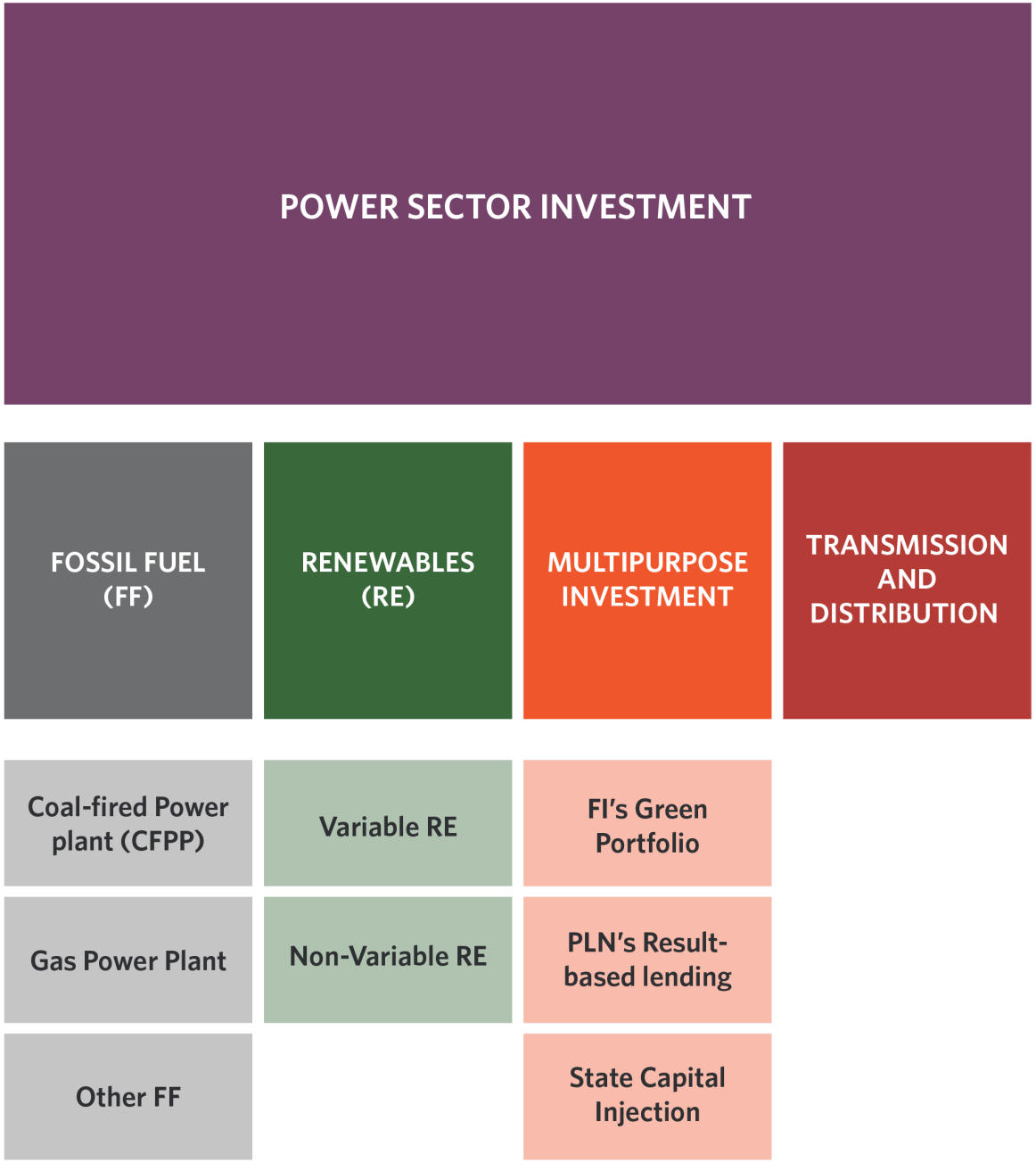
- Public (State Budget), Public (Non-state Budget), and Private
- Domestic or International
- Financing Instrument: Market-rate loan, Concessional Loan, Equity, Grant

Finance flow reported in the data sources consist of:

- Committed Investment (87%)
- Disburse fund (13%)

Finance Flow through PLN is divided into two purposes :

- Investment Expenditure
- Operational Expenditure



Power Sector Investment Categories

The use of finance flows are categorized into:

- Fossil Fuels (FF)

  Coal-fired power plant, Gas Power plant, other fossil fuels power plants, such as diesel.

- Renewable Energy (RE)

  Variable RE (e.g. Solar PV, Wind), Non-variable (e.g. Geothermal, Hydro, Biomass)

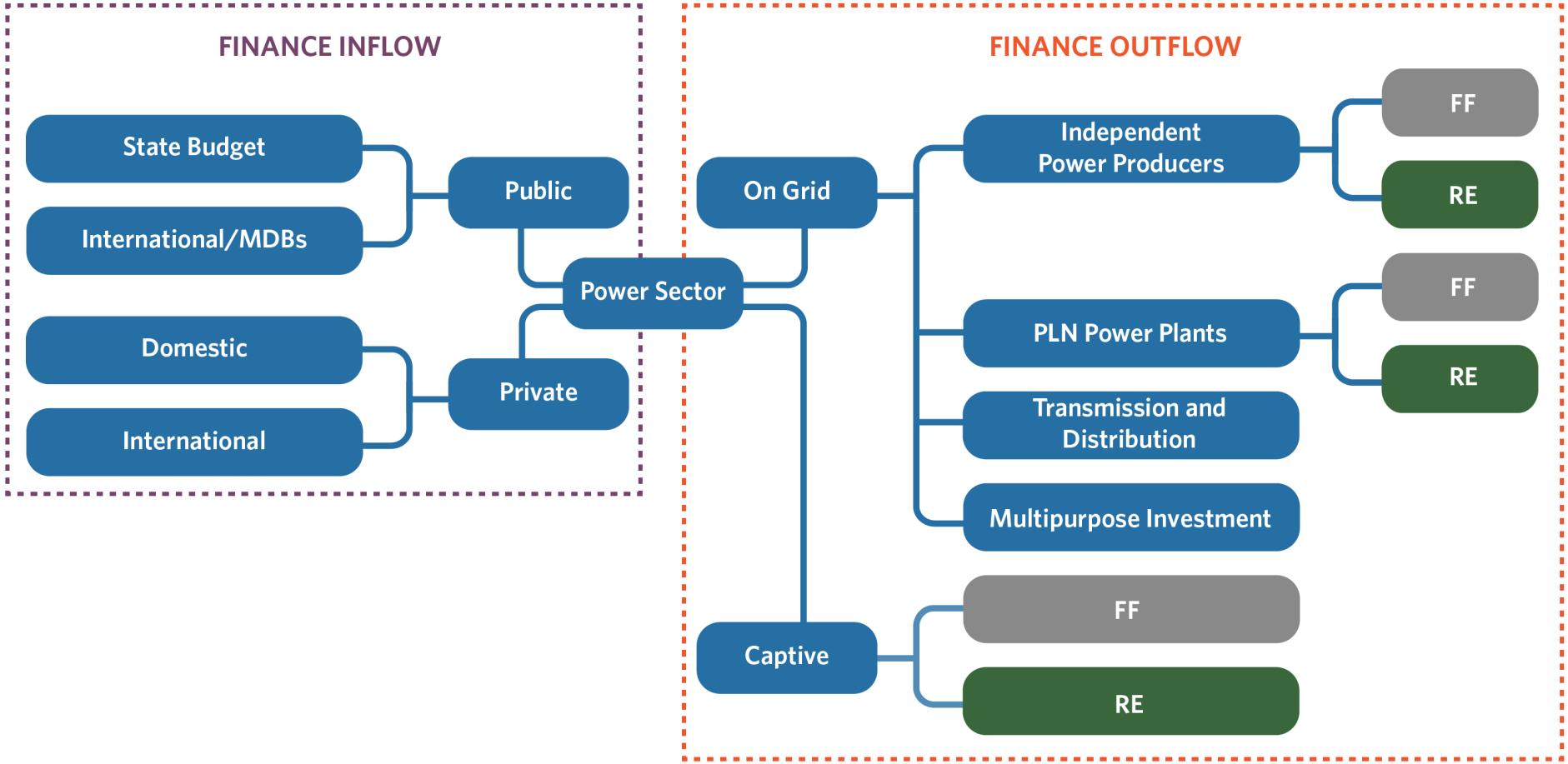
- Transmission and Distribution (T&D)

- Multipurpose

  For finance flows with no detail information whether it is used for RE power plant, FF, or T&D, such as Green Portfolio in FI (financial institutions), state capital injection to SOEs, PLN's result-based lending.

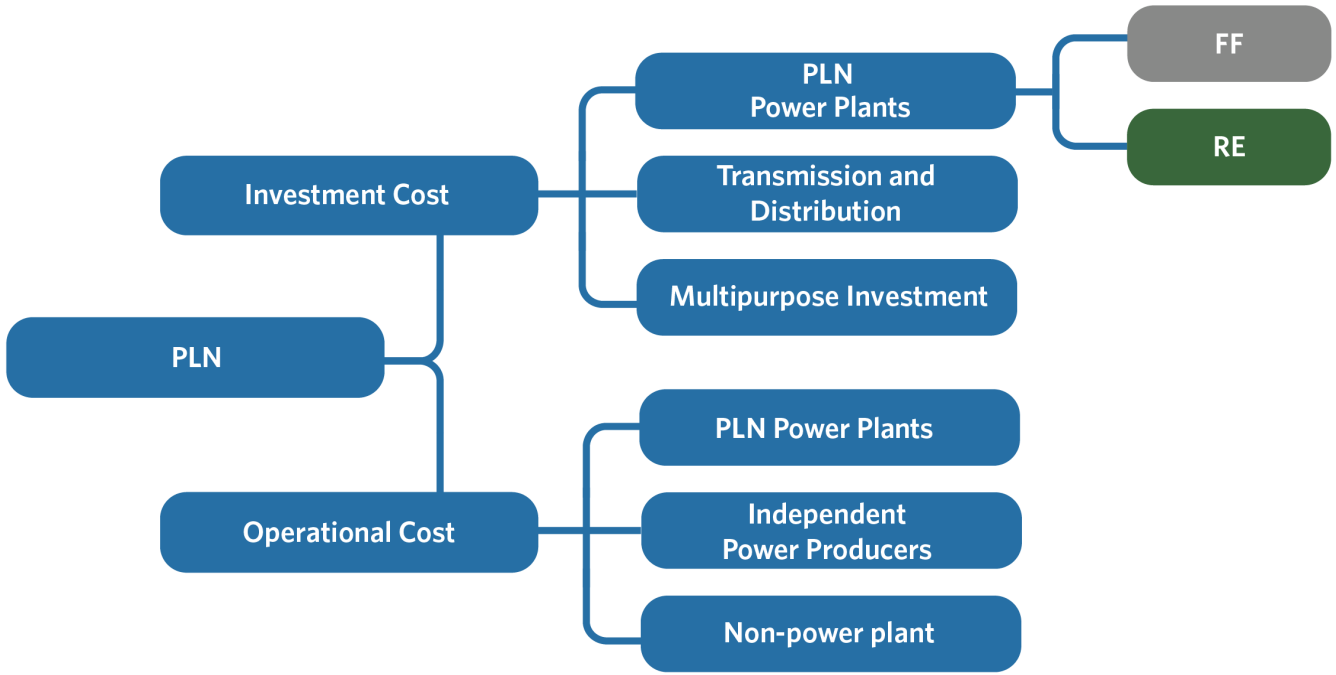
Investment Finance Flows to Power Sector

The investment finance flows from the inflow (source) to outflow (use) in this study is described below:



Finance Flows through PLN

The use of finance flows through PLN is mapped as follows:



- PLN uses the finance flow it has received to cover investment cost (capital expenditure) and operational cost.
- The investment cost consists of the capital expenditure for:
  - Power plants
  - Transmission & distribution
  - Other investment (Multipurpose)
- The operational cost consists of costs:
  - To operate PLN power plants
  - To pay the electricity bought from IPP
  - To operate & maintain other PLN's non power plant assets (e.g. T&D)

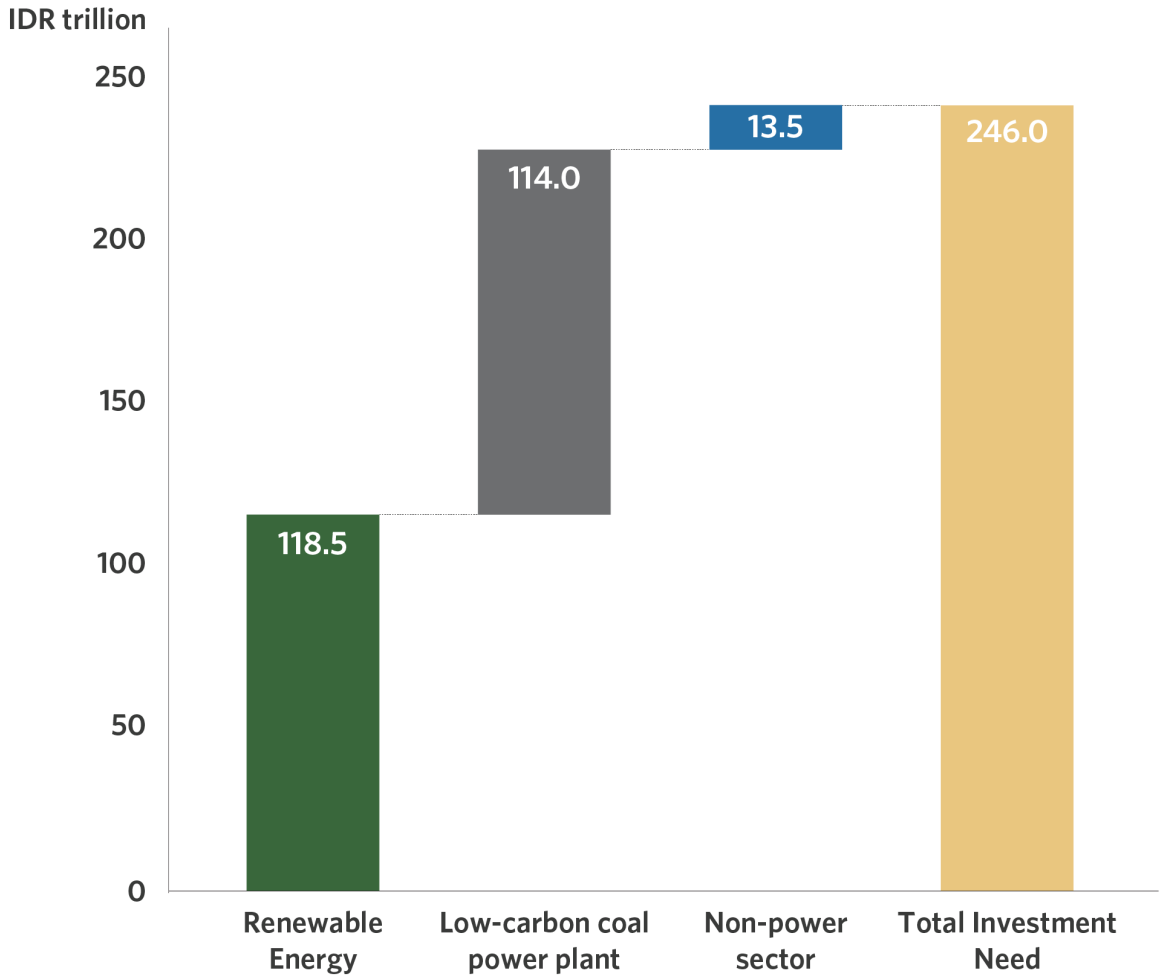
Indonesia Power Sector Finance Landscape

Investment Requirement for Power Sector

Indonesia power sector requires a total investment of $245 billions or $18 bn annually to achieve 2030 climate target, according to Indonesia Third Biennial Update Report Under the United Nations Framework Convention on Climate Change (2021).

While the government still sees the need for the so-called low-carbon coal power plant, renewable energy (RE) has the largest share to achieve Indonesia's 2030 climate target, requiring around USD118.5 billion between 2018-2030 (48% of total investment needs).

Investment needed in the power sector to achieve Indonesia's 2030 climate target (2018-2030), USD billion

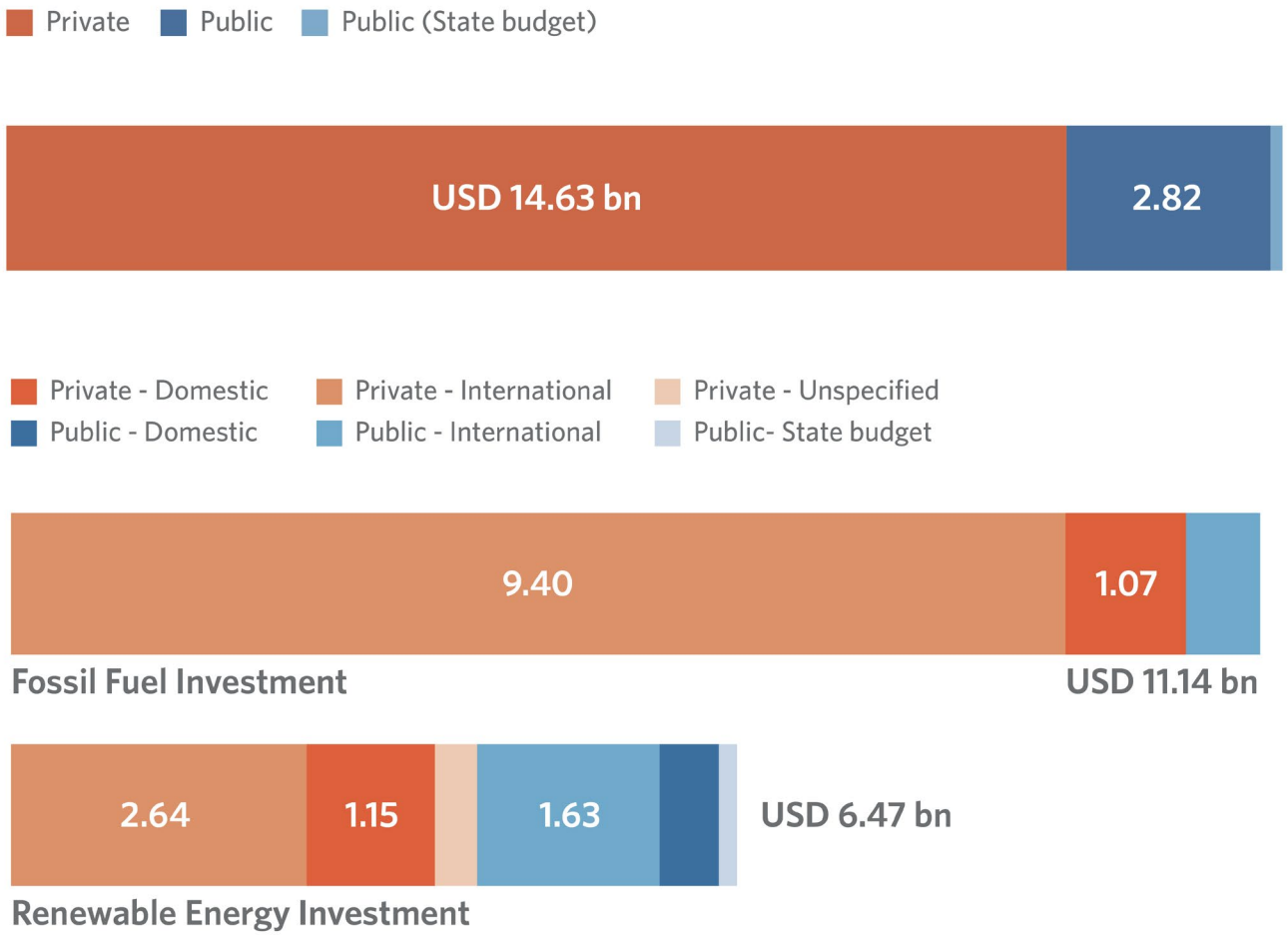


Investment Reported in Power Sector

Between 2019-2021, reported investments in power sector amounted to around USD17.6 bn, with investment for fossil fuel (~USD11.1 bn) almost twice the investment in renewables (~USD6.5 bn).

In terms of the financing source, private financial institutions (FIs) was the largest source of investment (83%) for Indonesia's power sector. However, most of private FI investment goes to fossil fuels, with RE having a more varied mix of public and private finance.

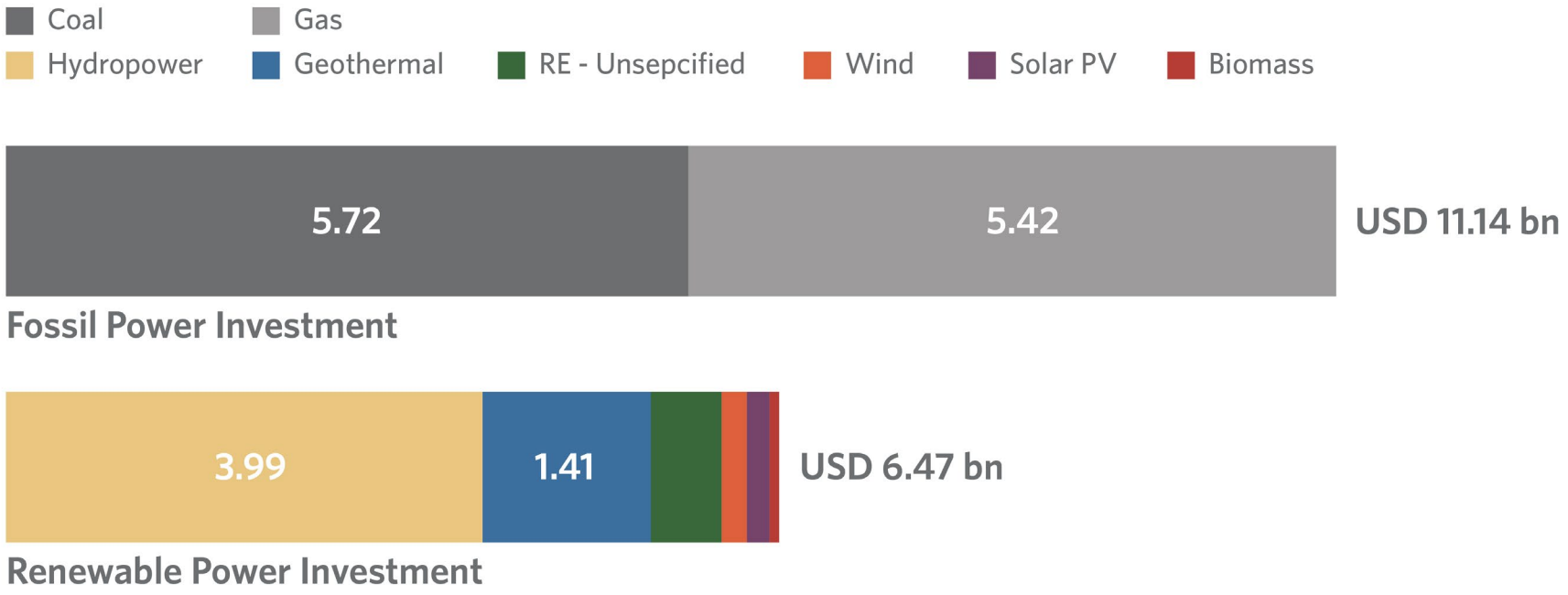
Power Sector investment, 2019-2021, USD billion, by FI (source) type



Investment Reported in Power Sector

The reported investment in fossil fuels was distributed almost evenly between coal and gas plants, while RE investment was mostly concentrated on hydropower, followed by geothermal.

For RE, this shows how technologies with baseload characteristic are still preferred compared to variable RE (i.e., solar and wind). Some known causes for lagging variable RE include uncompetitive tariff, geographical challenge for demand and supply, high local content requirement, as well as preferential policies for coal.



Unreported FF investment and additional categories of RE infrastructure

T&D and Multipurpose Investments

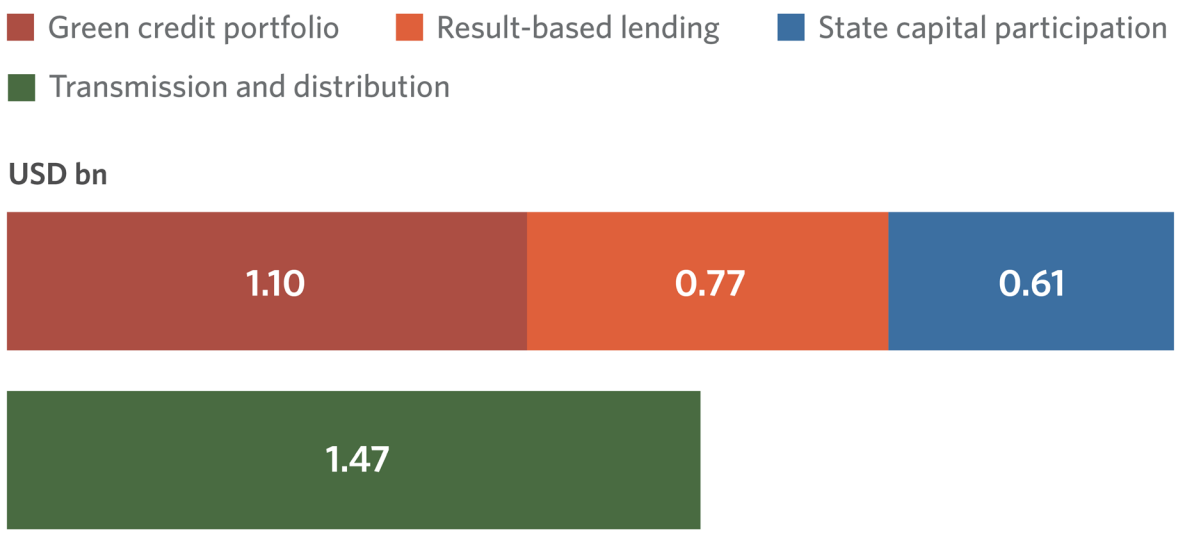
There are two categories of investment that cannot be included in FF nor RE Categories: Transmission & Distribution (T&D) and Multipurpose.

'Multipurpose' category is introduced due to lack of detailed investment data, which can include[1]:

- Result-based lending (RBL) covers indicators for T&D, RE, institutional capacity, and social monitoring.
- Green Credit Portfolio refers to sustainable credits from private banks that can include renewables, clean transport, and MSME activities.
- State Capital Participation includes capital injections made by the Gov't to PLN, the state-owned power company.

Meanwhile, the T&D category covers investments in the power grid outside of power plants.

Multipurpose and T&D investment, 2019-2021, USD billion, by project type

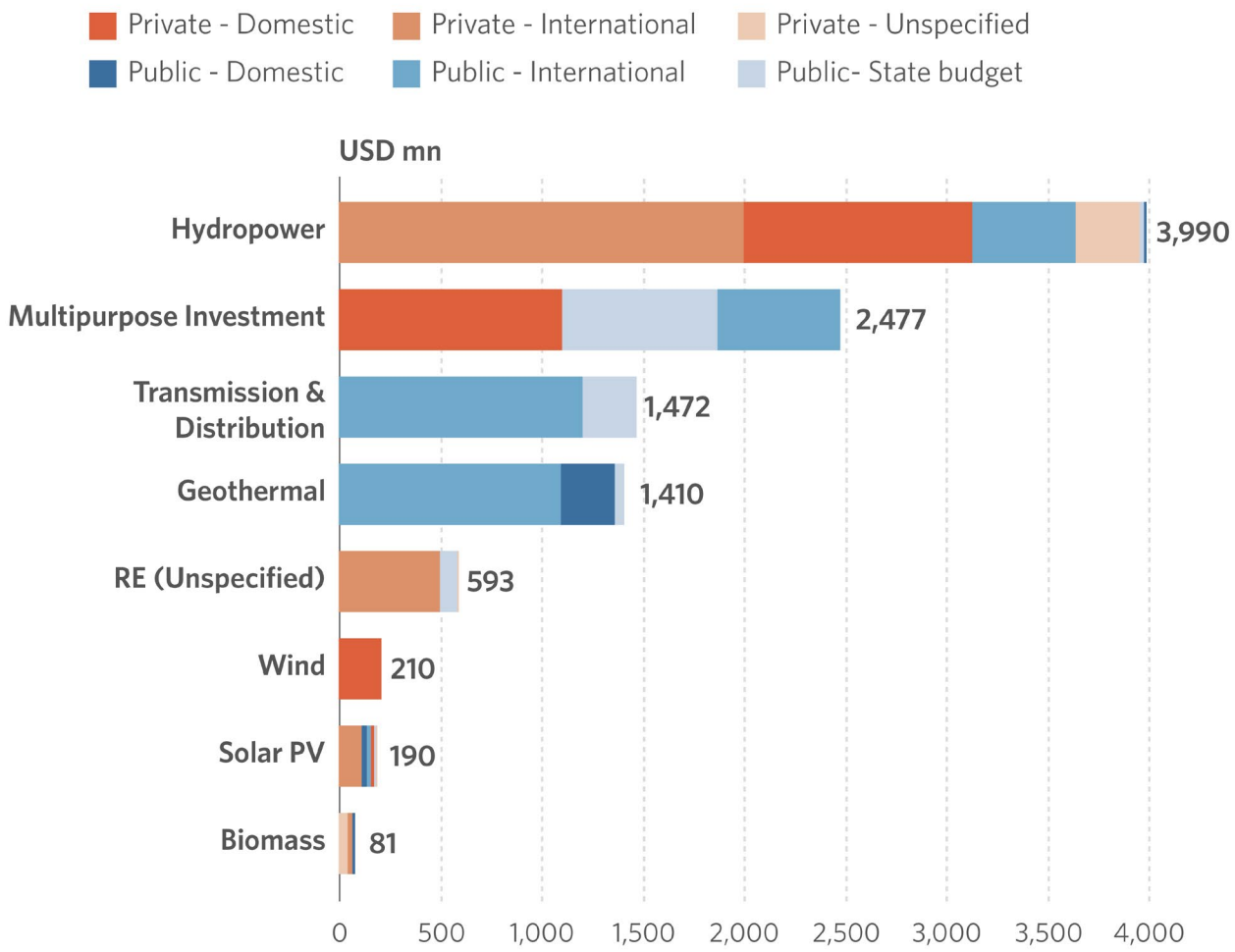


Financing Source of RE Investment

The reported investment in RE was mostly derived from international source (58%) and concentrated in baseload RE (e.g. hydro and geothermal). Hydro and Geothermal have the following characteristics:

- Hydropower, benefiting from mature technologies and diverse types (e.g., run-of-the-river, pumped storage), is favored for its stable, reliable output. Major projects like Mentarang Induk/Kayan (USD 2.3bn) and Upper Cisokan Pumped Storage (USD 0.38Bn) highlight the scale of investment.
- Geothermal energy, is mostly composed of public investment, due to challenges stemming from high exploration costs, permitting complexities, and local content requirements.

Renewable power and supporting infra. investment, 2019-2021, USD billion, by FI (source) type

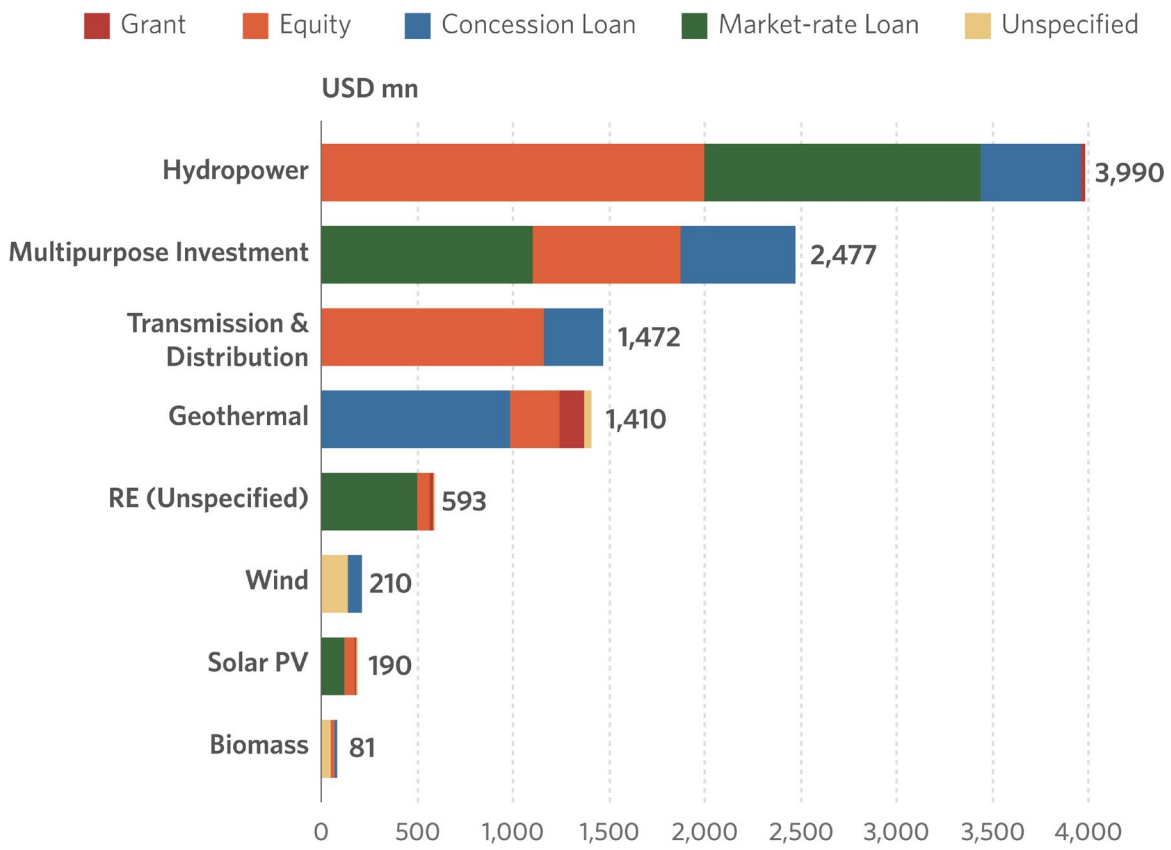


RE Financing Instruments

Different type of tracked RE technology had different profile of financing instrument. For geothermal, 79% of its investment were through concessional loan and grant, indicating that public funds were still needed to accommodate the risks. An example is the Dieng (55MW) and Patuha (55MW) Geothermal powerplant project receiving concessional finance of USD 0.35Bn . Meanwhile, for hydropower, only 13% were from grant and concessional loan, with the rest being equity investment and market-rate loan.

Other than driving up price, Indonesia's local content requirement policy has deterred various international DFIs to invest and provide concessional loan for renewables, as it conflicts with their respective procurement policy. In addition, most concessional loan require sovereign guarantee typically only provided for SOEs.

Renewable power and supporting infra. investment, 2019-2021, USD billion, by financing instrument



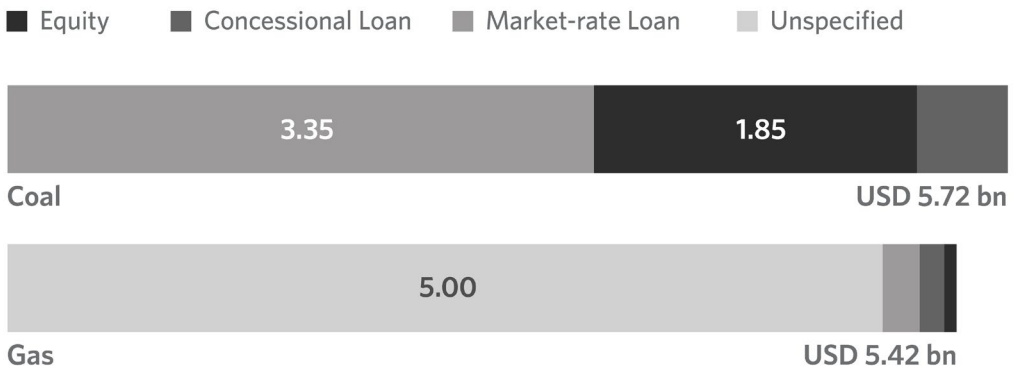
Fossil Fuel Financing Instruments

The reported fossil fuel investments relied less on concessional finance, with overwhelming share (~91%) coming from international sources.

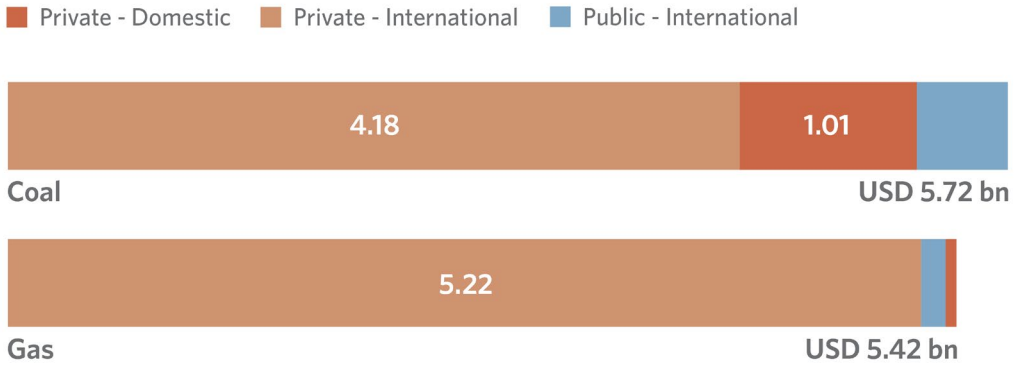
For coal-fired power plants (CFPP), this is exemplified in the Java 9 and 10 CFPPs (USD 3,6 Bn) market-loan investments made by FIs in different countries.

Meanwhile for gas power plants, the investments was mostly for the Batubara CCGT 1.8GW Power Plant (USD 5.0 Bn), captive use serving industrial zones in North Sumatra with unspecified sources of finance. This exemplifies lack of information found for captive use powerplants.

Fossil power investment, 2019-2021, USD billion, by financing instrument



Fossil power investment, 2019-2021, USD billion, by FI (source) type

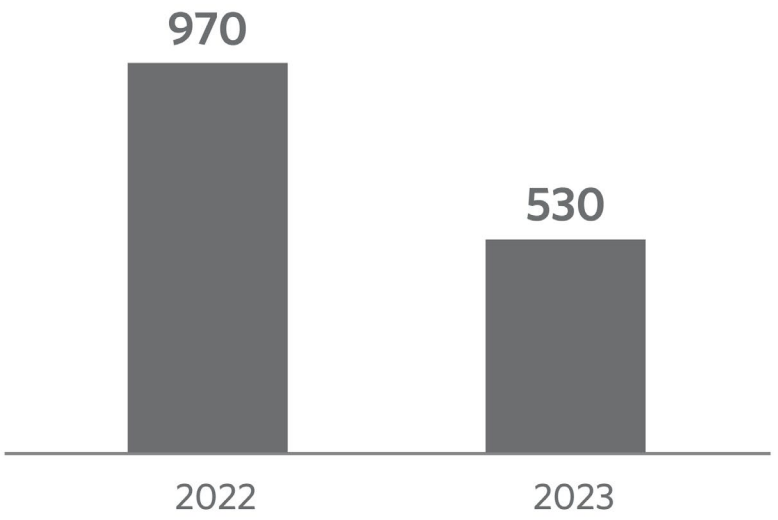


Estimating Unreported Investment in Fossil Fuel

The reported investments in CFFPs (2019-2021) were cross-checked against data of CFPPs that began operating between 2022 and 2023. This is to check for matches in investments and the projects' commercial operation date (COD) as it generally takes three years[1] to reach COD of a coal-fired power plant (CFPP).

The result suggests that there are 1,500MW Capacity of CFPPs that were not captured in the data of reported coal investments, mostly from powerplants used for captive use.

CFPPs not yet captured in the data of reported investments
in MW, by year of operation

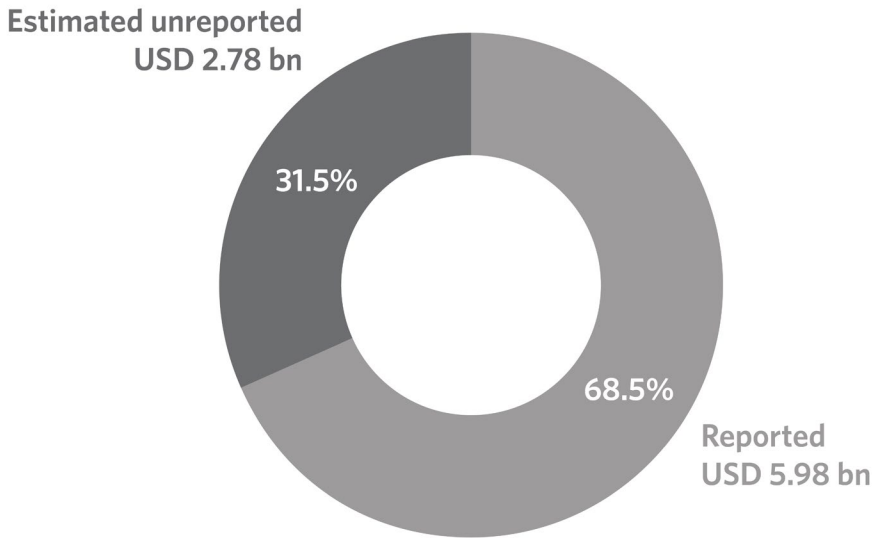


Unreported Investment in Fossil Fuel

The estimated gap in MW capacity of CFPPs was used to estimate [1] the project costs of CFPPs that were not captured in the investment data from 2019 to 2021. which formed the estimate of unreported investments.

The results suggest that the real amount of investment in coal was likely to be higher (~$2.78bn of unreported investment)

CFPP Investments, 2019-2021
in USD Billion

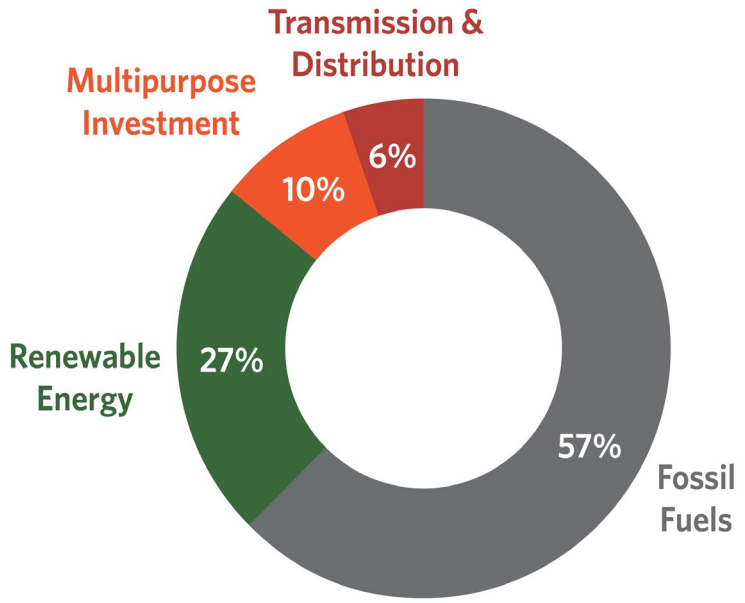


Source: Global Coal Plant Tracker, Global Energy Monitor (GEM), January 2024 release, Global project finance Tracker, Global Energy Monitor (GEM), October 2023 release

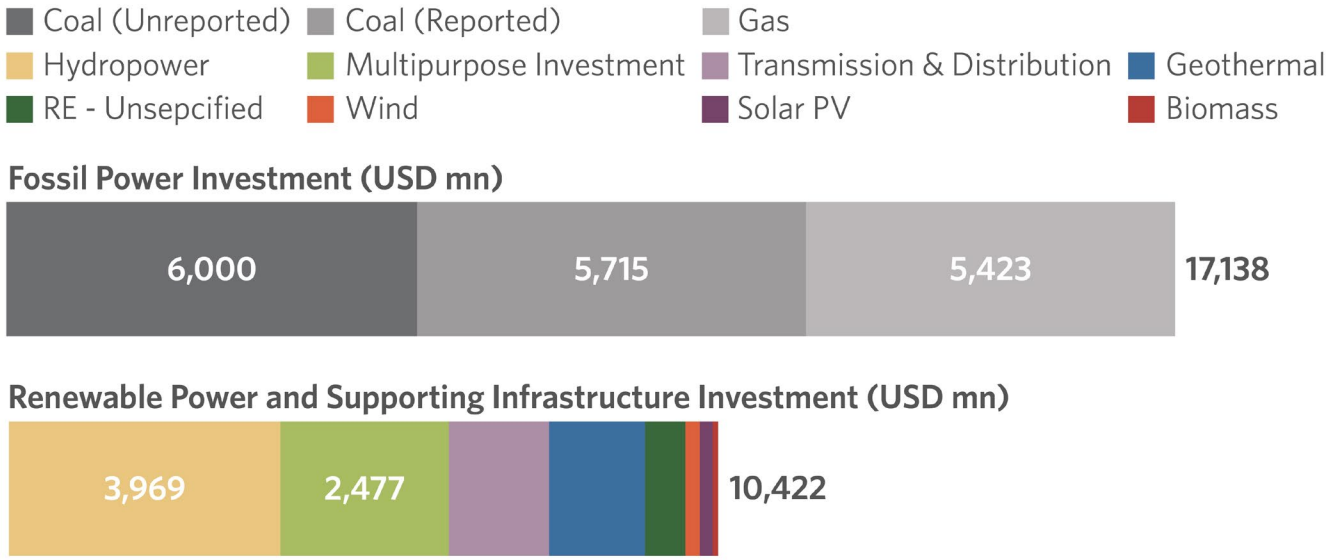
1. In estimating the unreported investments, the Global Coal Plant Tracker data was used to monitor increases in MW of Coal-Fired Power Plants (CFPP), where each CFPP can be identified by an ID and includes data points like Commercial Operation Date (COD) and capacity. Supplementary data from GEM provides financial details for each CFPP, including investment amounts.

Power Sector Outlook: Fossil Fuels Domination (57%)

Power sector investment, 2019-2021,
in %, by technology



FF, RE and supporting infrastructure investment, 2019-2021,
USD billion, by Technology



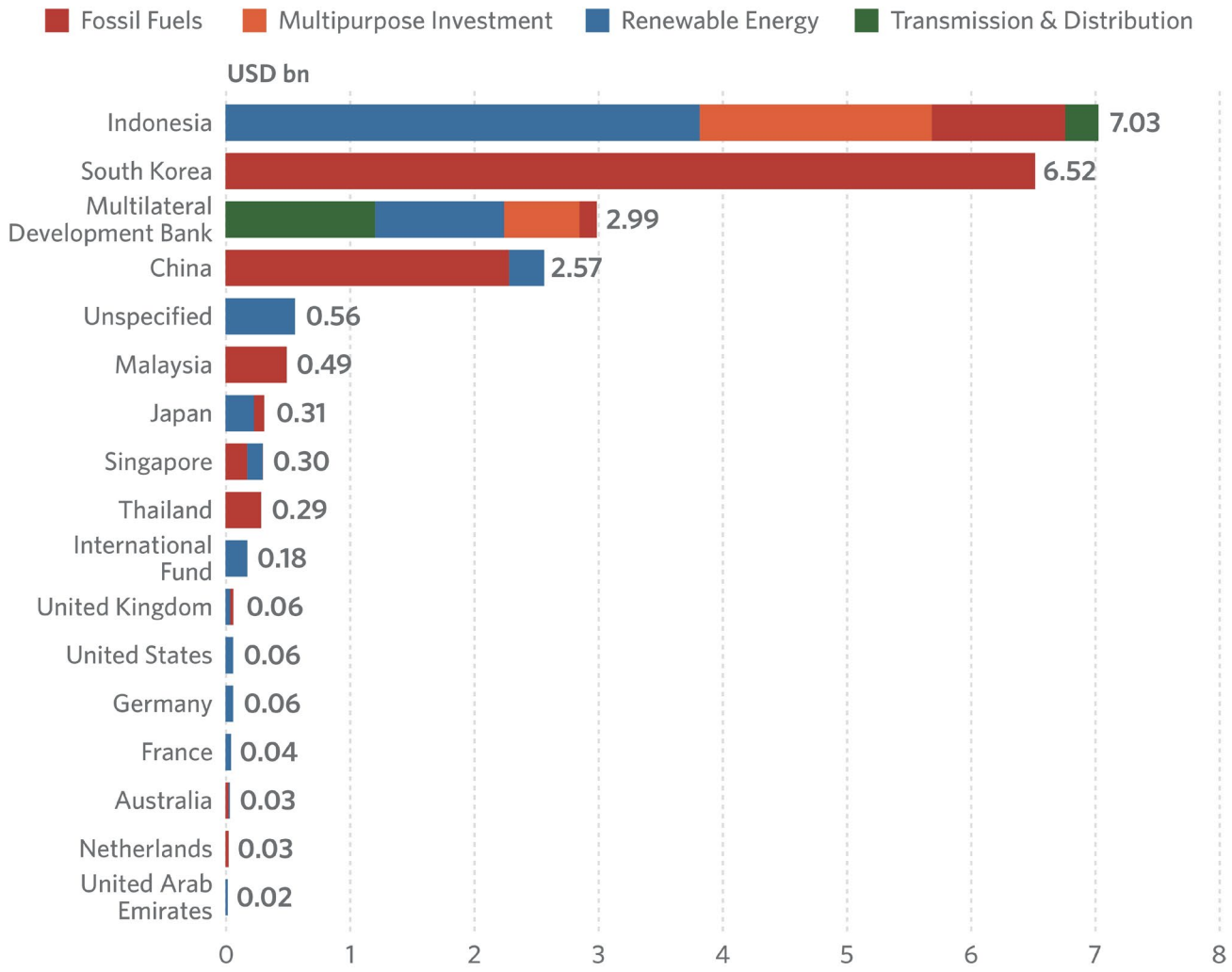
After factoring in the estimated unreported coal investments and the additional investment categories (Multipurpose and T&D), fossil fuels technologies retained the largest share of investment (57%). Given the estimated nature of coal investments included for captive use, it should be noted that there is still a data gap for investments made for captive use.

Foreign Investors Dominating Fossil Fuel

South Korea contributed the largest amount of fossil fuel reported investment ($6.5bn), followed by China ($2.3 bn).

FF investments from these countries are expected to decrease in the coming years due to climate pledges that China and South Korea have made. These pledges should be monitored.

Power Sector investment, 2019-2021, USD billion, by source country



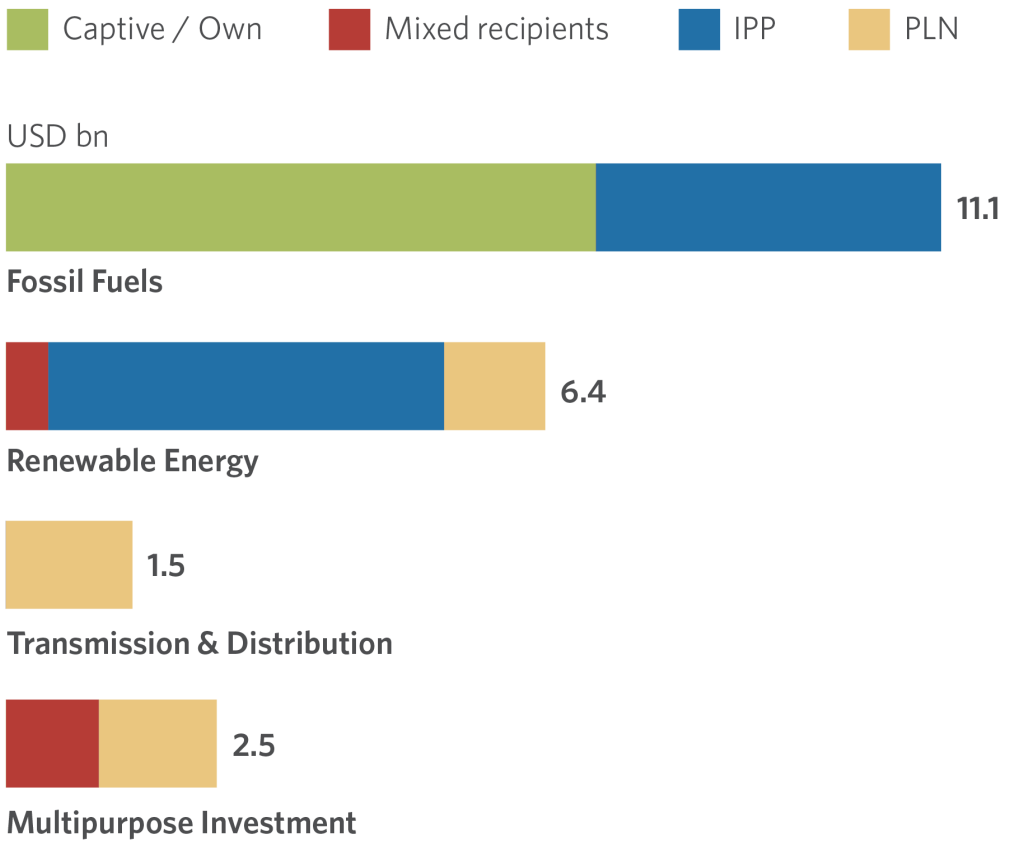
Deep-dive Analysis of Funding Flow through PLN

Power Sector Investment: IPP takes the lead

For on-grid power, IPP dominates with USD4.6bn RE (~22% of total) and USD4bn fossil (~19% of total) investments, while PLN had USD1.2bn (~6% of total) investment in RE, and none in fossil.

This trend is driven in part by PLN's increasing debt burden[1] and obligations under "take or pay" contracts with IPPs, which have constrained its ability to make large capital investments. Consequently, this trend is expected to continue as renewables are typically capital intensive. Without careful planning and strategic oversight, both PLN and the Indonesian government could face unsustainable compensation payments

Power Sector investments, 2019-2021, USD billion, by Developer Type



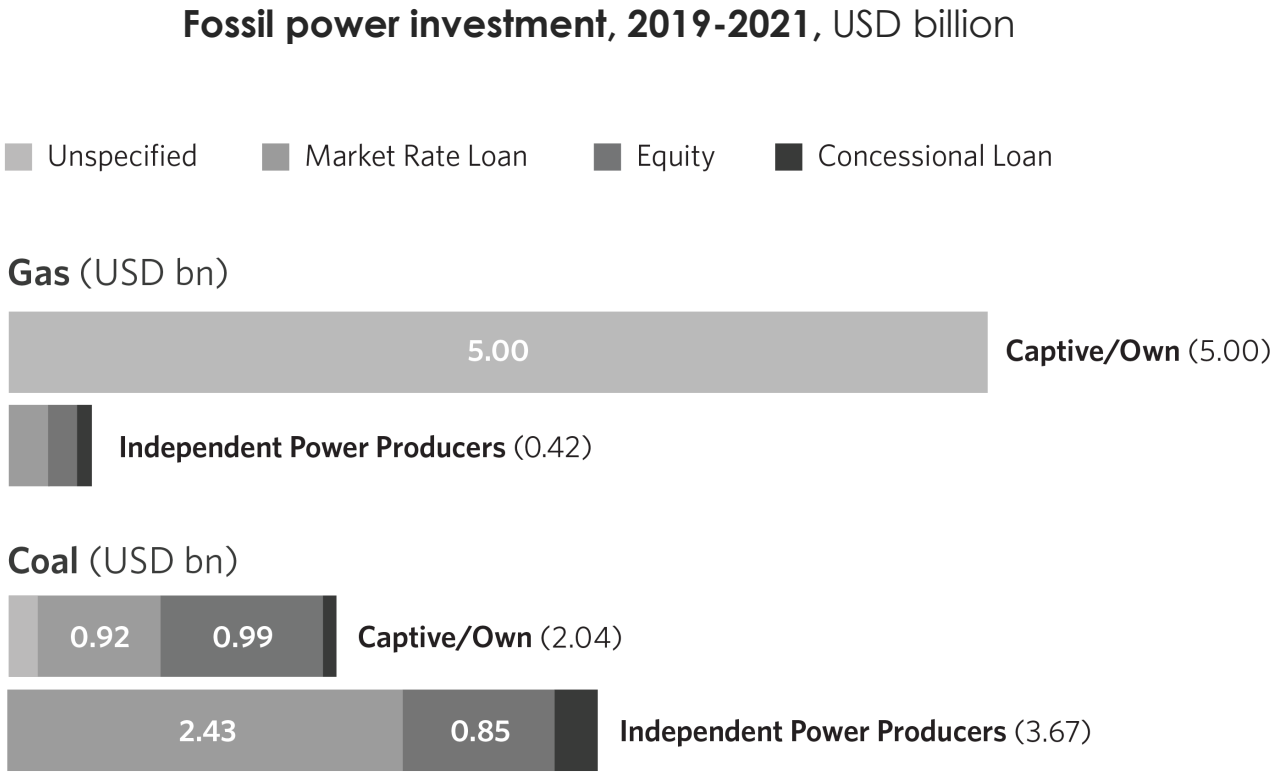
1. Computed from PLN audited financial statements

FF Investment: coal dominates

For fossil fuels, a total of USD11.1bn investment is directed to coal and gas power plants.

For Coal, IPP receives more investment with around USD3.7bn (mostly market-rate loan) compared to captive coal (USD2bn). An IPP coal project, Java-9&10, is concerning given it contributes to the overcapacity of Java and could strain PLN's finances[1], crowding out investments from future RE projects.

Meanwhile, for gas, IPP only received USD 0.4bn, compared to captive's USD5bn (Batubara Regency 4.8GW CCGT Power Plant in North Sumatera, financing modality not specified)



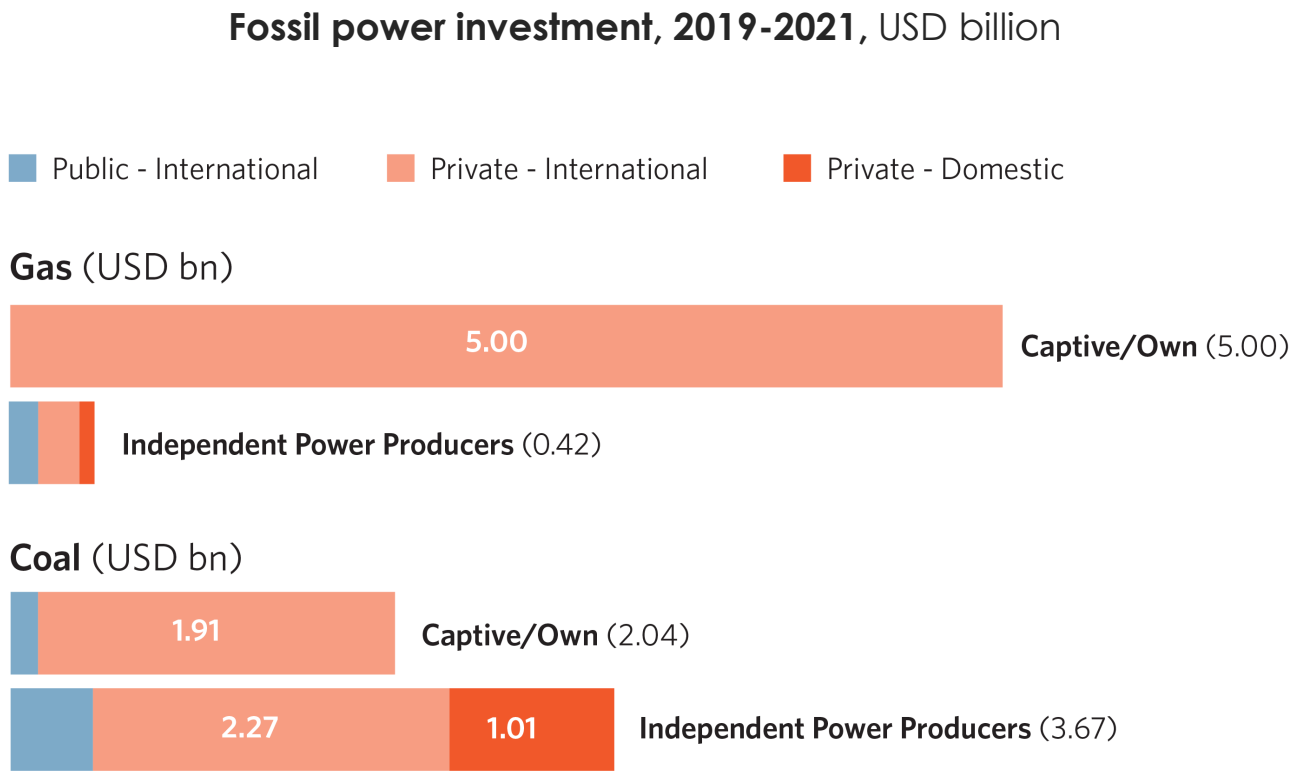
Note: Does not include estimated unreported CFPP investments
1. Source: https://ieefa.org/wp-content/uploads/2020/04/PLN_Time-for-IPPs-to-Share-the-Pain_April-2020.pdf

Foreign Sources Dominate FF Power Sector Investments

The source of investment for fossil fuel power is dominated by international private FI (USD9.4bn or ~84% of fossil investments).

Domestic private FI contributed to USD1bn of fossil investment, mostly for IPP coal power (Jawa-9 1GW and Jawa-10 1 GW CFPP).

There is still public funding for fossil identified, namely from ADB and IFC for gas, Korea and China public banks for coal.



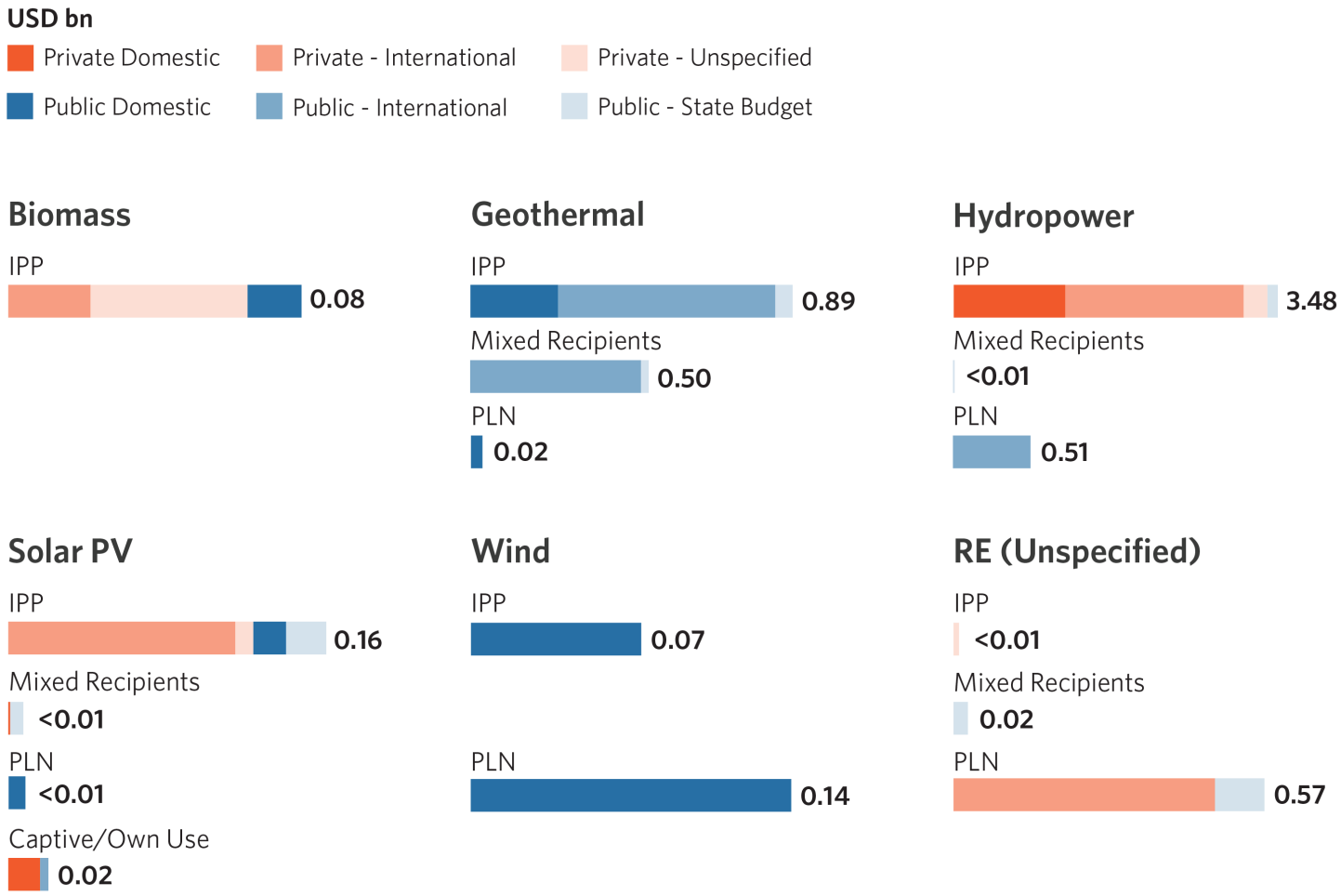
Funding Sources for RE Projects (1/2): Public and Private Sources

For IPP, most of RE investment came from private FIs, with USD3.6bn compared to USD0.9bn from public FIs. Domestic private FIs still mostly finance hydropower projects (98% of domestic private FIs investments).

Meanwhile PLN received roughly get equal amount of private (USD0.5bn) and public (0.7bn) financing.

Unlike other RE technologies, tracked geothermal investment is primarily dominated by public – international investment, mostly to Geo Dipa Energi, a state-owned geothermal IPP company.

Renewables investment by FI (source), 2019-2021, USD billion



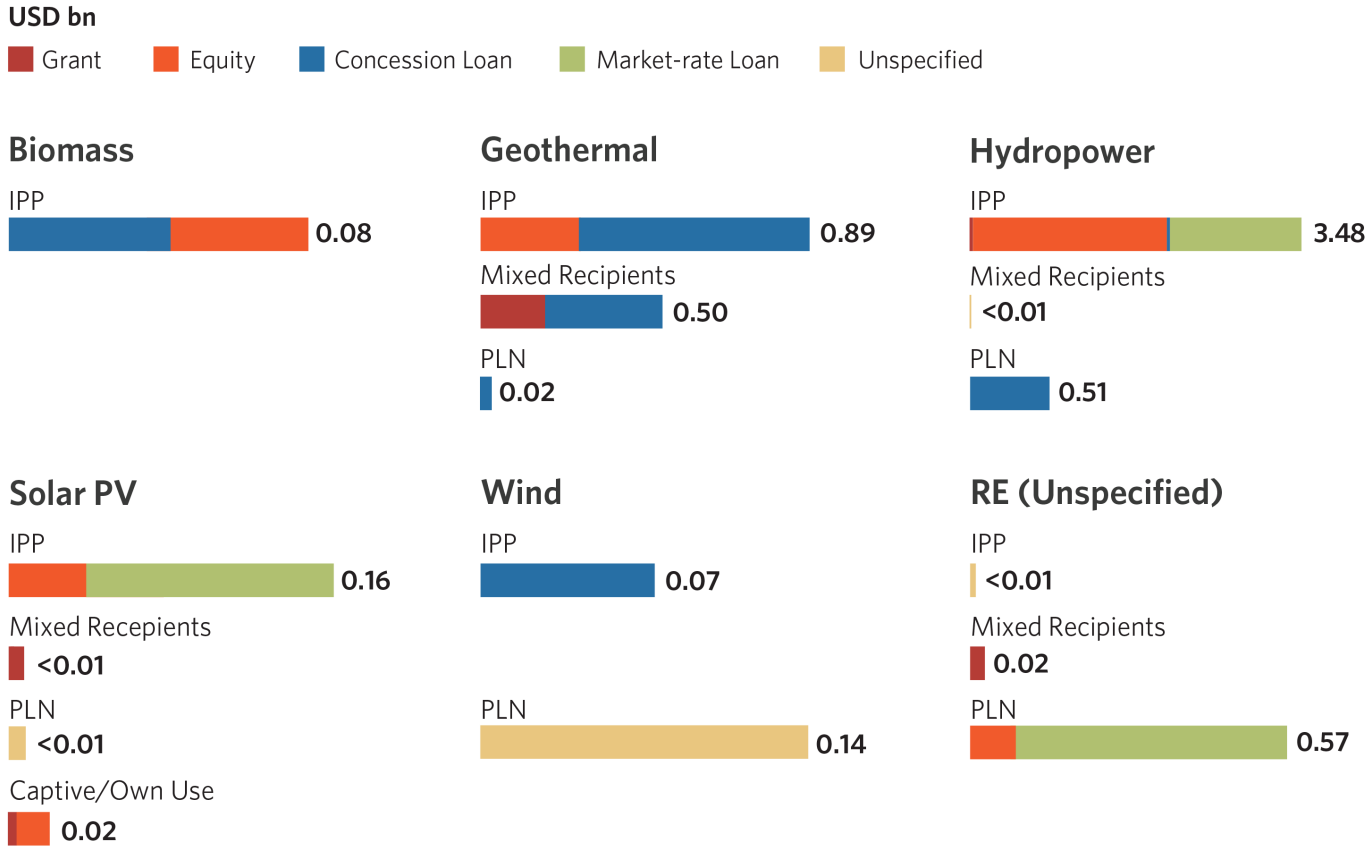
Graphic note: Bars are not to scale across sectors.

Funding Sources for RE Projects (2/2): Geothermal projects' concessional funding demonstrates high risk

Financing instrument for IPP's RE project varied by technology, with IPP hydropower project having a larger share of equity (USD2 bn) followed by market-rate loan (USD1.4 bn). Meanwhile IPP geothermal project had larger share of concessional loan (USD0.6 bn) followed by equity (USD0.3 bn).

Geothermal projects carry high risks, particularly during the early exploration stage which could deter private investors. Initiatives like the Geothermal Resource Risk Mitigation (GREM) mechanism are designed to reduce these exploration risks and encourage private sector involvement in geothermal energy. However, the potential project would need to meet the comprehensive safeguard and procurement standards.

Renewables investment, 2019-2021, USD billion



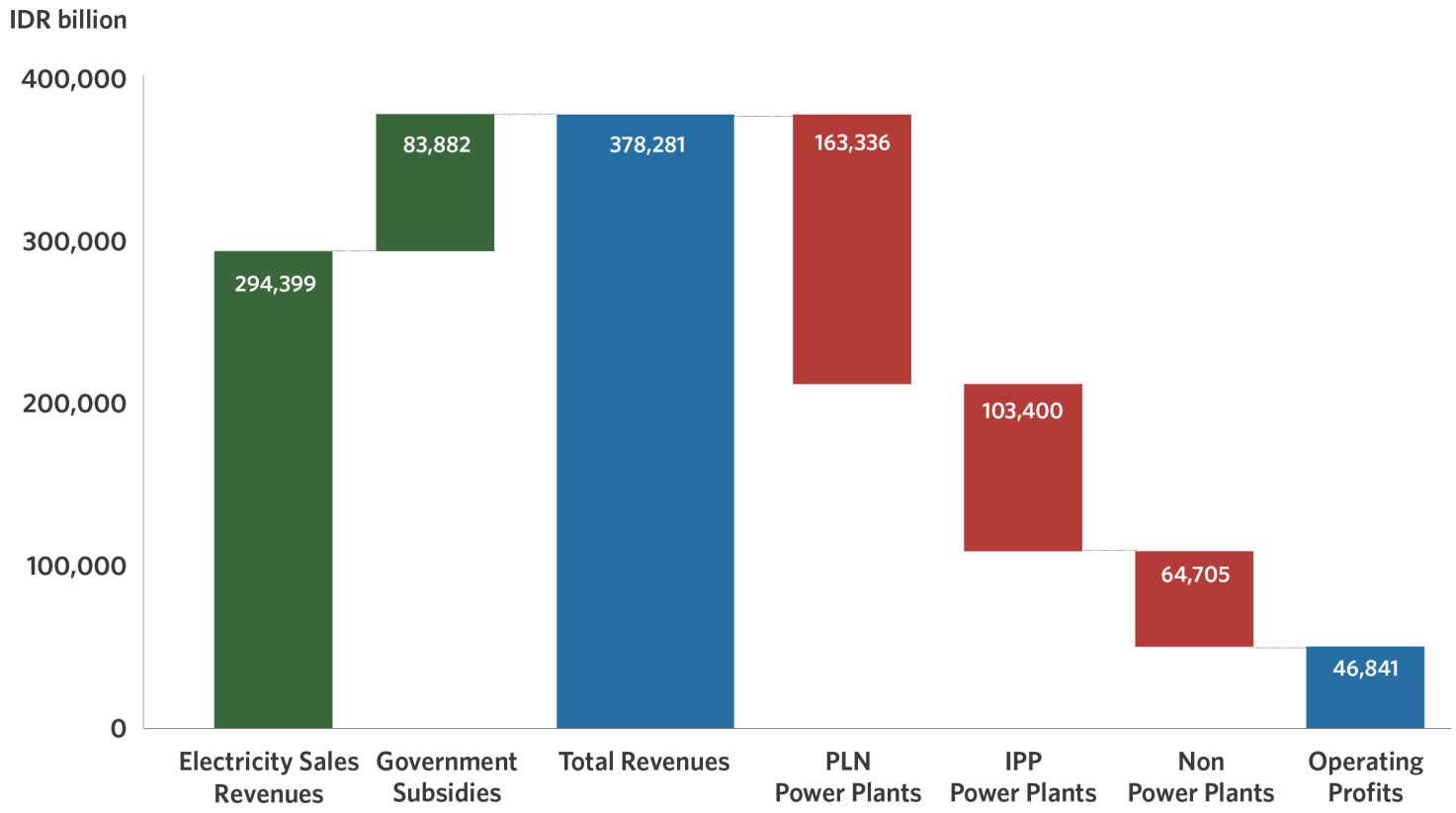
Graphic note: Bars are not to scale across sectors.

PLN Operational Funding Flows

Total revenues over the past two years comprised operational (78%) and gov't subsidies (22%). While the average total operating profit showed a positive amount, it required gov't subsidies to offset the lower total revenues from operational to sustain it.

Operational costs were mainly from PLN-owned plants (49%), followed by IPP power plants (31%), and Non-Power Plants (20%).

Average PLN Revenue and Operational Costs (by source), 2019-2022, IDR Billion



*Operating profit excludes interest & tax expenses
** Non-Power Plants costs refers to opex related to transmissions and head office costs

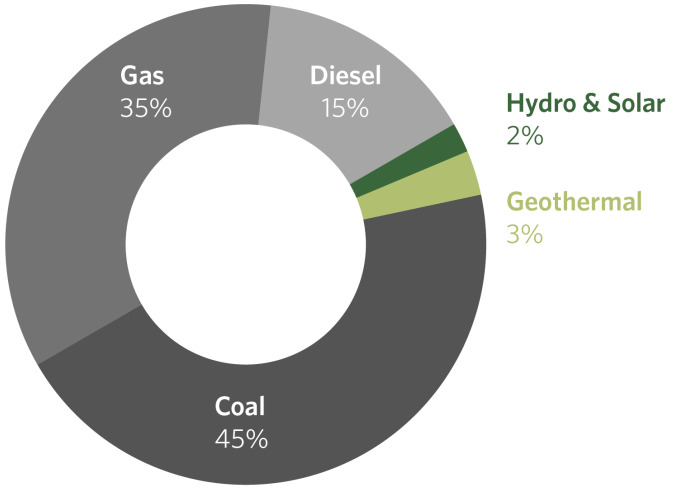
Cost Structure of PLN-owned Plants

Coal plants accounted for both the largest share of annual operating costs (~45%) and of annual production (65%).

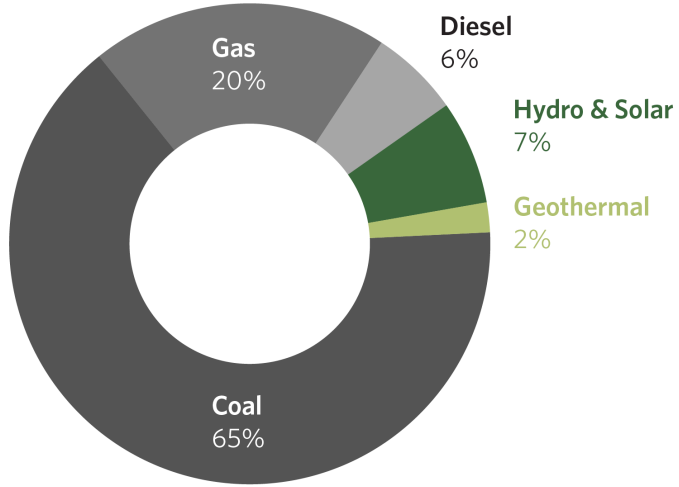
Gas and diesel also incurred significant costs (~35% and ~15% respectively) but contributed far less to annual production (~20% and ~6% respectively), indicating higher costs of production.

Renewables in PLN-owned power plants' energy mix produced the least (5%) and incurred relatively low cost (9%). Indicating a lower overall investment in renewables by PLN in this period.

Average Annual Operating costs of PLN Power Plants (By Type), 2019-2022, in %



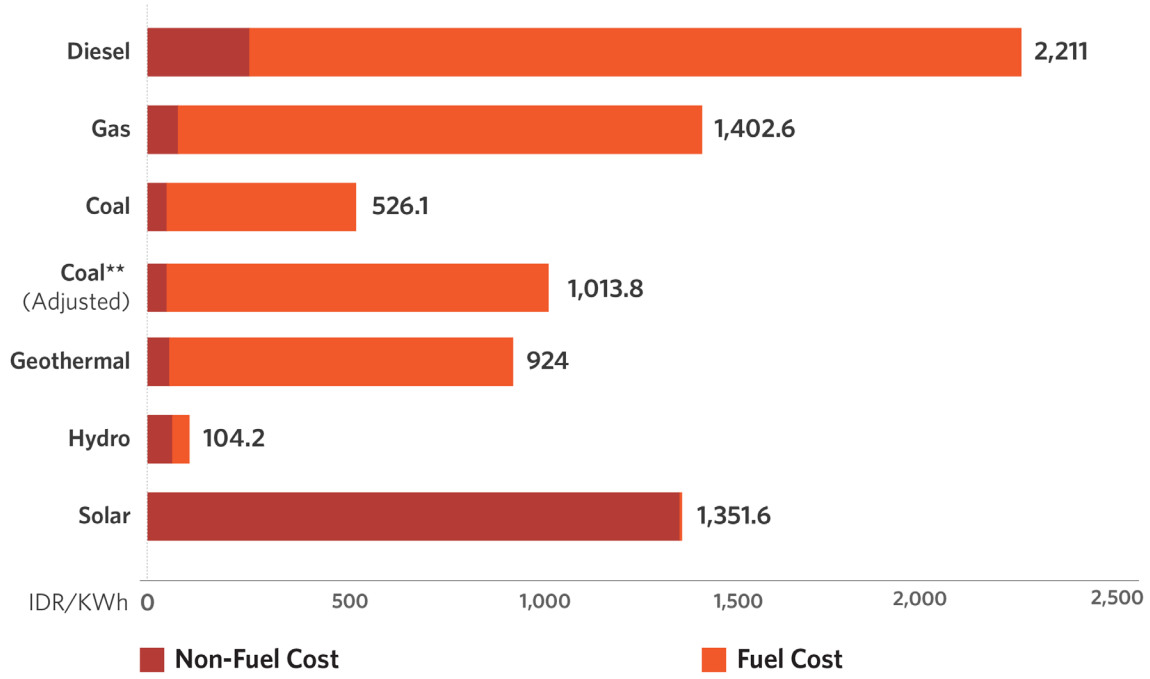
Average Annual Production of PLN Power Plants (By Type), 2019-2022, in %



Main Contributor of Operational Cost

Fuel costs contribute the most to Operational Costs per unit production for power plants (excluding Hydro & Solar)

Operational Costs* Per unit production (by type), 2019-2022, IDR/Kwh



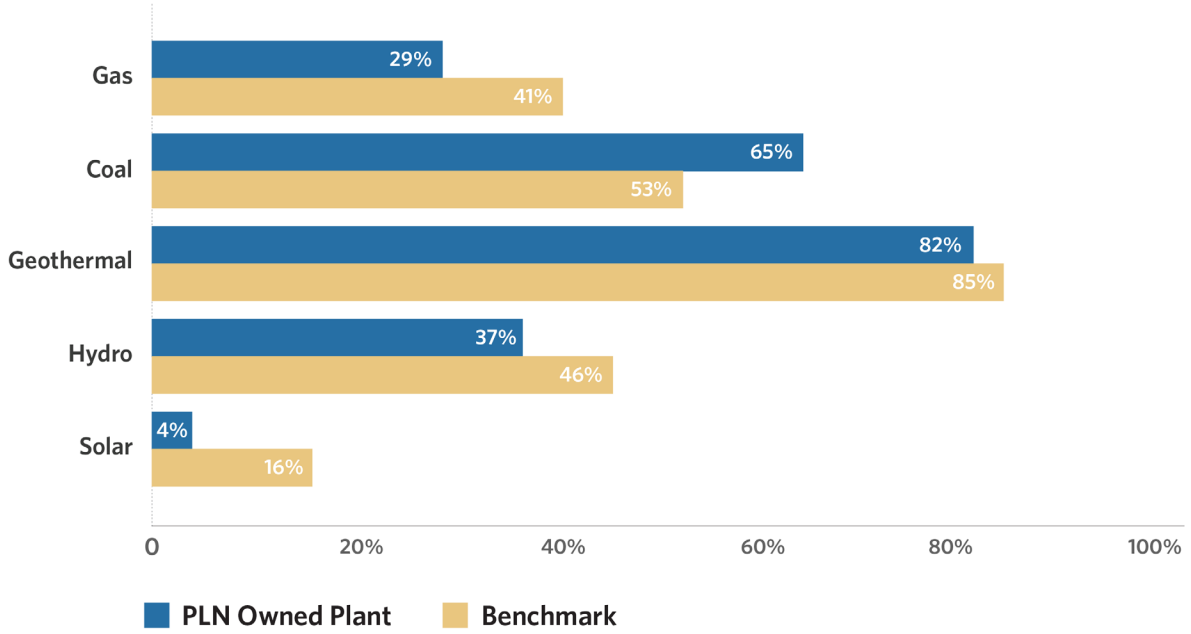
- The most expensive operation cost is Diesel PP (IDR 2.2k/KWh), followed by Gas PP (IDR 1,4k/KWh) and Solar PV power plants (IDR 1,4k/KWh).
- For Coal, we can see the effect of government's Domestic Market Obligation (DMO), which fixed the price of coal at a certain for domestic buyers, often lower than export market price. This distorted the operational costs of Coal power plants to become significantly lower.
- If we adjust the price of coal using export market price, operational cost of coal power plants doubled (IDR 0,5k/KWh vs. IDR 1.0/KWh).

* Excludes depreciation costs
**Coal (adj) adjusts Coal fuel costs into the Coal Indonesia Export Prices based on MEMR Statistics Report in 2023
*** Data Source: Computed from PLN statistics 2019 - 2022

Capacity Factor and Operational Cost

PLN-owned Solar PV has lower recorded capacity factor, contributing to lower production and higher operational cost per production

Average Annual Capacity Factor (by type), 2019-2022



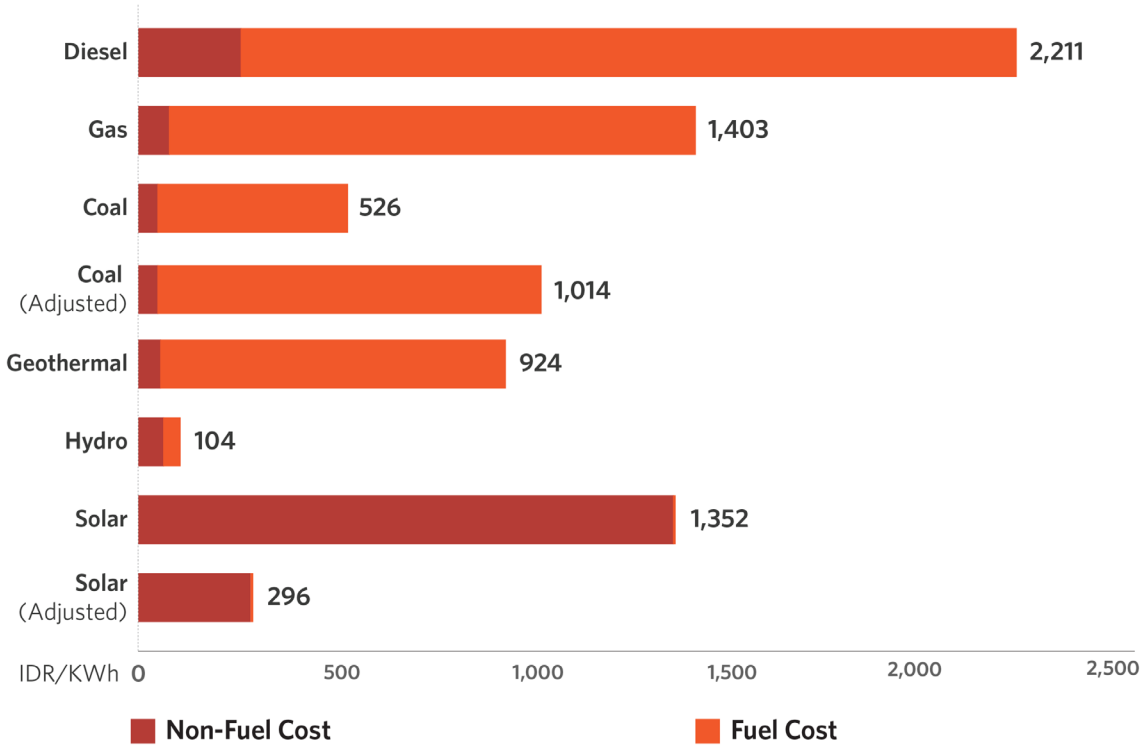
- **Capacity factor** refers to the ratio of the actual output of a power plant over a period to its maximum potential output/installed capacity.
- For Solar power plants, the higher costs per unit production as compared to coal is due to PLN's owned solar power plants operating at a below average capacity factor relative to its benchmarks.
- Meanwhile other types of powerplants perform relatively close to their benchmarks.

1. Hydro includes Mini Hydro
2. Benchmarks notes: Gas, Coal and Solar uses Southeast Asia averages, while hydro and geothermal uses global averages
3. Source : PLN statistics (2019 – 2022), GEM - Race to the Top Southeast Asia 2023 Methodology (2023), IRENA (2023)

Scenario Analysis

PLN-Owned Solar PV power plants with 'adjusted' capacity factor has significantly lower operational costs.

Operational Costs Per unit production (KWh)
2019-2022, by type, in IDR/KWh



- If adjustment is made to the capacity factor of Solar PV, such that it is more aligned with regional benchmark, and with the same total cost of production, there would be a significant decrease in its operational cost compared to that of other power plant types.

- The below-average capacity factor of PLN solar PV could be attributed to:
  - **Curtailment** - not all electricity production can be absorbed by the grid.
  - **Low efficiency of operations/technology used** that can cause low production of Solar PV.

  More data on the above root causes is needed to close the gap between the capacity factor of PLN solar PV with its regional benchmark. This will significantly reduce its operational costs (as modeled in the graph).

Notes:
- Excludes depreciation costs
- Coal (adj) adjusts Coal fuel costs into the Coal Indonesia Export Prices based on MEMR Statistics Report in 2023
- Solar (adj) adjusts operational costs using average of Southeast Asian Solar PV capacity factors as reported in GEM 2023

Data Source: PLN statistics 2019 – 2022 (2023), MEMR Statistics Report (2023), GEM - Race to the Top Southeast Asia 2023 Methodology (2023)

Recommendation and Next Step

CLIMATE POLICY INITIATIVE

Conclusion

- Data transparency, especially in the use of public funding, is necessary to allow public monitoring and evaluation. Moreover, the lack of data granularity, either in public funding or private funding spending/use, creates data gap for further analysis.
- Unreported investment in fossil fuel sector can lead to inaccurate knowledge of climate finance flows and thereby climate commitments.
- Foreign investors, mainly for captive power, contribute significantly to the continuity of fossil fuel development in Indonesia.
- PLN still relied on government's subsidy to cover its operational cost, which is mostly for fossil fuel power plants operations.
- The implementation of DMO in coal has resulted in the lower production cost of coal-fired power plants (CFPP) compared to Geothermal and Solar PV. This has created the impression that RE power plants have higher operational cost than CFPP.
- Using the market price of coal creates a higher operational cost of CFPP than RE power plants.
- Capacity factor of solar PV power plants in Indonesia is 4 (four) times lower than its regional average. This has significantly contributed to its higher operational cost.

CLIMATE POLICY INITIATIVE

Recommendations

- Public spending, especially for developing public facilities, such as power plants, should be publicly available and accessible.
- Investors for captive power plants, either from local or foreign investors, should share details of their investment spending and purpose, at least to the government.
- Spending in multipurpose investments, such as Green Credit Portfolio and Capital Injection to SOE, should be classified based on the type of investment/infrastructure developed.
- Subsidy should be strategically directed to areas that support the achievement of Indonesia climate targets.
- RE feed-in tariff should not be benchmarked with fossil fuel price that is still heavily subsidized.
- Improving capacity factor of PLN Solar Power Plants will decrease its operational cost.

Next Step

- We will be seeking access to State budget (APBN) public spending from 2022 onward to update the power sector finance flow.

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CLIMATE POLICY INITIATIVE

Thank You