CIF CLIMATE INVESTMENT FUNDS

ReACT:

A simplified guide to repurpose coal assets

- *Annexes*

/ March 2023

DISCLAIMER

www.climateinvestmentfunds.org

This publication was produced by the Climate Investment Funds (CIF); however, the findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of CIF, its governing bodies, or the governments they represent. While reasonable efforts have been made to ensure that the contents of this publication are factually correct, CIF does not take responsibility for the accuracy or completeness of its contents, and shall not be liable for any loss or damage that may be occasioned directly, or indirectly, through the use of, or reliance on, the contents of this publication.

This report is based on data and research conducted till August 2022. More recent data may have become available since the research was completed.

This work was funded by the CIF Technical Assistance Facility.

TABLE OF CONTENTS

1. Introduction

Launched in 2021, the CIF's Accelerating Coal Transition (ACT) program is the world's first largescale dedicated coal phaseout effort. Given the extent of coal dependence in developing regions, and the challenges to be faced by the most vulnerable communities while phasing out coal and replacing it with clean and sustainable solutions, a comprehensive study was conducted to understand the most common obstacles to reducing coal dependence. It also covers the latest scalable clean solutions that can be utilized to ensure balanced progress in this broad exercise.

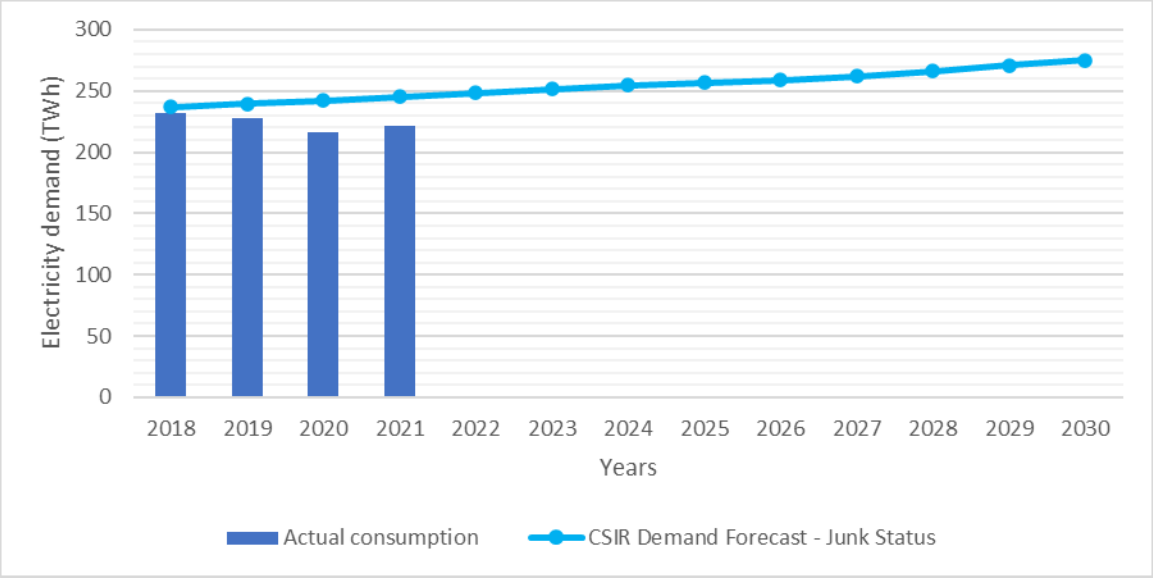
This Background document provides further detail for each of the case studies that built to the final conclusions in the main report. The approach was to conduct a landscape analysis of the sector through multiple angles of technical and financial health, policy and regulation, market readiness, risk assessments, among others. The broader contextual nuances of each country play into the overall analyses conducted, and the conclusive differing approaches to coal transition that may need to be considered.

2. Country Overview – South Africa[1]

2.1. Energy Outlook and Relevance of Coal

2.1.1. Energy Security Outlook of South Africa

In 2020 and 2021, the domestic electricity consumption of South Africa was around 216.0 TWh and 221.0 TWh respectively. When compared to previous years of 2018 and 2019, a reduction in consumption values in the range of approximately 3 percent and 7 percent were observed (Figure) [141]. While this decrease can be attributed to the impact of the pandemic (COVID-19), it is important to note that the consumption has not changed significantly over the last decade. Between 2010 and 2019, it has varied between 227.3 TWh (2019) and 240.5 TWh (2011). Over the last four years, the consumption was lower than even the lowest projections (i.e., the 'junk status') made by the Council for Scientific and Industrial Research (CSIR) in 2017 [142]. These projections, extending from 2017 up to 2050, were used as an input for the updated Integrated Resource Plan (IRP) published in 2019. In 2021, there was an uptick in the domestic consumption, increasing by 2.3 percent over the 2020 value to reach 221.0 TWh. Further, in 2021, South Africa exported 13.7 TWh and imported 10.1 TWh [141]. However, over the past years a drastic increase in power demand trend is not evident.

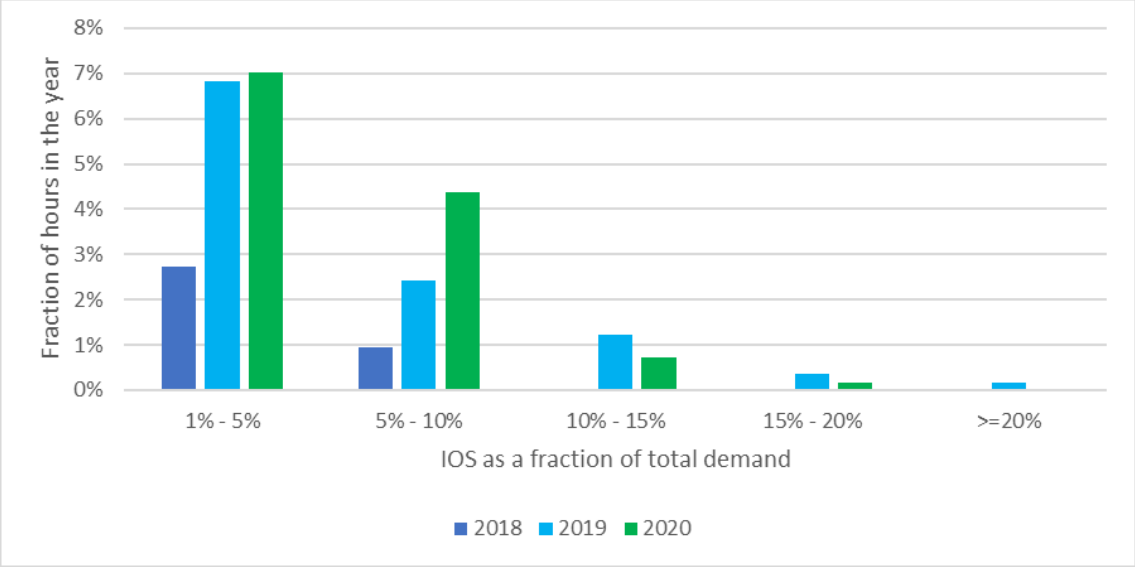


Source: Stats SA, DMRE Forecast for Electricity Demand

Figure 1. Energy Demand for South Africa

[1] The figures quoted in USD in this section have been calculated using USD/ ZAR exchange rate of 14.75

Despite the reduction in demand, the fraction of demand met through Interruption of Supply (IOS) actions such as load shedding has increased nearly four times between 2018 and 2020 from 0.18 percent to 0.69 percent respectively. Although this fraction is small, it can be observed from Figure that it has been driven by both low-impact and high-impact incidents. While the outage level did not exceed 20 percent of total demand in 2020, there was a significant increase in the frequency of outage levels between 5 percent and 10 percent. The increased use of IOS points to the inability of the system to meet demand in an uninterrupted manner even though the demand has slightly decreased over the past three years. This can be put down to three significant factors – unreliable generation, poor transmission network, and load reduction for commercial reasons.



Source: Eskom data, BV analysis

Figure 2. Use of Interruption of Supply (IOS)

As of 31 March 2021, the grid-connected installed generation capacity (excluding pumped hydro storage) in South Africa was reported to be 49,825 MW. Of this, Eskom, the state-owned integrated electricity utility, owned facilities with a cumulative capacity of 43,742 MW (87.8 percent) while 6,083 MW (12.2 percent) was under the ownership of independent power producers [59]. Further, of the total domestic generation of 244.3 TWh in 2021, 217.7 TWh (89.1 percent) was produced by Eskom [141]. Thus, the availability of Eskom power plants is a good indicator of the health of the overall generation ecosystem. The utility uses the following metrics to quantify the availability of its plants [143]:

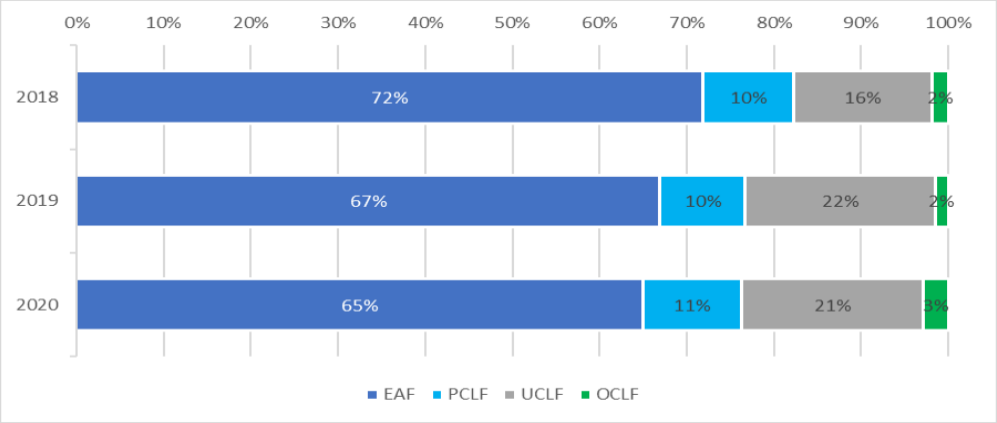
- The Planned Capability Loss Factor (PCLF) is the amount of time generation units were taken offline for planned repairs or maintenance and is calculated as a percentage of the total installed capacity over the same time frame.
- The Unplanned Capability Loss Factor (UCLF) is the amount of time generation units were taken offline for unplanned outages and is calculated as a percentage of the total installed capacity over the same time frame.

- The Operational Capability Loss Factor (OCLF) is the amount of time generation units were taken offline for outages caused by things that are outside of the unit's manager's control and is calculated as a percentage of the total installed capacity over the same time frame.
- The Energy Availability Fraction (EAF) is the fraction of the installed capacity that is available for generation and is calculated as a percentage of the total installed capacity over the same time frame.

Over any time period, the EAF, PCLF, UCLF, and OCLF add up to 100 percent.

From Figure , it can be observed that the plant performance has declined over the past three years, with the average EAF dropping from 72 percent in 2018 to 67 percent in 2019 to 65 percent in 2020. While PCLF has remained nearly the same across the three years, the level of non-planned outages, i.e., UCLF + OCLF has increased by nearly 5 percent between 2018 and 2019 and remained at the same level in 2020.

Eskom, which also undertakes the role of the System Operator in the country, cites prolonged poor maintenance of the older coal fleet and design defects in the newer units as significant reasons for the poor performance [144]. To remedy the situation, the utility had instituted the Reliability Maintenance Recovery (RMR) program in 2020. RMR was scheduled to be completed by September 2021; however, the scope of the program has now been extended to cover more generating units.



Source: Eskom data, BV analysis

Figure 3. Eskom Plant Availability

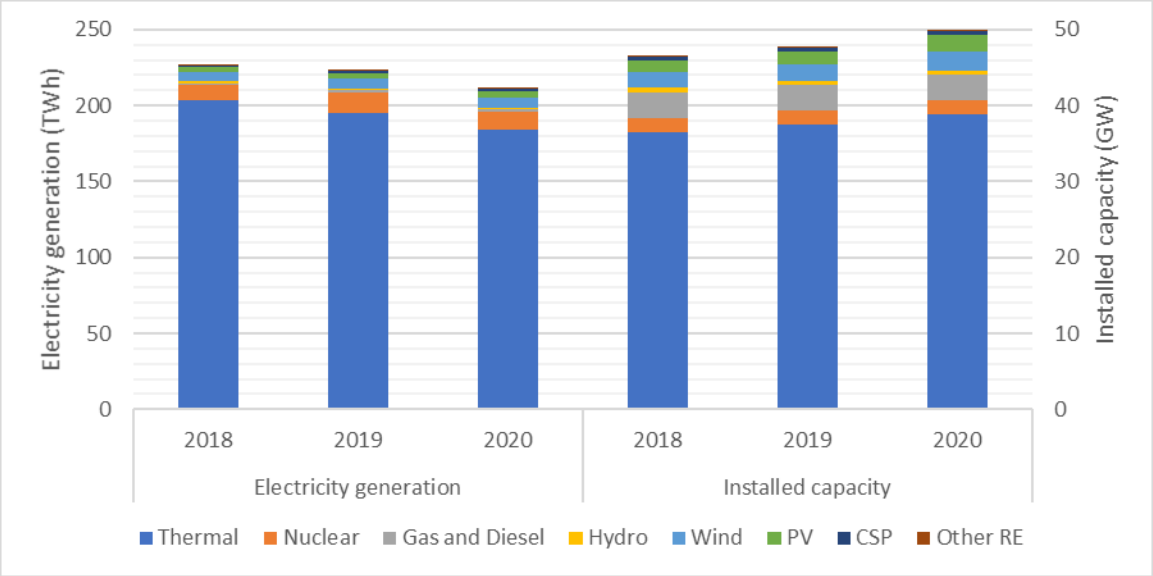
The average load factor, calculated as the ratio of the time-averaged generation to the total installed capacity, for 2021 was 56.0 percent. Thus, while the total installed capacity vis-à-vis the demand appears to be reasonable, factors such as ageing fleets, poor maintenance and design defects have caused the overall health of the power infrastructure system to be in a critical condition from the energy security perspective.

2.1.2. Relevance of Coal Generated Power

Coal has been the mainstay of South Africa's electricity sector, unlike the rest of sub-Saharan Africa, which is majorly reliant on hydro power [145]. From Figure , it can be observed that coal (thermal) contributes toward 85 percent of the total domestic generation. However, while the total domestic generation has decreased from 2018, the quantum of non-coal-fired generation has increased.

While generation from renewables has increased by 15 percent between 2018 and 2020, diesel-fired open cycle gas turbines owned by IPPs generated in 2020 more than double what they produced in 2018. In addition to being polluting, the latter is also significantly more expensive for Eskom as compared to self-generation or that purchased as a part of renewable power procurement programs [59].

All, except two, of the utility-scale operational coal power plants are owned by Eskom [146], whose fleet also consists of a nuclear power station, hydro stations, gas-fired stations, and a wind farm [59]. With coal power plants making up over 80 percent of the utility's installed capacity, it is clear that Eskom will be significantly impacted by decommissioning of these plants, as will South Africa's energy security, should the capacity shortfall not be made up timeously.

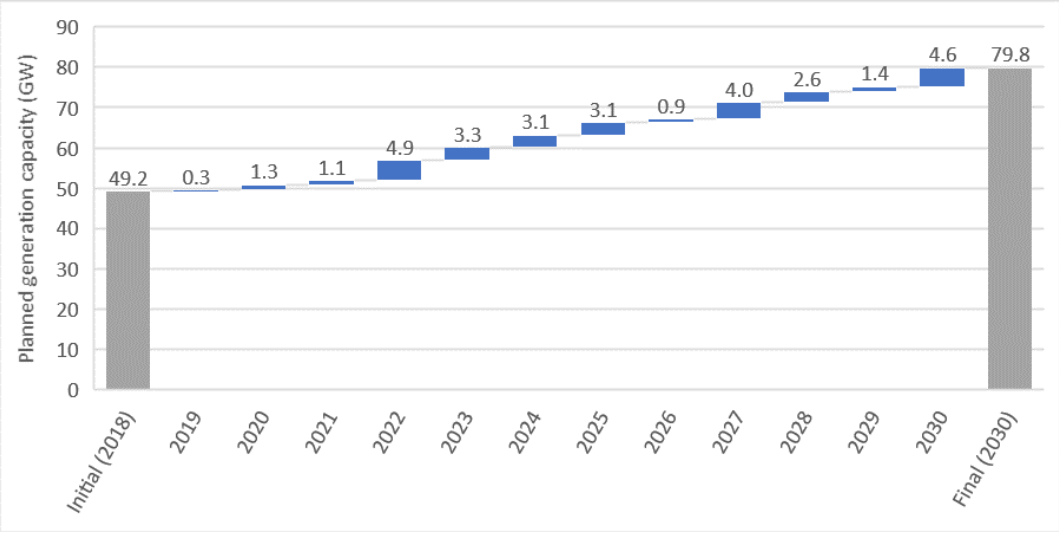


Source: Eskom data, Eskom Integrated Reports (Installed capacity for a year denotes the installed capacity as of March 31 of the next year)
Note: CSP - Concentrated solar power, PV- Photovoltaics

Figure 4. Share of Sources in the Power Sector

2.1.3. New Capacity Planning

The IRP 2019 guides the addition of new generation capacity up to 2030. Figure 0 provides the annual breakup of 30.6 GW of net new capacity additions as envisioned by the IRP over 12 years [147].



Source: Integrated Resource Plan 2019

Figure 0. Planned New Installed Capacity (IRP 2019) by Timeline

According to the IRP 2019, over 10.5 GW of installed coal-fired capacity is set to be decommissioned by 2030. Table provides the decommissioning schedule for coal power plants projected to be retired by 2050 as provided in the IRP [147], along with their installed and nominal capacities as provided in Eskom's Integrated Report 2021 [59]. The difference between the installed and nominal capacities reflects auxiliary power consumption and reduced capacity caused by the age of the plant. Further, the non-zero nominal capacity of Grootvlei and Komati Power Plants implies that they have not been completely decommissioned yet.

Table 1. Decommissioning Schedule as per IRP 2019

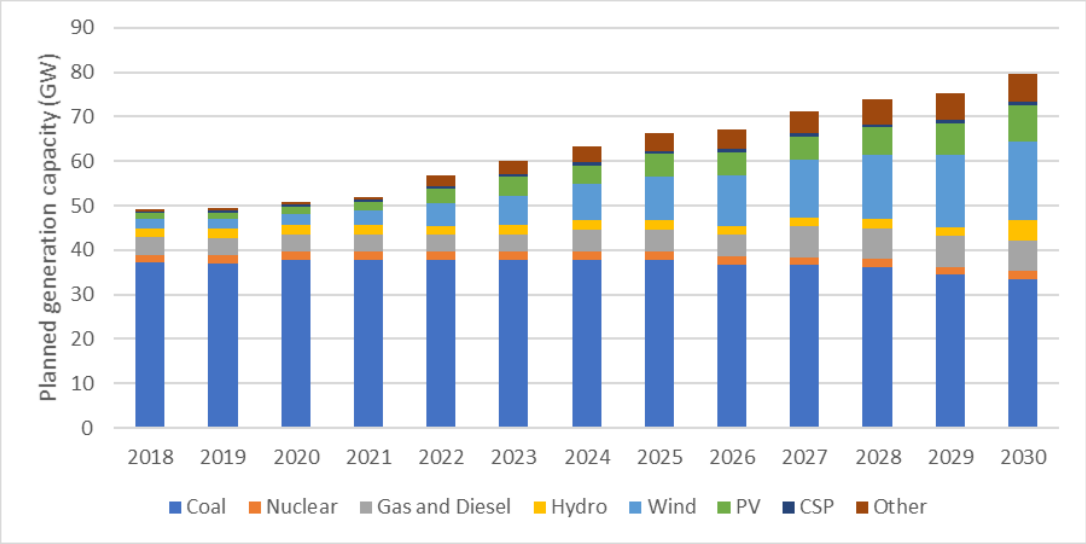
Sr. No.	Coal power Plant	Installed Capacity (MW)	Nominal Capacity (MW)	Decommissioning Period
1	Grootvlei	1,180	570	2018 – 2020
2	Komati	990	114	2019 – 2020
3	Camden	1,561	1,481	2020 – 2023
4	Hendrina	1,760	1,135	2020 – 2026
5	Arnot	2,220	2,100	2021 – 2029
6	Kriel	3,000	2,850	2026 – 2029
7	Matla	3,600	3,450	2029 – 2033
8	Duvha	3,000	2,875	2030 – 2034
9	Tutuka	3,654	3,510	2035 – 2040

Sr. No.	Coal power Plant	Installed Capacity (MW)	Nominal Capacity (MW)	Decommissioning Period
10	Lethabo	3,708	3,558	2035 – 2040
11	Matimba	3,990	3,690	2037 – 2041
12	Kendal	4,116	3,840	2038 – 2043
13	Majuba	4,110	3,843	2046 – 2050

Source: IRP 2019, Eskom Integrated Report 2021

Other than the Medupi Power Station (latest unit commissioned in August 2021) and Kusile Power Station (under construction), the IRP envisions an addition of 1.5 GW of new coal capacity by 2027. The bulk of new capacity addition, however, is set to be in wind (15.8 GW) and solar photovoltaic (PV) (6.8 GW). As a result, the shares of wind and solar PV in installed capacity would rise from 3.8 percent and 2.9 percent in 2018 to 22.7 percent and 10.6 percent respectively by 2030. Correspondingly, their contributions to annual generation are also expected to reach 17.8 percent and 6.3 percent. The plan also envisages conversion of diesel-fired plants to gas-fired facilities and an additional 3 GW of gas-fired capacity. While this capacity would be required to back up renewables initially, the IRP forecasts that their utilization would drop significantly over time, as it is limited by the availability of gas. As the fixed costs need to be recovered regardless, a lower load factor would lead to higher levelized cost of offtake to make the project viable. Thus, the development of new gas-powered facilities must be accompanied with investments in infrastructure to enhance the availability of gas, through domestic production as well as imports.

Figure 6. gives the break-up by source of the generation capacity as per IRP 2019. Here, 'Other' includes distributed generation, cogeneration, biomass, and landfill. The allocation under this category in 2022 also includes 2 GW of generation capacity contracted under the Risk Mitigation IPP Procurement Programme (RMIPPPP) in 2021. This was a technology-agnostic power procurement program specifically aimed at procuring dispatchable and flexible generation from IPPs. Successful project bids comprise of at least one of gas turbines and PV-with-storage [148] [149]. Although this capacity was scheduled to come online by 30 June 2022 [150], the announcement of the successful bids was delayed by six months. This could result in a corresponding delay in the addition of capacity to the grid.



Source: Integrated Resource Plan 2019

Figure 6. Planned Generation Capacity by Source

In addition to the planned generation capacity above, IRP 2019 envisions an expansion of utility-scale storage capacity from the current 2.9 GW to 3.4 GW by 2022 and 5 GW by 2029 [147]. Although, pumped hydro is currently the only form of storage, preference for a specific technology is not mentioned.

As discussed above, while the actual demand has been lower than the forecast, reliability issues in the coal-dominated generation fleet have still necessitated increased load shedding. In addition, they have also led to increased utilization of expensive diesel-fired peaking power plants. As per Eskom's assessment, a continued EAF of 66 percent will cross the system inadequacy thresholds within the next five years assuming no new capacity is added after 2020 [144]. Further, even if the capacities contracted under the recent procurement programs start commercial operation as scheduled, achieving system adequacy would require the continued operation of coal power plants in violation of the Minimum Emission Standards (MES), that are statutorily supposed to be shut down. This underlines the precarious situation of energy security in South Africa.

While new generation capacity is focused on gas and renewables, coal would continue to play a significant role in at least the next decade according to the IRP. Therefore, the accelerated decommissioning of coal power plants would be enabled by two levers:

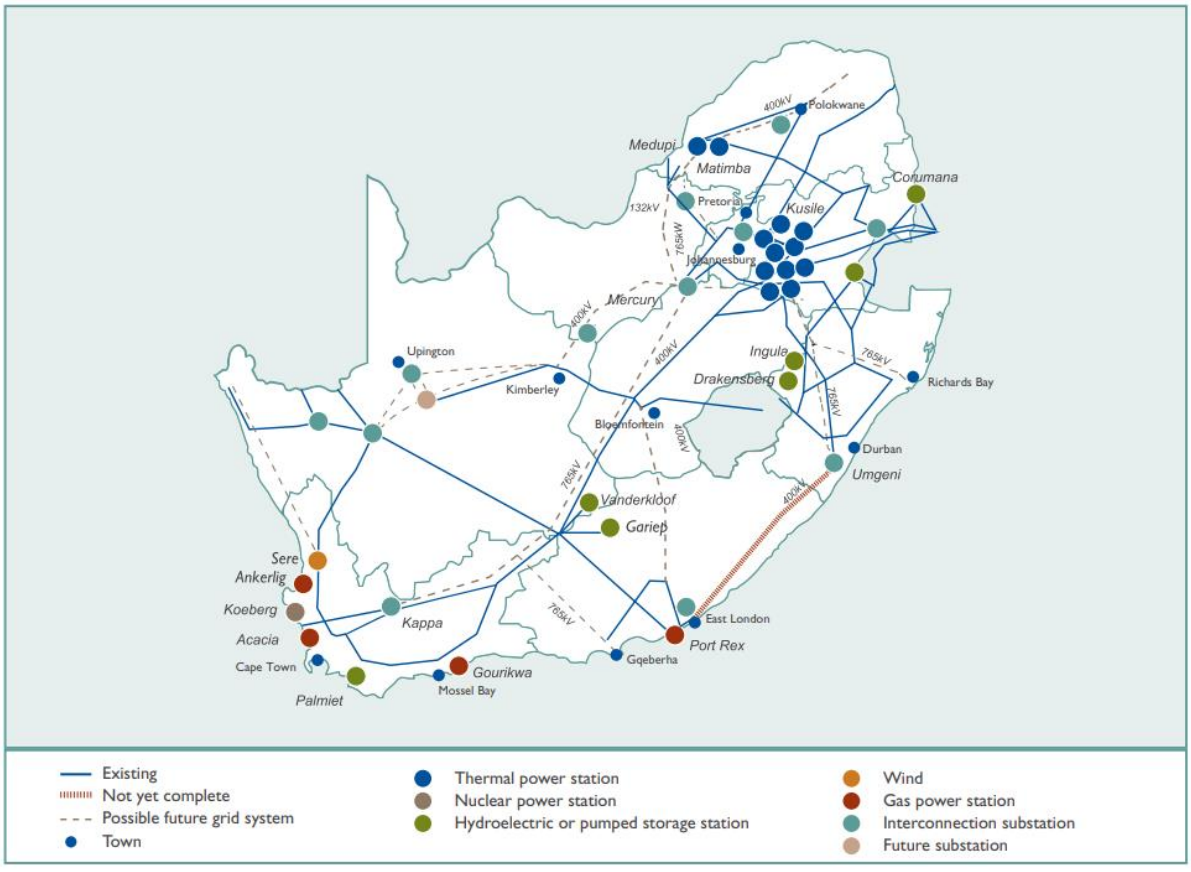
- Deployment of renewables and utility-scale storage beyond what has been planned in the IRP – This would lower the share of coal in the generation mix without adversely impacting the energy security
- A rapid, significant, and sustained improvement in the reliability of the newer coal-powered generation fleet – This would allow the accelerated retirement of the older coal-powered power plants.

2.1.4. Strategic Relevance of Coal

Coal is not just South Africa's major source of power, but also a significant contributor to the country's economy.

South Africa was the seventh-largest coal producer in 2019, with its production of 258.4 million tons accounting for 3.2 percent of the world's total production [1]. While the South African mining sector was responsible for over 7 percent of the country's GDP in 2019 [151], coal and lignite mining generated an income of R156 billion (USD ~10 billion), i.e., 28.3 percent of the total income from mining – the highest of any mining product. Coal contributed to more than 44 percent of all domestic sales from mining and 17.6 percent of all mining exports, underlining the importance of coal in the domestic value chain as well as international trade. Coal mining was also the second-largest employer in the mining sector, providing employment to 108,717 people in 2019 [152].

The importance of coal mining is even more apparent in the province of Mpumalanga, which also houses most of Eskom's generation facilities. Mining contributed to 21.2 percent of the provincial GDP in 2019 at current prices [151]. As of 2014, coal mining had contributed 83.6 percent to the gross value added by the mining sector in the province. Further, in 2014, two of the three districts – Nkangala and Gert Sibande – contributed to 96.4 percent of the mining sector and 83.8 percent of the utilities sector in the province [153]. The decommissioning of coal power plants without making up for the lost economic and social benefits, therefore, could deal a double blow to the economy in the area.



Source: Eskom Integrated Report 2021

Figure 7. Location of Eskom Generation Facilities

In energy terms, 97 percent of the coal produced in South Africa was of the non-coking bituminous variety. Nearly 30 percent of it was exported, with 60 percent of the rest used for generation of electricity.

2.2. Financing Landscape

The Republic of South Africa is among the largest economies of Africa. The country's GDP stood at USD 335.3 billion in 2020 [154] and is primarily driven by services, manufacturing, and mining activities. Economic growth has been continuously slowing down since the global financial crisis of 2008. Growth rates have remained below 2.0% since 2014 and turned negative at -6.4% in 2020 due to the crisis led by COVID-19 [154]. The South African economy faces the challenges of political and policy uncertainty, structural inequalities with persistently elevated unemployment rate (34.9% in the quarter ending on September 2021 [155]), and widespread poverty. The economy is expected to rebound sharply with GDP growth estimated at 5.0% in 2021 [154].

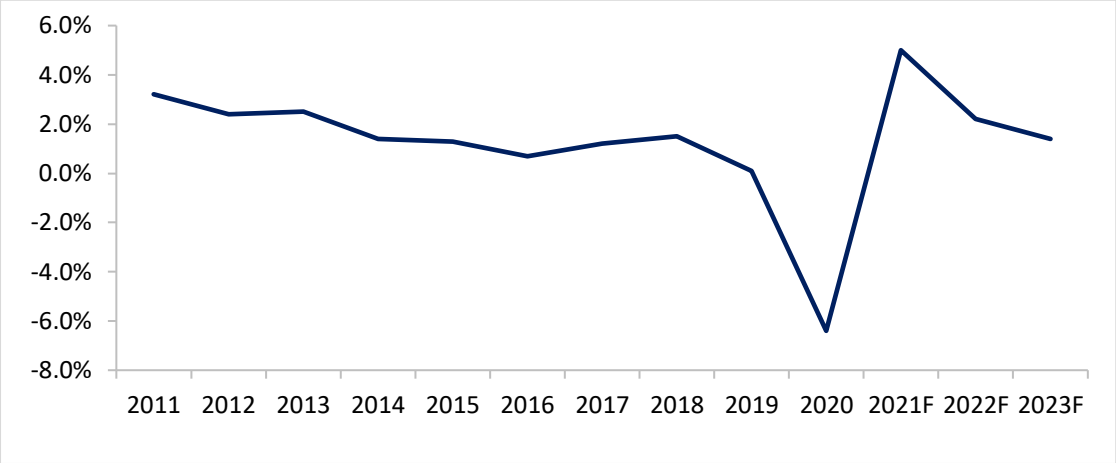


Figure 8. Real GDP Growth Rate (Annual,%) [154]

2.2.1 Public Finances

This section provides an overview of public finance sources (Government and Eskom) and their ability to finance coal repurposing initiatives in South Africa.

2.2.1.1. Government

The Medium-term Expenditure Framework (MTEF) estimates total public-sector infrastructure spending of USD 53.6 billion over the next three years [156]. SOEs are envisaged to contribute the most significant chunk at USD 19.1 billion, followed by USD 12.9 billion and USD 12.3 billion at the local and provincial level, respectively [156].

Table 2. Public-Sector Infrastructure Expenditure (Historical and Estimates) [156]

Particular	FY 2018A	FY 2019A	FY 2020A	FY 2021E	FY 2022E	FY 2023E	FY 2024E
Public-sector Infrastructure Expenditure	16.02	14.66	12.71	15.33	16.92	18.02	18.69

Particular	FY 2018A	FY 2019A	FY 2020A	FY 2021E	FY 2022E	FY 2023E	FY 2024E
Expenditure on Energy	3.74	2.71	1.78	2.12	3.00	3.41	3.76
Energy Expenditure as% of Total	23%	18%	14%	14%	18%	19%	20%

Further, Draft National Infrastructure Plan (NIP) 2050, published in August 2021, estimates infrastructure investment requirement of USD 422 billion by the public-sector between 2016 and 2040, with electricity and transport accounting for 72% [157]. The NIP 2050 estimated USD 146 billion investment is required to fill the gap between the current levels and the target levels of infrastructure investment.

In addition to the existing gap in the infrastructure funding as identified above, the Government of South Africa faces various other challenges such as low economic growth, below forecast tax revenue collection, rapidly rising debt levels, and struggling SOEs (which necessitate large-scale Government support). This is expected to constrain the Government's ability to finance coal repurposing investments.

The major roadblocks faced by the government have been covered below in brief:

- **Below Forecast Tax Revenues:** South Africa is in a relatively comfortable position compared to other African economies in terms of tax collections, with a tax-to-GDP ratio of 22.5% in FY 2021 [158]. However, subdued economic growth over the years has led to lower tax collections than the budgeted figures, resulting in a higher deficit than initial estimates and lower expenditure on capital investments. Over the years, focus of tax collection has shifted to individuals from corporates, and the latter contributed only 16.4% to total tax collections in FY 2021 [159]. Higher contribution of personal income tax and VAT, at 39.1% and 26.5% in FY 2021 [159], respectively, has resulted in increased reliance on labor activities and household consumption for tax collections.
- **Large Wage Expense:** Public-service compensation stood at USD 43.2 billion in FY 2021 and has accounted for over one-third of budgeted expenditure historically [160]. Wage hikes have been a contentious issue in South Africa, with public sector unions having called for multiple strikes over the last decade demanding wage increments. The Government's roadmap to fiscal consolidation relies heavily on containing the wage expenditure given that it forms an increasingly large portion of the budgetary allocation.
- **Increasing Fiscal Deficit and Rising Debt Levels:** Ever since the global financial crisis of 2008, the South African Government budget has been characterized by a large fiscal deficit. Consolidated budget balance stood at -14.0% of GDP in FY 2021 based on the revised estimate [160], primarily driven by the COVID-19, which pushed Government revenues lower and necessitated significant spending on support programs. The Government foresees to run fiscal deficit of -9.3%, -7.3% and -6.3% for the next three years [160]. Further, the gross Government debt stood at 80.3% in FY 2021 and is expected to reach 87.3% in FY 2024 based on medium-term estimates [160].

Debt-service costs are estimated to rise to 22.2% of revenues in FY 2024 from 15.2% in FY 2020, led by increased borrowings and higher interest rates [159].

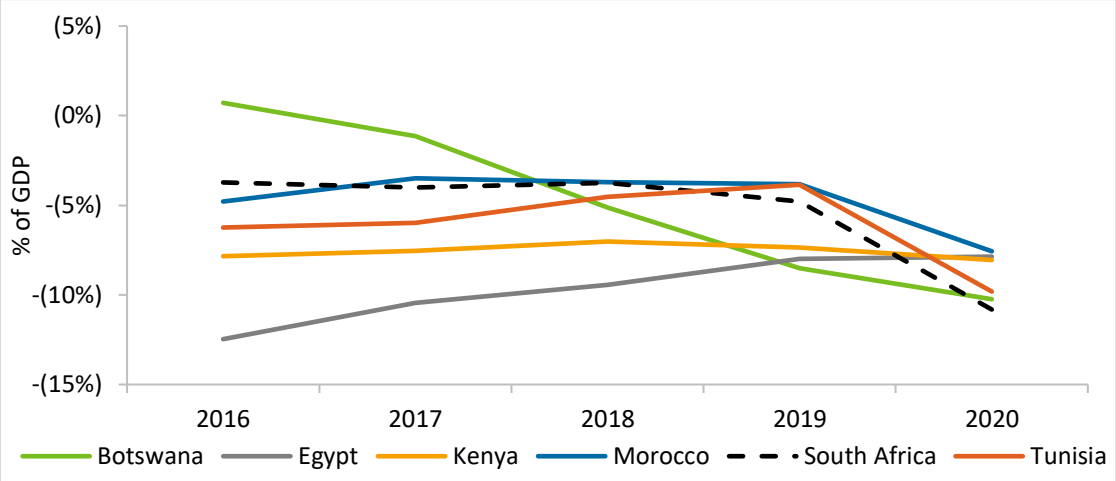


Figure 9. Fiscal Balance (% of GDP) [154]

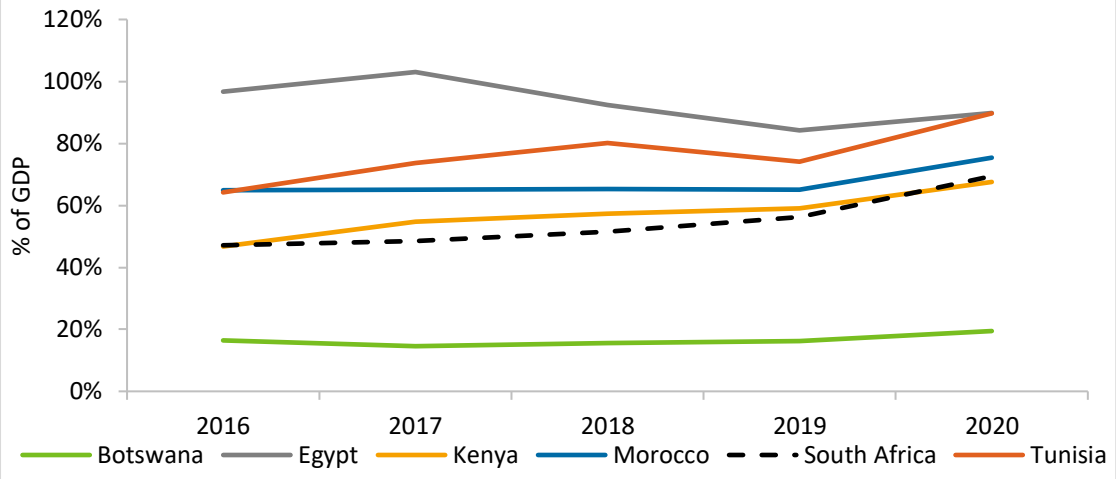


Figure 10. Government Gross Debt (% of GDP) [154]

- **<u>Contingent Liabilities and Provisions:</u>** Contingent liabilities and provisions for multilateral institutions stood at USD 100.8 billion in FY 2021 driven by government guarantees issued on behalf of various SOEs or for IPPs and other PPP projects. As highlighted above, the government debt is already high and is expected to increase in near term. High level of contingent liabilities coupled with high debt, severely limits government ability to take-up additional leverage for funding infrastructure investment.
- **<u>Sub Investment-Grade Rating:</u>** While overall debt levels are comparable to other economies in the region, the additional borrowing capacity of the South African Government is limited by its

non-investment grade sovereign ratings. Fitch, S&P, and Moody's downgraded South Africa's sovereign credit rating to non-investment status in 2017. Currently, the country is rated as BB-, Ba2, and BB- by S&P, Moody's, and Fitch, respectively [161] [162] [163]. The decline in the sovereign credit ratings has resulted in foreign investors pulling out capital from South African bond markets in recent years (foreign sector holdings of Government bonds slipping to 29.3% in March 2021 from 41.4% in December 2017 [164]), thus, limiting the source of funds for the country.

2.2.1.2. Eskom

Eskom is a vertically integrated electricity utility, with the Government of the Republic of South Africa as its sole owner. Eskom has a near-monopoly in the country's generation, transmission, and distribution (along with municipal distributors), with the company fulfilling over 90% of the electricity requirement of the country [165]. Eskom has significant exposure in coal generating assets with coal-fired power plant capacity of 43.3 GW out of the total installed capacity of 51.1 GW at March 2021 end [165]. Considering the significant share of coal-fired power plants in Eskom's portfolio, Eskom will naturally be at the center of in coal repurposing initiative in South Africa.

Eskom, widely regarded as the crown jewel among South Africa's SOEs, used to be a profitable and financially independent company in the early 2000s. Its generation was one of the lowest-cost globally, driven by abundant and easy-to-mine coal reserves of the country. However, the company has faced challenges on both the operational and financial front in the last decade, and its financial position has deteriorated such that Eskom needs continuous support from the Government to meet its capital requirements.

The same has happened due to the following reasons:

- **Heavy Generation Losses due to Limited Essential Maintenance:** Eskom added a limited capacity of ~2.1 GW in the first decade of the millennium compared to the electricity sales rising by 23.7% to 224.4 TWh in FY 2011. This led to a steady decline in the excess generation capacity. Reserve margin (representing the difference between net system capability and peak load), reduced to 5.6% in FY 2008 from 17.0% in FY 2002 [165]. Reduction in excess capacity forced Eskom to postpone planned maintenance of generation units, which was essential to ensure continued operations. Coupled with challenges in coal quality and an aging fleet (median age of the coal-fired fleet is close to 40 years currently), delayed maintenance resulted in a higher Unplanned Capability Loss Factor (UCLF) of 20.0% and reduction in average plant availability to 64.2% in FY 2021 [165]. Operational challenges arising from the continued deferral of plant maintenance, refurbishment, and replacement of plant assets and equipment impacted the financial performance of Eskom.

Table 3. Eskom Historical Operational Metrics [165]

Particular	Units	FY 2001	FY 2006	FY 2011	FY 2016	FY 2020	FY 2021
Capacity	MW	42,011	42,011	44,175	45,075	49,517	51,115
Electricity Sales	GWh	181,511	207,921	224,446	214,487	205,635	191,852

UCLF	%	NA	NA	6.1%	14.9%	22.9%	20.0%
EAF	%	92.0%	87.4%	84.6%	71.1%	66.6%	64.2%

- **Weaker Balance Sheet and High Debt Service Obligations:** Eskom is heavily reliant on debt with a gross debt burden of USD 27.2 billion as of FY 2021 end, with ~40% denominated in foreign currencies. While the debt-to-equity ratio has reduced from 3.17x in FY 2019 to 2.03x in FY 2021, net interest-bearing debt has primarily remained flat from USD 28.7 billion to USD 26.8 billion in the same period [165]. Reduction in debt-to-equity ratio was driven by capital injection from the Government (amounting to USD 3.3 billion and USD 3.8 billion in FY 2020 and FY 2021, respectively). The Government has further committed additional support of USD 2.1 billion, USD 1.5 billion, and USD 1.4 billion for the next three years to Eskom [165].

Table 4. Eskom Historical Balance Sheet Snapshot [165]

Balance Sheet (USD MN)	FY 2019	FY 2020	FY 2021
Total Equity & Liabilities	51,234	55,812	52,993
Equity	10,168	12,615	14,633
Debt Securities and Borrowings	29,872	32,792	27,242
Working Capital	3,454	3,722	3,545
Other Liabilities	7,740	6,683	7,573

Further, Eskom also faces the issue of increased receivables resulting from delays in collections from municipalities. Municipal debt in arrears has reached to USD 2.4 billion in FY 2021 from USD 0.6 billion in FY 2017, with another USD 0.5 billion of arrears due from Soweto small power user [165]. Rising working capital requirements and losses have resulted in volatile operating cash flows, which remain inadequate to fund even the interest component of debt service. The average cost of debt has steadily increased from 9.2% in FY 2018 to 9.7% in FY 2021 with capital expenditure reducing from USD 4.1 billion in FY 2017 to USD 1.6 billion due to continued liquidity constraints [165].

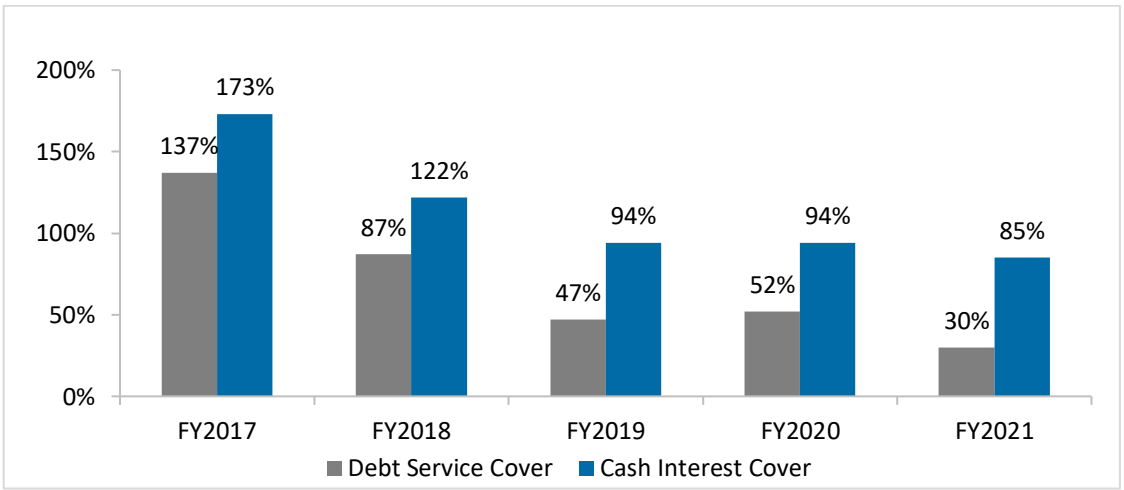


Figure 11. Coverage Ratio [165]

- **<u>Non-cost Reflective Tariffs Make Operating Existing Units Economically Unviable:</u>** While Eskom has been historically profitable (till FY 2016-17), margins have been very volatile in the last decade. Growth in revenues has been driven by tariff hikes in the previous decade, with electricity sales peaking in FY 2012 at 224,785 GWh and have steadily declined since to 191,852 GWh in FY 2021 [165].

  While the tariffs cover basic operating costs and hikes have historically outpaced inflation, they are not reflective of actual operating costs associated with aging plants and debt servicing costs, which has pushed Eskom into loss-making territory.

Table 5. Eskom Historical Financial Metrics [165]

Particular	Units	FY 2001	FY 2006	FY 2011	FY 2016	FY 2020	FY 2021
Electricity Revenue	ZAR BN	24.98	35.51	90.38	161.69	197.31	202.64
PAT	ZAR BN	2.56	4.64	5.81	5.15	(20.77)	(18.93)
Electricity Tariff	ZAR per MWh	137.6	170.5	402.7	762.4	1,018.6	1,110.4
Electricity Operating Cost	ZAR per MWh	119.0	139.9	327.8	628.0	803.0	905.3

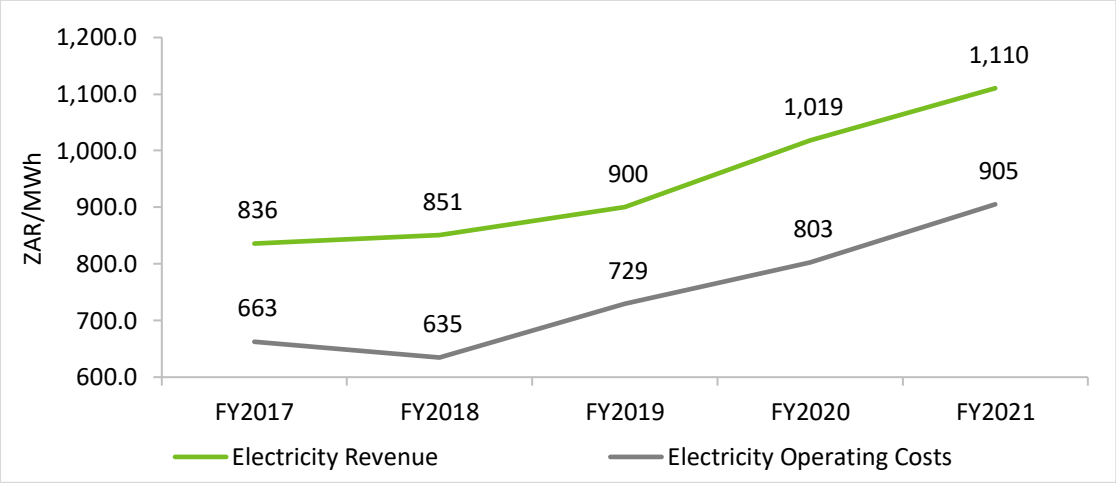


Figure 12. Tariff and Costs per Unit (ZAR / MWh) [165]

Table 6. Eskom Historical Income Statement [165]

Income Statement (USD MN)	FY2019	FY2020	FY2021
Revenue	12,342	13,607	14,033
EBITDA	2,130	2,496	2,225
% Margin	*17.5%*	*18.5%*	*16.1%*

Operating Profit	114	613	393
% Margin	*0.9%*	*4.5%*	*2.8%*
PAT	(1,419)	(1,408)	(1,284)
% Margin	*-11.5%*	*-10.3%*	*-9.1%*

The National Energy Regulator of South Africa (NERSA) determines Eskom's revenue and allowed tariffs on a multi-year basis through the implementation of Multi Year Price Determination (MYPD) methodology and broader stakeholder consultation. MYPD3, applicable from April 2013 to March 2018, allowed an average tariff hike of 8% over the 5-year period, against an application for an average hike of 16%. Eskom applied for an average annual tariff hike of 15% under MYPD4, to be implemented from April 2019 to March 2022. However, NERSA allowed hikes of 9.4%, 8.1%, and 5.2% only, resulting in a revenue shortfall of USD 6.9 billion over three years. Historically, NERSA's final determinations have been lower than Eskom's application and resulted in tariffs that do not reflect actual costs leading to weakening financial position of the utility. Moreover, sharp hikes in tariff may not necessarily result in a positive impact on Eskom as some revenue gains are offset by lower volume, increased bad debt, and possible reduction in Government support.

- **Weak Credit Ratings Further Impact Already Strained Financial Position:** Fitch has rated Eskom's local-currency long-term rating at B (outlook stable). This rating is largely driven by strong Government linkages in the form of sovereign ownership and control, monopolistic position, and importance to the nation's economy. Eskom's ratings derive further comfort from continued equity injections and liquidity support extended to it by the state through budgetary allocations. Eskom is currently rated two notches below the country's sovereign rating with an SCP at CCC-. Sub-investment grade ratings reflect the company's worsening operational performance, non-cost reflective tariffs, weak liquidity and solvency position, and high leverage.

Eskom faces complex challenges, as discussed above, which is leading to deterioration in its operational metrics and degradation of its financial position. These challenges leave Eskom with very little room to take any initiative to reduce its dependency on coal generation as its primary focus is aimed at restoring the country's existing fleet to prevent recurring blackouts (deferment of necessary maintenance activities leading to high unplanned shutdown).

2.2.2. Financial Institutions / Banks

South Africa has a well-developed financial services sector which is dominated by private players. Institutions have fairly developed infrastructure capabilities and offer a wide range of products covering multiple market segments.

The South African banking sector has eighteen registered banks, four mutual banks, five co-operative banks, and thirteen local branches of foreign banks as of November 2021 [166]. There are 29 foreign banks with approved representative offices registered with Prudential Authority. However, the banking sector is heavily concentrated, with the five largest banks (Standard Bank,

FirstRand, Absa, Nedbank, and Investec) collectively holding 90.1% of total sector assets as of March 2021 [167].

Total assets of all registered banks have grown steadily to USD 448 billion in September 2021, up by ~36% from USD 330 billion in December 2016 [168]. However, credit extension has lagged in recent years, registering a growth of ~24% in the same period [169]. Credit growth has been low, reflecting relative maturity of the sector and restrained risk appetite due to subdued economic growth.

Given the size and scale of the banking system in South Africa, it is relatively well-placed to finance infrastructure projects compared to other sources of funds. However, participation of the banking sector in financing the infrastructure requirements of the country has been subdued compared to their capacity and faces several challenges despite being well-developed, well-capitalized, and having a strong balance sheet.

- **Lending is Concentrated Towards Households and the Public-Sector:** Bank credit is focused towards secured lending with home loans and mortgages, together accounting for 32.2% of total credit extended as of September 2021 [170]. Ownership share in sovereign debt securities of banks and monetary institutions has increased to 22.7% in March 2021 from 15.0% in December 2017 as the secondary market witnessed selling from foreign investors [59]. The increase in Government bondholding has reduced liquidity available on the balance sheet of banks and resulting in reduced ability to finance infrastructure projects.
- **Limited Bankability of the Available Infrastructure Projects:** Infrastructure projects, particularly those belonging to the energy and electricity sector, have Eskom or local municipality acting as the off-taker. These entities have weak financial position and revenue base with volatile cash flows. Political uncertainty and unpredictability in the regulatory framework add additional layers of complexity. These factors limit the lenders' appetite to undertake commercial and political risks associated with the infrastructure projects in the country.

Competitive Landscape in South African Economy for Renewable Transactions:

As highlighted in the earlier sections, markets would witness participation from broader base of financial institutions in the long term and align with the renewable energy projects, once precedent transactions for coal repurposing are suitably established. However, DFIs will take a lead in driving the projects towards successful implementation in the near-term.

In near term, participation landscape of financial institutions is expected look like following figure.

Parameters	DFIs	Local Commercial Banks	International Commercial Bank	ECAs
Tenor				
Margin				
Financial Structuring				
Liquidity				
Activity in Market				

Most Favorable Favorable Moderate Least Favorable

Figure 13. South Africa: Financing Landscape for Financial Institutions (Short Term)

The following figure highlights the availability of capital and key financing terms that might be offered by various lenders in the long term.

Parameters	DFIs	Local Commercial Banks	International Commercial Bank	ECAs
Tenor				
Margin				
Financial Structuring				
Liquidity				
Activity in Market				

Most Favorable Favorable Moderate Least Favorable

Figure 14. South Africa: Financing Landscape for Financial Institutions (Long Term)

An analysis of financing available for renewable energy projects undertaken in the country is presented below. It also looks at the investor base providing capital to these projects.

Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), launched in 2011 by the South African Government, aims to increase private participation and add renewable capacity in the country's energy sector. The program has seen an investment commitment of ZAR

192.6 billion through four bid windows (BW1, BW2, BW3, BW3.5, and BW4), with 92 awarded projects having an aggregate installed capacity of 6.3 GW [171]. REIPPPP has seen interest from local, regional, and international developers (including Old Mutual, Enel, IDC, Engie, and others) providing equity capital to the projects. Another central theme has been the partnership between local and foreign sponsors for equity participation in the projects. However, debt has been mainly contributed by local institutions with minimal foreign participation. The four large local banks and DBSA have participated in every bid window.

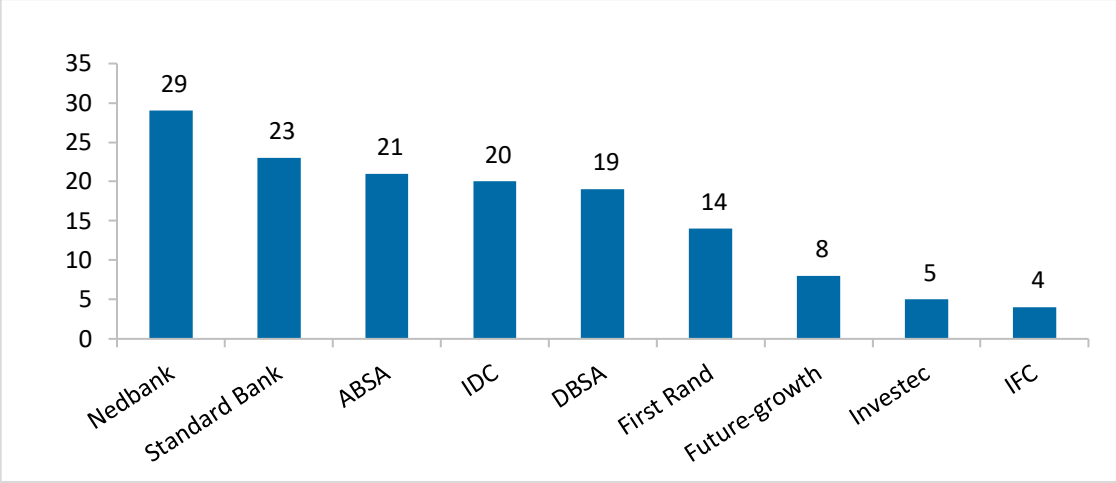


Figure 14. Number of Projects Financed by Major Lenders

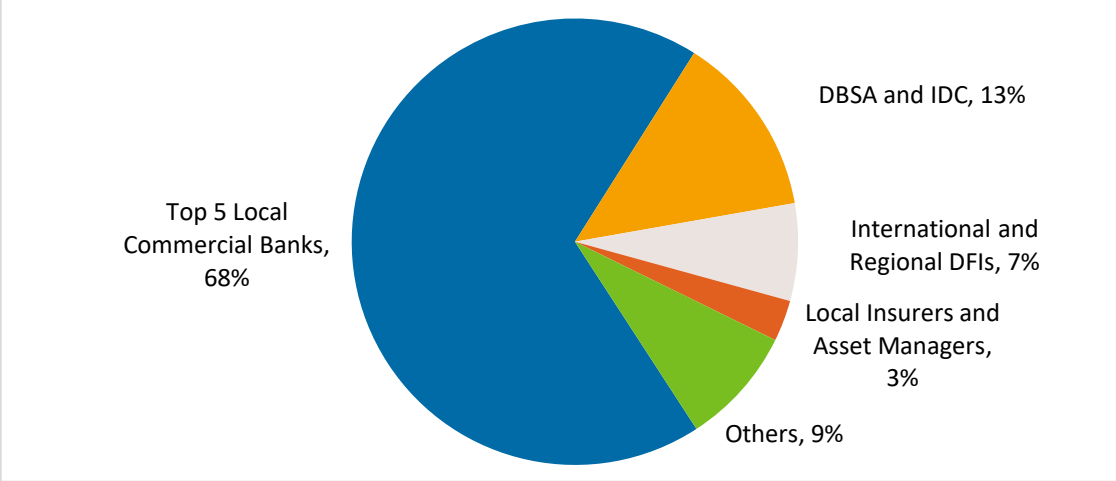


Figure 15. Debt Funding by Type of Lender (%)

Major highlights as evident from recent transactions in the renewable sector are summarized below:

- Local currency financing has been more common in South Africa in recent years
- DFIs generally participate with newer tech like batteries, renewable + battery, etc.
- Commercial banks generally provide aggressive margins as compared to DFIs in case of proven renewable projects like solar, wind, hydro, etc.

As mentioned above, it is envisaged that a similar trajectory will be followed by the coal repurposing activity as well with DFIs participating in the initial phases and commercial banks taking the lead after the implementation of a few projects.

2.2.3. Capital Markets

South Africa's equity capital markets are the most developed in the region in terms of market capitalization and liquidity. The market capitalization of all shares listed on South African exchanges stood at USD 1,254 billion as of September 2021 [155], well over 3x of GDP, and is comparable to most of the developed economies in this aspect. Johannesburg witnessed 58 IPO listings in the last ten years with an aggregate amount of USD 7.7 billion raised and accounted for over two-thirds of all Sub-Saharan exchanges [172].

South African debt capital markets are among the major source of financing for the economy after monetary institutions. The nominal value of outstanding bonds was USD 252 billion as of March 2021, up by close to 29% from USD 195 billion as of December 2018 [59]. The bond market is primarily dominated by the Government and SOEs, which accounted for 74.5% and 7.9%, respectively, of total outstanding bonds in March 2021 [59].Financial institutions accounted for another 13.5% of outstanding debt securities. The concentration is more pronounced in the trading activity in secondary market, with over 98% of volumes coming from sovereign bonds.

2.2.4. Green Bonds

South Africa has been focusing on the development of green bond markets as a viable option to fund sustainable development activities from the early stages. The country was the first emerging-market nation globally to issue a green bond with two issuances in 2012 [169] and alone accounts for almost two-thirds of cumulative issuances out of the African continent as of June, 2021 [173]. As part of the effort to bolster the green bond market in South Africa, National Treasury released a working draft of a green taxonomy for public consultation in June 2021 [62].

The South African green bond market has evolved over the years and has seen several notable green bond issuances, including:

- Industrial Development Corporation (IDC), South Africa's state-owned agency, which became the first green bond issuer in South Africa with its USD 700 million offering in 2012 [174]
- The City of Johannesburg issued a USD 99 million green bond in 2014, followed by the City of Cape Town issuing a USD 68 million green bond in 2017. These were the first municipal corporations to issue green bonds in Africa [171]
- Growthpoint Properties was the first non-financial private corporate from South Africa, with its USD 93 million green bond offering in 2018 [175]
- Standard Bank of South Africa issued a USD 200 million green bond in March 2020 on a private placement basis to IFC and was the country's first offshore green bond issuance
- IFC announced a loan of up to USD 150 million to the Absa Bank in May 2021 to increase funding for biomass and renewable energy projects in the country. This is the first green-certified loan in Africa, complying with the Green Loan Principles [176]

- The African continent has lagged other regions in issuing green bonds so far, with the continent accounting for USD 4.0 billion of cumulative green bond issuance out of USD 1,303.3 billion globally as of June, 2021 [175]. South Africa green bond issuance has seen only ten different issuers so far and has been dominated by large banks and sovereign or quasi-sovereign entities.
- Additionally, taxonomies are constantly evolving across the globe and diverge on their understanding of qualifying activities, the framework for monitoring, and protection against greenwashing. Moreover, internationally developed and accepted taxonomies may not be cognizant of local market dynamics and repurposing constraint that South Africa faces as a fossil fuel dependent country. Any misalignment can act as a bottleneck for the successful deployment of the funds and hamper the development of local green bond market.

2.2.5. Emissions Trading Instruments

A carbon tax in South Africa was introduced in June 2019, at a rate of ZAR 120 per ton carbon dioxide equivalent (tCO_2e) emissions, with rates standing at ZAR 134 per tCO_2e by end of 2021.

The national treasury has allowed industries to reduce emission taxes liability in the range of 5-10% by using a carbon offset allowance. This allowance is aimed to serve the dual purpose of incentivizing emission reduction in industries not covered by the tax and allow industries to implement mitigation measurements at a lower cost. Under phase 1, three different offset standards are allowed, including the Clean Development Mechanism (CDM), Verified Carbon Standard (VCS) and Gold Standard (GS), with domestic standards under development [177].

The South African carbon market, which was largely dormant, saw fresh activity in 2020 as carbon taxpayers flocked to the market with renewed interest to reduce their tax liability [178]. 3 million carbon credits were estimated to be traded in 2020. The Climate Neutral Group estimates supply of 3 million tonnes worth of credits in 2021 against demand of credits equivalent to 8-10 million tonnes. With most of the historical supply being exhausted, prices are expected to firm up.

Eskom, even though accounting for two-fifth of South Africa's emissions, is not allowed to generate carbon credits from taxable activities (given that stationary consumption is a taxable activity). The other half of the market is also concentrated with only a few large emitters. Since the emission sources in South African market are highly concentrated, carbon markets are also expected to be concentrated around a handful of participants and might not be favorable for carbon trading. Since the domestic carbon market is currently in a nascent stage in South Africa, the country may consider participation in the developed carbon markets which exist across the world. Such international markets may offer viable financing options for the repurposing initiative in South Africa in the longer run.

2.2.6. Conclusion

A summary of the capacity of various financing pool available in the economy to fund the large-scale coal repurposing exercise is presented in the table below.

Table 7. South Africa: Summary of Key Financing Pools

	Capability to Fund Transition		
Sources	**Short Term**	**Long Term**	**Comments**
Government	**Low**	**Low**	• The Government of South Africa has been running fiscal deficits to provide the necessary support to the population in the face of economic slowdown. • Large wage bills, below forecast tax revenues, high amounts of contingent liabilities due to government guarantees, and high-interest payments leave little room in the national budget for spending on infrastructure development activities (including any coal repurposing initiative). The sub-investment grade rating too has constrained the country's ability to fund large scale coal repurposing initiatives.
Eskom	**Low**	**Low**	• Eskom has been facing challenges on both the operational and financial front such as aging generation fleet, deferment of necessary maintenance activities leading to high unplanned shutdown time and rolling blackouts across the country in recent years, time delay and cost overruns in the commissioning of new capacities putting strain on financials. • Eskom relies heavily on continuous government support in the form of capital infusion and debt guarantees, it would have limited resources to fund coal repurposing initiatives.
Financial Institutions	**High**	**High**	• The banking sector in South Africa is fairly developed and dominated by five banks controlling over 90% of all assets. These large banks operate across the continent and have been a major source of capital for infrastructure projects historically. Domestic commercial banks have been leading financing in proven renewable deals (solar and wind), while DFIs are still more active in newer technology related to renewables (such as battery, etc.). As such active participation is expected from such DFIs on a short-term basis itself.

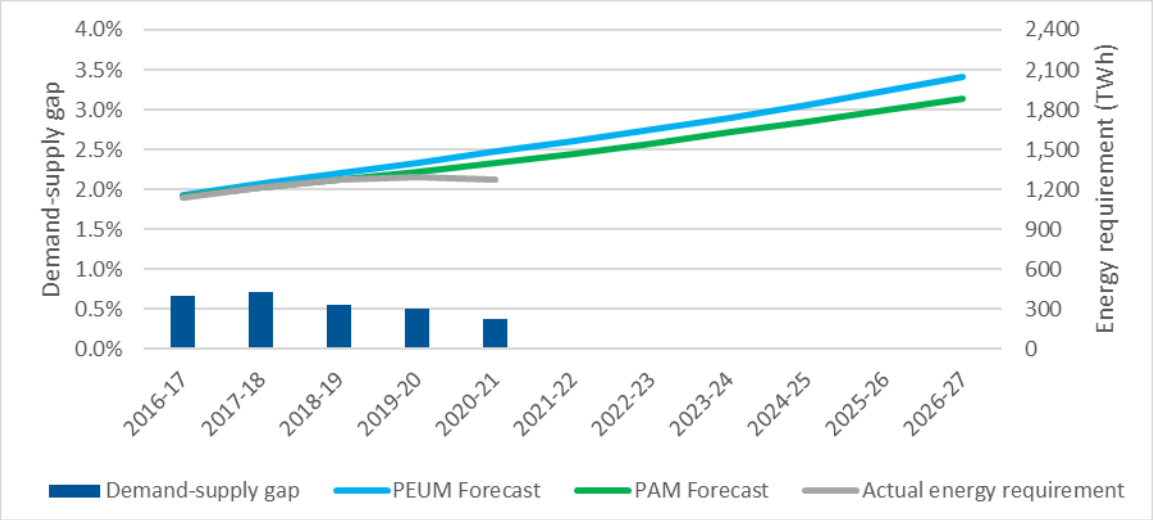
	Capability to Fund Transition		
Sources	**Short Term**	**Long Term**	**Comments**
Capital Markets	**Low**	**Medium**	• South African equity markets are most developed in terms of market capitalization and liquidity as compared to other major African economies, but the market is heavily concentrated and dominated by several large companies. • The bond capital market in the economy is also the largest among the emerging economies. However, it is primarily crowded by government and public entities, with private non-financial corporations having miniscule participation. Additionally, the non-investment grade credit rating of the country acts as an effective cap on domestic issuances and limit participation by foreign investors in the market. • While on short term basis, active participation is not envisaged, capital markets can potentially be a source of capital for coal repurposing on a long-term basis as and when the market gets further developed and liquid. • The green-bond market is still under development and may prove to be a suitable source of financing the coal repurposing projects in the longer run.
Carbon Markets	**Low**	**High**	• Carbon trading markets in South Africa are currently in a nascent stage. However, markets have witnessed renewed interest from participants, driven by offset allowance available under the country's carbon tax. • In the long-term, markets are expected to be a significant source of capital for coal repurposing project as volumes and prices improve and become favorable.

3. Country Overview – India[2]

3.1. Energy Outlook and Relevance of Coal

3.1.1. Energy Security Outlook of India

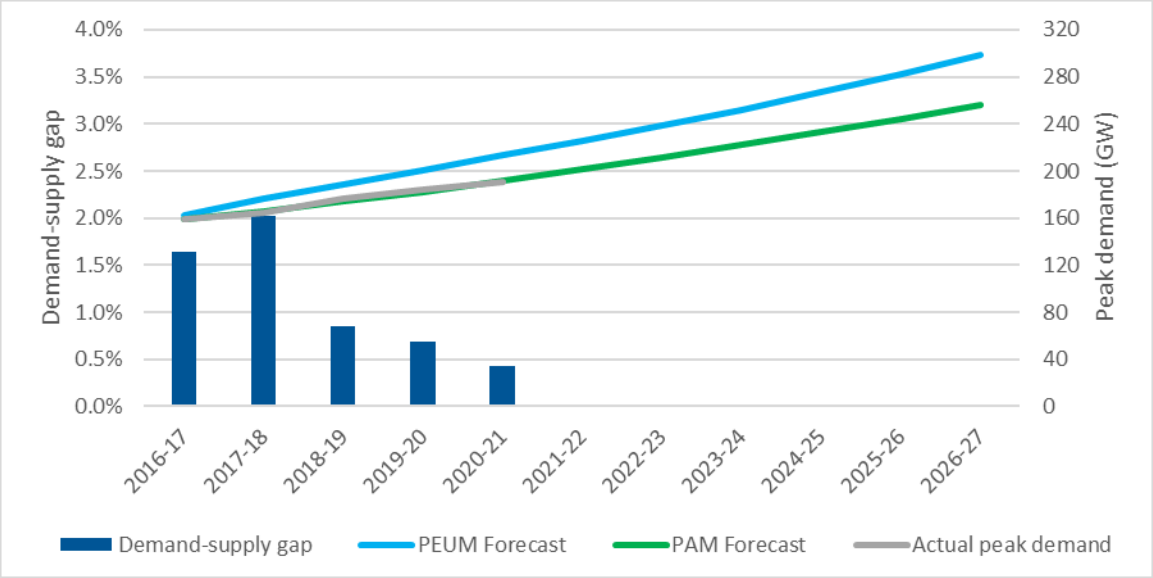
In the 19th Electric Power Survey (EPS) published by the Central Electricity Authority (CEA), the Partial End User Methodology (PEUM) and the Partial Adjustment Model (PAM) were used to forecast the demand from utilities [179]. From Figure, it can be observed that the actual energy requirement tracked the PAM forecast much more closely. Despite the growing demand, the reducing demand-supply gap shows that electricity generation has more than kept pace. Further, India also turned into a net exporter of electricity in 2017. The peak demand requirement has followed a similar trend, as can be observed in Figure .



Source: Electric Power Survey, CEA and Load Generation Balance Report (2017-18 to 2021-22), CEA

Figure 16. Utility Energy Demand and Supply

[2] The figures quoted in USD in this section have been calculated using USD/INR exchange rate of 75.0

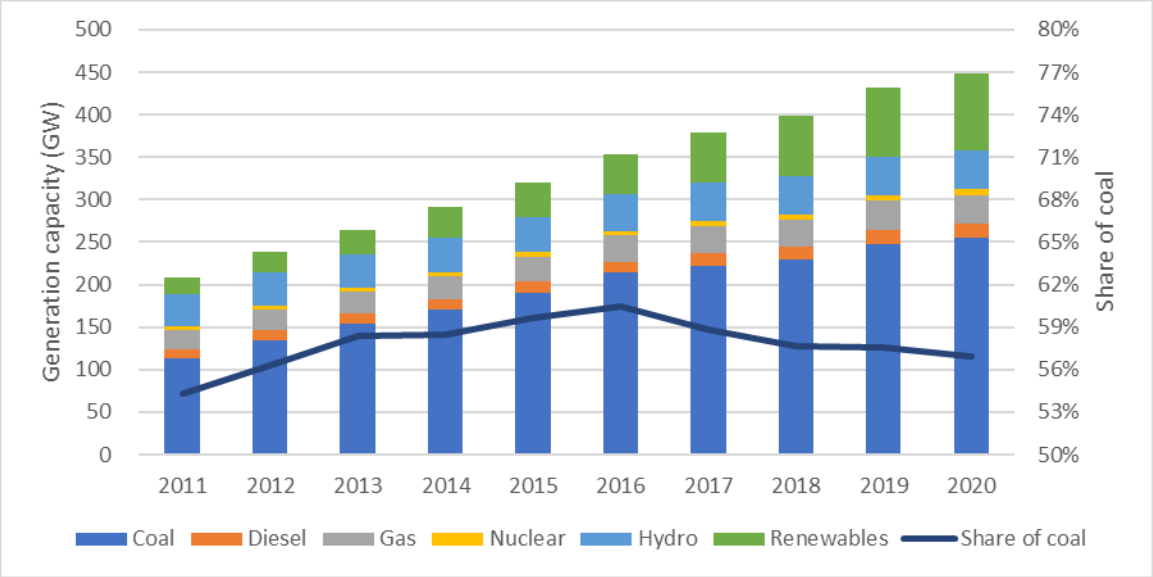


Source: Electric Power Survey, CEA and Load Generation Balance Report (2017-18 to 2021-22), CEA

Figure 17. Utility Peak Power Demanded and Met

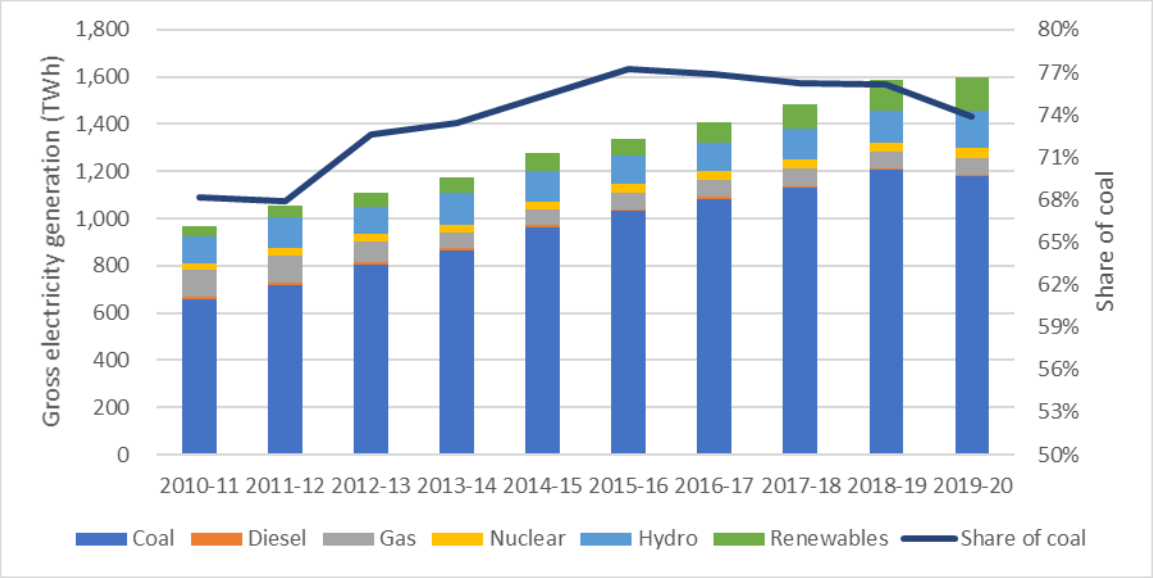
3.1.2. Relevance of Coal Generated Power

Coal power plants form the bedrock of the Indian power sector, contributing to just over half of the installed generation capacity (Figure). Over the last decade, the share of coal hit its peak in 2015-16 and has declined since then, as a result of slowing down of new coal capacity as well as the growth of renewables. Due to the lower capacity factor of renewables, coal power forms a higher share of electricity generation, producing nearly three-fourths of all electricity (Figure 19) [180].



Source: Energy Statistics 2021

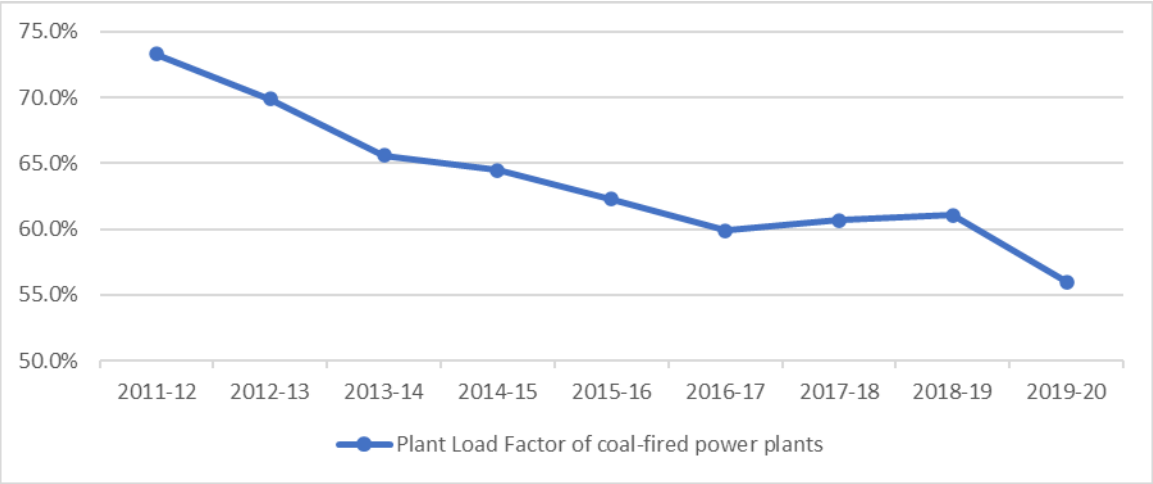
Figure 18. Installed Generation Capacity by Source (as on 31 March)



Source: Energy Statistics 2021

Figure 19. Gross Electricity Generation by Source

Although both, the installed capacity and electricity generation from coal power plants, have grown in absolute terms, the latter has grown more slowly than the former. This shows that the utilization of these power plants has decreased significantly over the years (Figure). A decreasing Plant Load Factor, the ratio of actual generation to possible generation at rated capacity, may affect the economics of the plant in two ways – operating a power plant at a lower PLF reduces its efficiency, thereby increasing the variable cost per unit, and the fixed costs have to be spread over a smaller quantum of units, thereby increasing the fixed cost per unit. While the actual impact depends on the plant-level generation pattern, the decrease in average PLF indicates there is scope to downsize the installed coal power capacity.



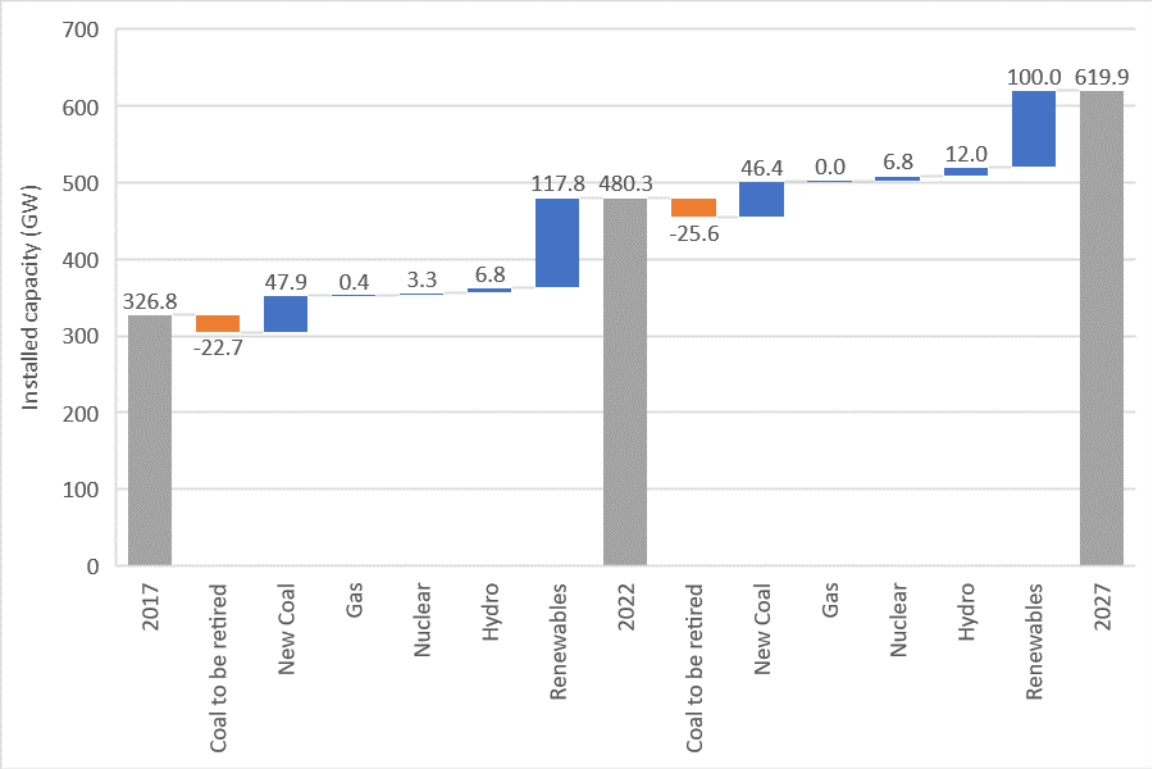
Source: Ministry of Power, India

Figure 20. Average Capacity Factor of Coal power Plants

3.1.3. New Capacity Planning

The National Electricity Plan (NEP) developed by CEA guides development of new generation capacity. From the baseline of 326.83 GW in 2017, the third NEP targets cumulative additions to utility-owned capacity of 176.14 GW and 341.36 GW by 2022 and 2027 respectively [181].

Figure provides the breakup of the new capacity addition as envisioned in the NEP for the two five-year time periods, 2017-22 and 2022-27. According to the NEP, only 6.4 GW of new coal-fired capacity is required between 2017 and 2022. However, at the time of the drafting of the NEP, projects totaling to 47.9 GW were already expected to come online in this period. Further, while 46.4 GW is allocated to new coal-fired capacity between 2022 and 2027, the plan states that this is peaking demand requirement that can be met by any conventional (dispatchable) source. However, the plan allots the capacity to coal as 88.4 GW worth of projects are already under various stages of development. This pipeline of new projects risks entrenching coal into the generation ecosystem and may create barriers in transitioning away from coal power.



Source: National Electricity Plan, CEA

Figure 21.Breakup of Planned Utility Capacity Addition by Source (2017-22 and 2022-27)

The list of coal power plants whose units are set to be retired between 2022 and 2027 according to the National Electricity Plan is given in Table.

Table 8. Coal-Fired Capacity to be Retired Between 2022 and 2027

Sr. No.	Power Plant	Ownership	State	Region	Capacity to be Retired
1	Kahalgaon TPS	Central	Bihar	Eastern	840 MW
2	Talcher STPS	Central	Odisha	Eastern	1,000 MW
3	IB Valley TPS	State	Odisha	Eastern	420 MW
4	Southern REPL	Private	West Bengal	Eastern	136 MW
5	DPL TPS	State	West Bengal	Eastern	110 MW
6	Mejia TPS	Central	West Bengal	Eastern	420 MW
7	Farakka STPS	Central	West Bengal	Eastern	1,600 MW
8	Kolaghat TPS	State	West Bengal	Eastern	1,260 MW
9	Dadri (NCTPP)	Central	Uttar Pradesh	Northern	840 MW
10	Rihand STPS	Central	Uttar Pradesh	Northern	1,000 MW
11	Singrauli STPS	Central	Uttar Pradesh	Northern	2,000 MW
12	Unchahar TPS	Central	Uttar Pradesh	Northern	420 MW
13	Anpara TPS	State	Uttar Pradesh	Northern	1,630 MW
14	Obra TPS	State	Uttar Pradesh	Northern	1,000 MW
15	Rayalaseema TPS	State	Andhra Pradesh	Southern	420 MW
16	Ramagundem STPS	Central	Telangana	Southern	2,100 MW
17	Korba STPS	Central	Chhattisgarh	Western	2,100 MW
18	Gandhi Nagar TPS	State	Gujarat	Western	420 MW
19	Kutch Lignite TPS	State	Gujarat	Western	215 MW
20	Ukai TPS	State	Gujarat	Western	610 MW
21	Wanakbori TPS	State	Gujarat	Western	1,260 MW
22	Sabarmati TPS	Private	Gujarat	Western	362 MW
23	Sanjay Gandhi TPS	State	Madhya Pradesh	Western	420 MW
24	Vindhyachal STPS	Central	Madhya Pradesh	Western	1,260 MW
25	Bhusawal TPS	State	Maharashtra	Western	420 MW
26	Chandrapur STPS	State	Maharashtra	Western	1,420 MW
27	Khaparkheda TPS	State	Maharashtra	Western	420 MW
28	Koradi TPS	State	Maharashtra	Western	420 MW
29	Nasik TPS	State	Maharashtra	Western	630 MW

Sr. No.	Power Plant	Ownership	State	Region	Capacity to be Retired
30	Parli TPS	State	Maharashtra	Western	420 MW
	Total				**25,572 MW**

Source: National Electricity Plan

Table compares the breakup of the actual installed capacity in 2021 and the planned installed capacity in 2022. While coal-fired and gas-fired capacities seem to be in the neighborhood of their targets, there is a significant gap for the other three especially for renewables. Although missing these targets would likely not result in an energy shortage as the total capacity planned for 2022 included an excess of 41.5 GW of coal-fired generation, it would represent a missed opportunity to reduce dependence on coal and could possibly lock in investments on these power plants.

Table 9. Breakup of Installed Capacity in Utilities by Technology as of 31 March – Actual and Planned

Source	2017	2020	2021	2022 (Planned)	Gap (2021 – 2022)
Coal	192.2 GW	205.1 GW	209.3 GW	217.3 GW	8.0 GW
Gas + Diesel	26.2 GW	25.5 GW	25.4 GW	25.7 GW	0.3 GW
Nuclear	6.8 MW	6.8 GW	6.8 GW	10.1 GW	3.3 GW
Hydro	44.5 GW	45.7 GW	46.2 GW	51.3 GW	5.1 GW
Renewables	57.2 GW	87.0 GW	94.4 GW	175.0 GW	80.6 GW
Total	**326.8 GW**	**370.1 GW**	**382.2 GW**	**479.4 GW**	**97.2 GW**

Source: CEA Reports on Installed Capacity (March 2017, 2020, and 2021) and National Electricity Plan

As the plan uses the PEUM forecast of the EPS and considering the impact of COVID-19, the current planned additions are likely to exceed the actual requirement. At the same time, the pandemic would have also delayed the construction of new power plants. Thus, it is necessary to revise demand forecasts as well as the schedules for new generation capacity. However, if the new capacity can come online as scheduled, it may be possible to accelerate the retirement of existing coal power plants.

3.1.4. Strategic Relevance of Coal

Besides forming the base of India's power generation sector, coal also contributes significantly to India's economy. India was the second-largest coal producer by volume in 2019, with its production of 753.9 million tonnes accounting for 9.3 percent of the world's total production [1]. In 2019-20, the mining sector contributed to 1.9 percent of the country's Gross Value Added. Coal and lignite mining contributed to over one-fifth of the total output from the mining sector [182] and was also the second-largest employer in the mining sector [183], providing employment to over 400,000 miners [184]. The country is also a leading importer of coal with foreign coal meeting 75.1 percent of

its coking coal and 22.2 percent of its non-coking coal requirement [185]. Further, the share of coal in the country's import bill was 4.7 percent [186].

Coal was also the single-largest good transported by Indian Railways in terms of shipment weight (48.6 percent) and ton-kilometers carried (41.4 percent) [186] and contributed to 48.8 percent of freight revenue, with 19.1 percent specifically from shipping to thermal power plants [187]. This revenue earned by the Indian Railways from transportation of coal was more than its total receipts from passenger traffic. Thus, coal also plays an important role in subsidizing rail fares in the country.

Specifically, a recent study concluded that that 284 districts in India (38.5 percent) have some form of coal dependency. Typically, this means that they are home to either coal workers or pensioners, collect funds under the District Mineral Foundation (DMF) or benefit from coal mining companies spending billions of rupees under the Corporate Social Responsibility (CSR) programs [188]. Out of these 284 districts, the most coal-dependent are concentrated in the central and eastern parts of India in the states of Madhya Pradesh, Chhattisgarh, Odisha and Jharkhand. Considering the socio-economic impact of accelerated decommissioning of coal power on these districts in particular would be central for any just transition planning.

3.2. Financing Landscape

India is the third-largest economy in Asia after the People's Republic of China and Japan. GDP stood at USD 2,660 billion in 2020 [154] and is well diversified across agriculture, industry, and services. India is one of the fastest-growing major economies and has continuously recorded a growth rate of over 5% from 2009 to 2018. The country witnessed a GDP decline of 7.3% in 2020, its first contraction in four decades, due to the onset of the COVID-19. However, the economy is expected to rebound sharply and register a growth of 9.5% and 8.5%, respectively, in 2021 and 2022 [154].

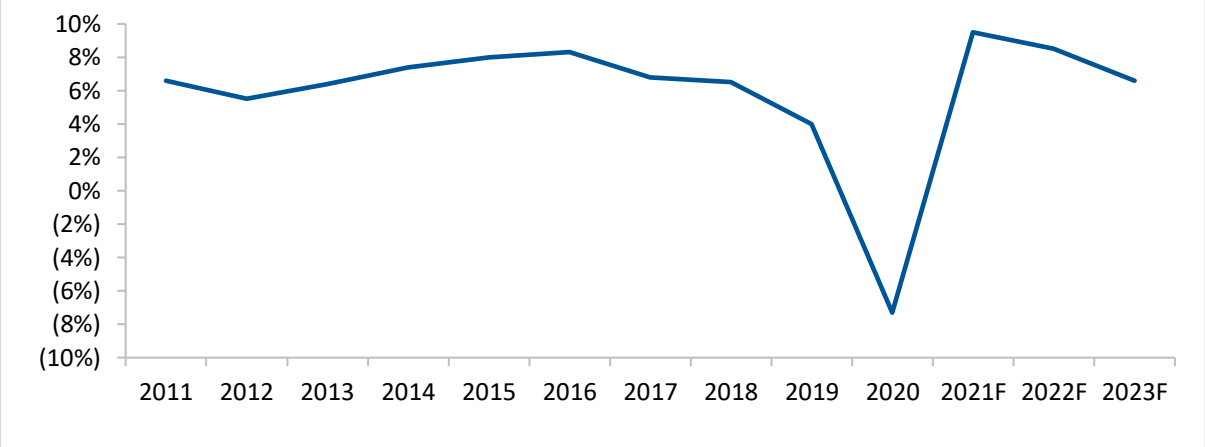


Figure 22. Real GDP Growth Rate (Annual,%) [154]

3.2.1. Public Finance

This section provides an overview of public finance sources (government, NTPC, and other public sector generators) and their ability to finance coal repurposing / transition initiatives in India.

3.2.1.1. Government

Indian government envisages infrastructure investments worth USD 1,480 billion over a period of 5 years from FY 2021 to FY 2025 under its National Infrastructure Pipeline (NIP), first announced in December 2019 [189]. Energy and road projects constitute the most significant part of the envisaged pipeline with a contribution of 24% and 18% respectively. Further, the central and state government will have an equal share of 39% and 40%, respectively, with the private sector contributing the remaining 21% [189].

Government of India is expected to be financially constrained in directly supporting any large-scale coal repurposing projects driven by following factors:

- **Weak fiscal position driven by subdued tax collections:** The fiscal deficit for India is higher than other regional economies, primarily driven by lower tax receipts. The tax to Gross Domestic Product (GDP) ratio for India stood at 6.7% and 6.8%, respectively, in 2019 and 2020 [190], the lowest amongst its South Asian peers. This is mainly due to low per capita income and the presence of a large informal/unorganized sector. While the overall collections have improved recently with robust Good and Services Tax (GST) collections, sustainability of uptick in collections remains to be seen. Lower tax collections constraints the government's ability to lead and fund infrastructure investments. The fiscal deficit has further widened in 2020 and 2021, due to lower tax receipt combined with higher support spending to absorb the economic shock during the COVID-19 pandemic.

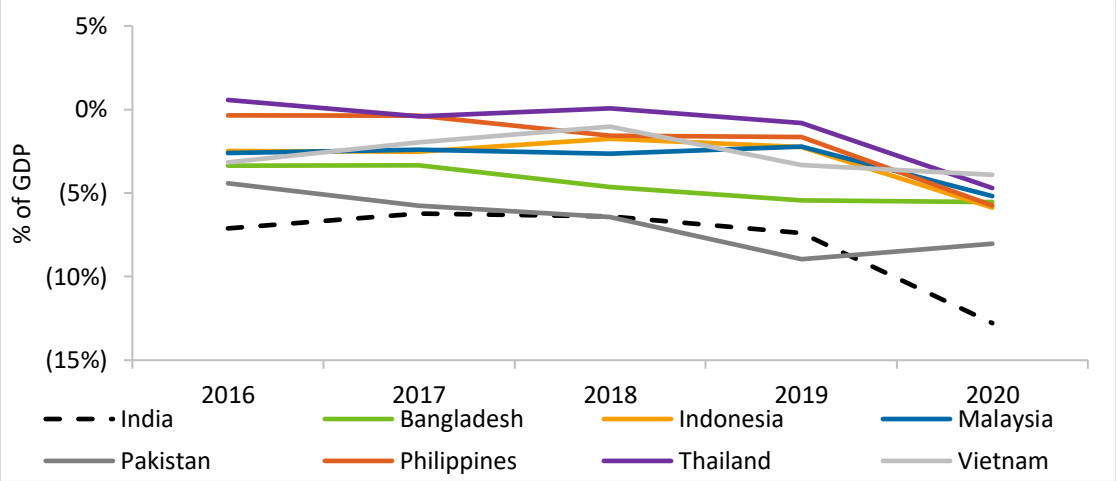


Figure 23. Fiscal Balance (% of GDP) [191]

- **Elevated Debt Levels and Lower Credit Ratings:** India's debt to GDP ratio is higher than other comparable economies in the region. Fitch Ratings estimates government debt to rise to 89.6% of GDP in FY 2021, against a median value of 60.3% for BBB-rated nations[3] [192]. High level of borrowing along with high yield on sovereign debt has resulted in interest payments accounting

[3] Fitch, S&P, and Moody's have assigned India a sovereign rating of BBB-, BBB-, and Baa3 respectively [192] [245] [246].

for 42.7% of revenue receipts of the Central Government as per the FY 2023 budget, as against 37.0% in FY 2016 [193].

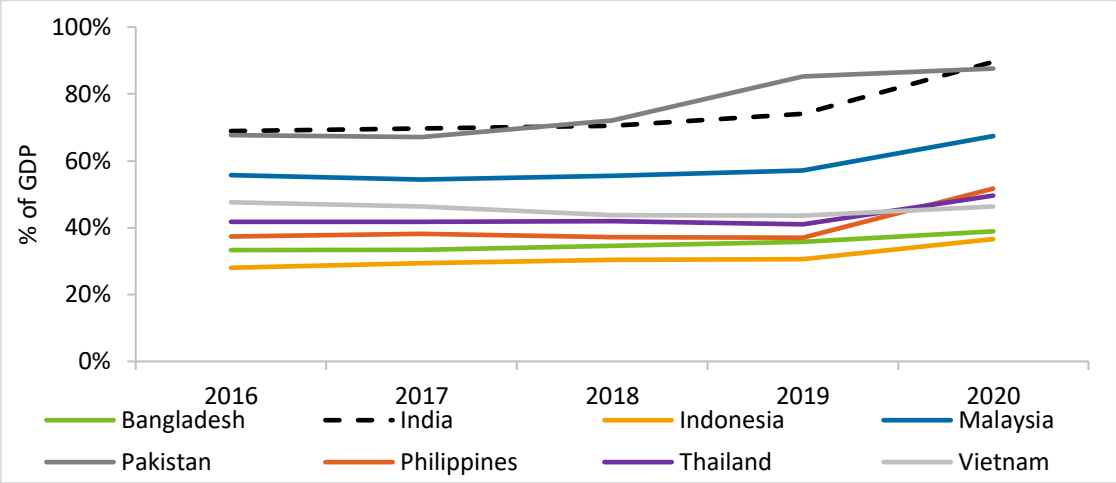


Figure 24. Government Gross Debt (% of GDP) [154]

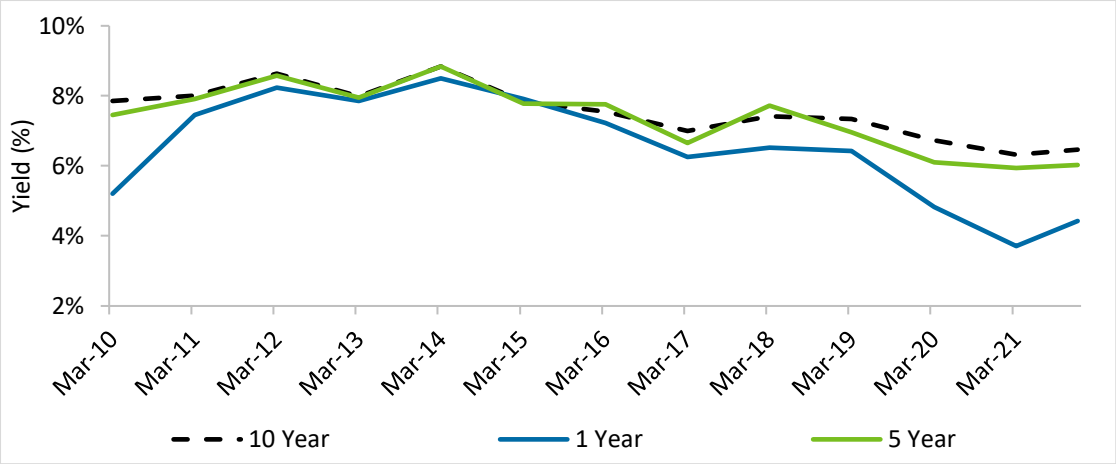


Figure 25. Central Government Bond Yields [191]

- **<u>Delay in Divestment Program:</u>** The Central Government set a target to raise USD 23.3 billion from asset monetization and stake sales for FY 2022. However, the receipts have been limited to just 5% of the initial target (as of December 2021). The divestment receipts stood at USD 5.1 billion against an initial target of USD 28.0 billion for FY 2021. Delay in divestment target and lower receipts lead to higher than budgeted fiscal deficit and lower expenditure on capital assets.

3.2.1.2. NTPC Limited

NTPC (formerly National Thermal Power Corporation) is India's largest power utility, with the group having an installed capacity of 65.8 GW in FY 2021 [194]. NTPC accounted for 17.2% of total installed capacity and 22.7% of total generation of India in FY 2021 [194]. The company is heavily dependent on coal for electricity generation – coal accounted for 82.4% of total installed capacity and 92.2% of

total electricity generation in FY 2021 [194]. NTPC alone accounted for 23.1% of India's thermal generation capacity of 234.7 GW in FY 2021 [194]. The coal-fired power plants accounted for 11.8 GW or 69.1% of the 17.1 GW capacity under the construction phase in FY 2021 [194]. NTPC holds a strategic place in the coal-based electricity generation and so is well placed to assist in the coal repurposing / transition initiative in India. This is also supported by its strong financial profile, primarily driven by its regulated business model and robust operating efficiency.

Table 10. NTPC (Consolidated) Historical Income Statement (USD million) [194]

Income Statement (USD million)	FY2019	FY2020	FY2021
Operating Revenue	13,372	14,595	14,871
EBITDA	3,557	4,205	4,530
% margin	*26.6%*	*28.8%*	*30.5%*
Operating Profit	2,402	2,824	2,870
% margin	*18.0%*	*19.3%*	*19.3%*
PAT	1,871	1,587	1,996
% margin	*13.7%*	*10.6%*	*13.0%*

- **Strong Linkages with the Government of India:** The Government of India is the majority shareholder of NTPC with an ownership of 51% as of December 2021 [194]. It was also awarded "Maharatana[4]" status in 2010. Strong government patronage extended to the NTPC still remains a key credit rating driver for the company. Domestic rating agencies have rated long-term facilities at AAA, while Fitch, Moody's & S&P Global have assigned ratings of BBB-, Baa3, and BBB-, respectively, which is equivalent to that of sovereign ratings [194]. The sound credit profile, as outlined above, translates into a lower cost of borrowings for the entity.
- **Regulated Business Model:** NTPC's tariffs are notified by Central Electricity Regulatory Commission (CERC) for each of its power plants. Tariff for close to 95% of the installed capacity is determined through a cost plus model which ensures that NTPC earns an assured return on equity of 15.5%.

[4] The Government of India classifies Central Public Sector Enterprises (CPSEs) as Maharatana, Navratana, and Miniratana, which allows these CPSEs great autonomy and flexibility in operational decision-making

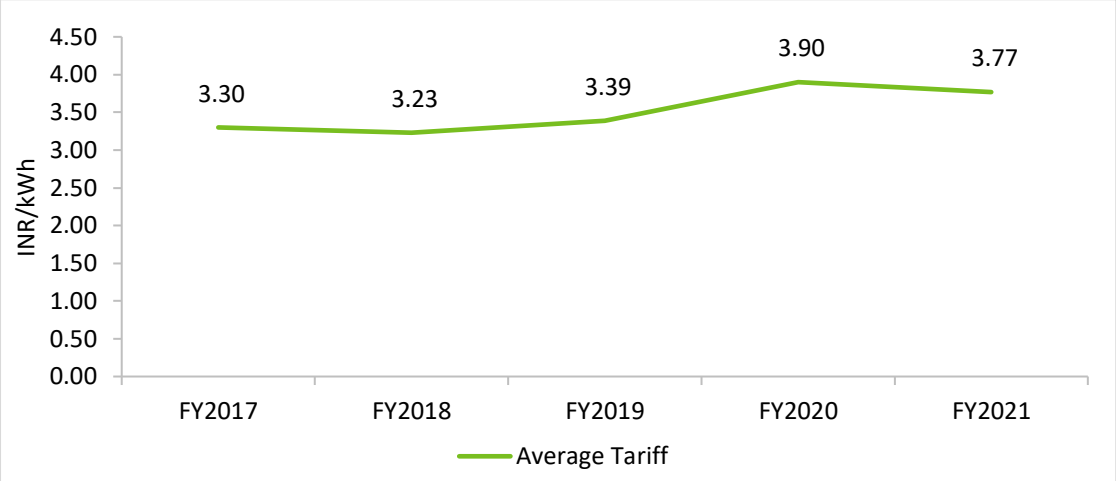


Figure 26. NTPC Average Tariff (INR/kWh) [194]

- **Robust Operational Efficiencies:** NTPC has leveraged years of technical experience to run its plants efficiently with minimum maintenance time. Coal supply has been secured through its own captive production and long-term Coal Supply Agreements (CSA) with Coal India Limited (CIL). These factors have helped the company in sustaining high load factors.

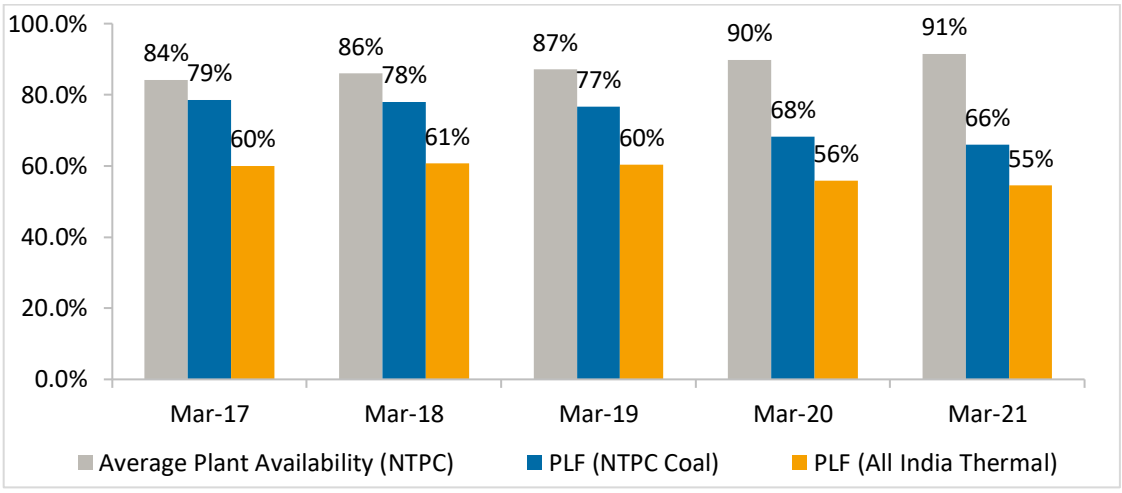


Figure 27. Operational Performance of NTPC Coal-fired Power Plants [194]

As evident from the above, NTPC has a strong operational track record and enjoys the availability of capital at favorable interest rates. However, NTPC has witnessed an increase in leverage in recent years driven primarily by large, planned capital expenditure. The company's debt-to-equity ratio has increased to 1.37 in FY 2021 from 1.01 in FY 2016. This is further expected to rise given NTPC's target to have 60.0 GW of renewable energy portfolio by 2032 and capex associated with installation of Flue Gas Desulphurization systems at thermal power plants. However, the increased revenue and profits driven by the commissioning of planned capacity and acquisition of brownfield renewable assets should support the leverage profile of the company.

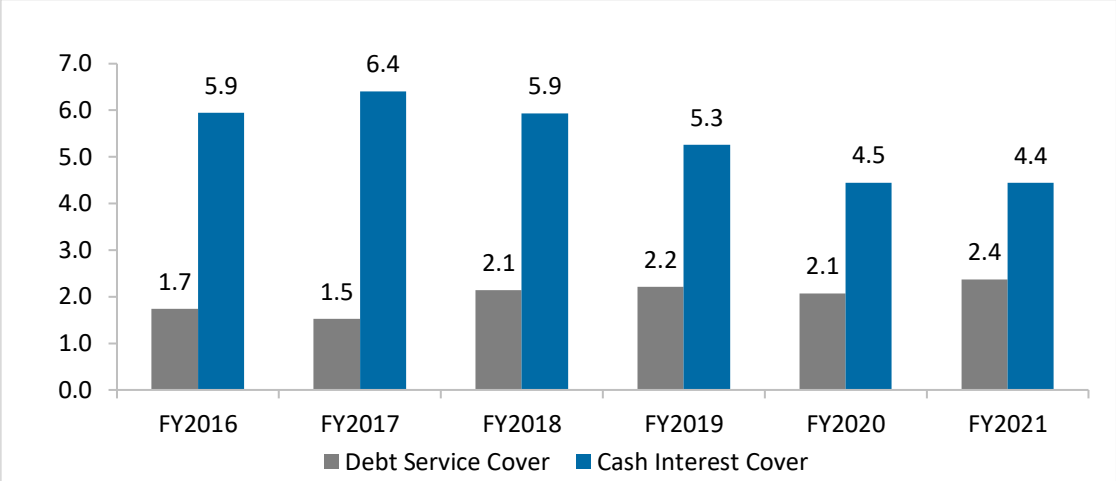


Figure 28. Coverage Ratio [194]

3.2.1.3. Other Public Sector Generators

India's coal-fired generation fleet stood at 202.7 GW as of March 2021, with the central government (including NTPC), state government, and private sector having capacities of 62.6 GW, 65.9 GW, and 74.2 GW, respectively [195]. However, the generation sector remains largely fragmented, with no other company, except for NTPC (accounting for 54.2 GW of coal-fired capacity), having an operational capacity of coal-fired power plants in excess of 10.0 GW, as of March 2021 [195].

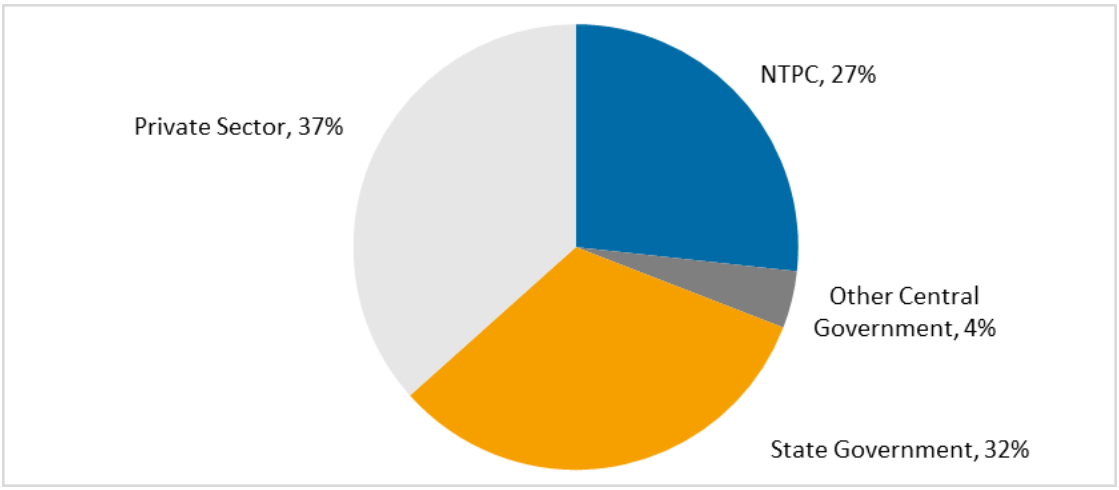


Figure 29. India's Coal-Fired Capacity by Ownership [195]

While NTPC has performed well over the years, the financial position of other public-owned generation companies is relatively weak, particularly of state government owned companies. State-owned generation companies face the challenges of delay in the collection from distribution companies (Discoms) and operate with significant leverage. The financial challenges are further exacerbated by high Aggregate Transmission and Commercial (AT&C) losses, non-cost reflective tariff, and delays in the collection of subsidy amounts for state-owned generation companies

performing the role of Discoms. These companies require continuous government support in the form of equity infusion, grants, loans or liquidity support to sustain operation.

Due to stretched balance sheets, these generation companies have not been able to efficiently tap the financial markets for their capital requirements and rely heavily on borrowings from Power Finance Corporation Limited (PFC), REC Limited (REC), and other public-sector /nationalized banks.

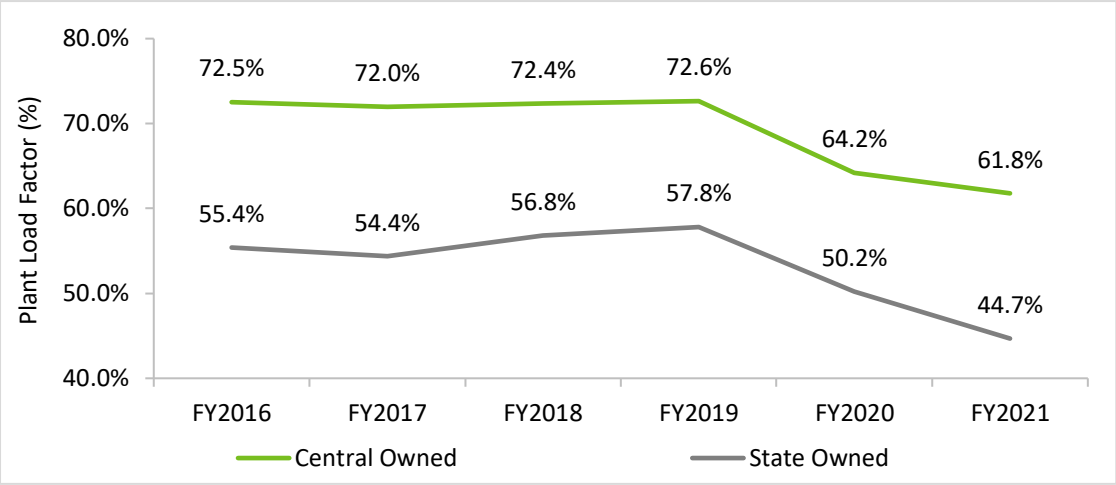


Figure 30. Plant Load Factor for Coal and Lignite based Power Plants [7]

3.2.2. Financial Institutions

This section covers and examines financial capacity of the government owned entities (PFC and REC), scheduled commercial banks, and non-banking financial institutions to mobilize capital for coal repurposing initiatives in India.

3.1.2.1. Public Sector NBFCs – Power Corporation Limited and REC Limited

PFC was set up in 1986 by the Government of India (56% ownership) as a financial institution dedicated to power sector financing. PFC is currently the largest government-owned Non-Banking Financial Company (NBFC), catering to all three segments of the power sector, viz. generation, transmission, and distribution. It was also awarded the "Maharatana" status in October 2021, which allowed the entity to have greater autonomy and flexibility in operational decision-making [196]. The company is rated AAA by domestic rating agencies (Crisil, Care Ratings, and ICRA). Fitch has assigned a credit rating of BBB-, at a level similar to the country's sovereign ratings, given its strategic role in the country's power sector, and noting strong linkages with the state in terms of ownership and control [197].

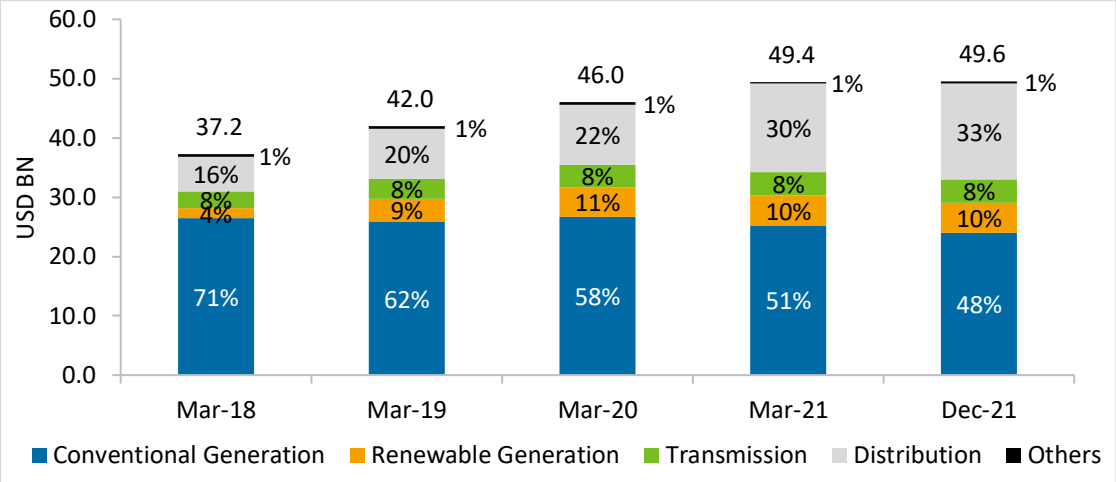


Figure 31. PFC (Standalone): Composition of Loan Assets (USD billion) [196]

REC (formerly Rural Electrification Corporation Limited) is another public sector NBFC which just like PFC, lends exclusively to the power sector (across the entire power sector value chain). It was set up in 1969 and is a "Navratna" Central Public Sector Enterprise (CPSE) under the Ministry of Power. REC is a publicly listed entity, with PFC holding 52.6% ownership in the company [198]. The company is rated AAA by domestic rating agencies (Crisil, Care Ratings, ICRA and India Ratings). Fitch has assigned a credit rating of BBB-, at a level same as the India's sovereign ratings, noting strong linkages with the PFC, which has strong support from sovereign Government [199].s

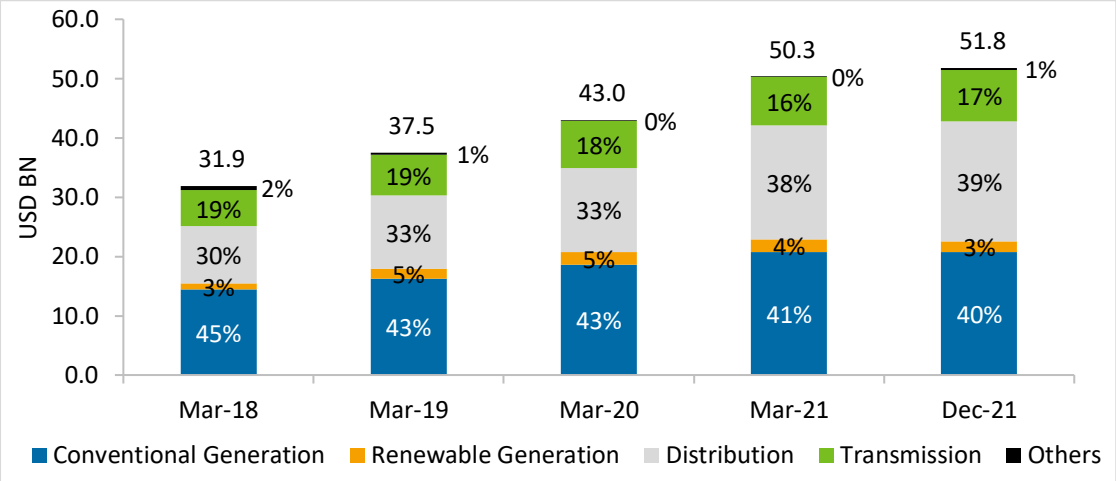


Figure 32. REC (Standalone): Composition of Loan Assets (USD billion) [198]

Given the large asset base, combined with the sector expertise built over the years and ability to borrow at favorable terms due to strong credit ratings and state linkages, both PFC and REC are a suitable candidate to fund coal repurposing / transition initiatives in India.

3.1.2.2. Scheduled Commercial Banks (SCB)

India's financial system is fairly developed and dominated by banks. Loans and advances extended by SCBs have grown from USD 1,053 billion in FY 2016 to USD 1,477 in FY 2021, with deposits increasing to USD 2,093 billion from USD 1,346 billion [200]. While the banking sector in India has

been dominated by public-sector banks historically, private-sector banks have outpaced their public sector peers in growth and have increased market share in recent years. Banks have been the largest source of funds for infrastructure projects in India. However, credit extended to the infrastructure sector has stagnated in recent years and stood at USD 146 billion in FY 2021 [201].

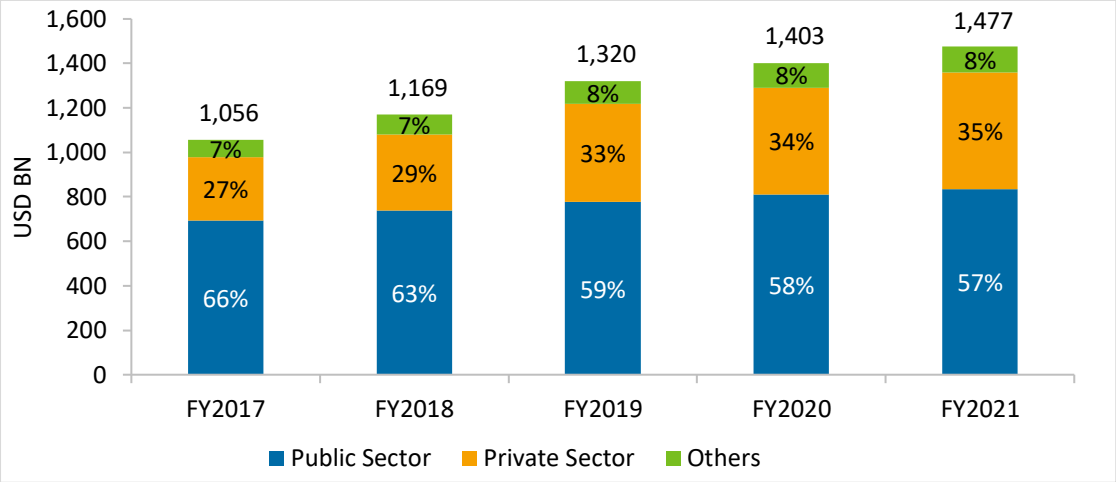


Figure 33. Bank Group-wise Outstanding Credit of Scheduled Commercial Banks[5] [200]

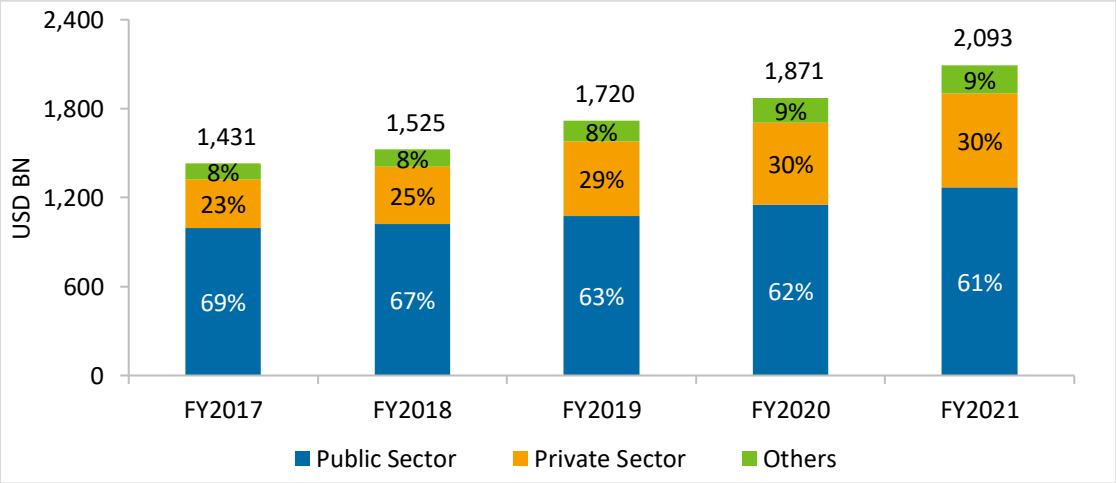


Figure 34. Bank Group-wise Deposits of Scheduled Commercial Banks[6] [200]

SCBs ability to fund large-scale coal repurposing projects may be constrained by elevated levels of non-performing assets (NPAs). Rapid growth in credit disbursement during the late 2000s and early 2010s saw bank credit to industries rise to USD 336 billion in FY 2014 from USD 114 billion in FY 2008 [202] driven by aggressive competition among banks to increase their asset base. However, as the economy slowed down over the years, banks started to face challenges in assets quality. Road projects and the power sector contributed heavily to infrastructure NPAs. Large NPAs have reduced the risk appetite of SCBs to fund infrastructure projects.

[5] Others include foreign banks, regional banks and rural banks.
[6] Others include foreign banks, regional banks and rural banks.

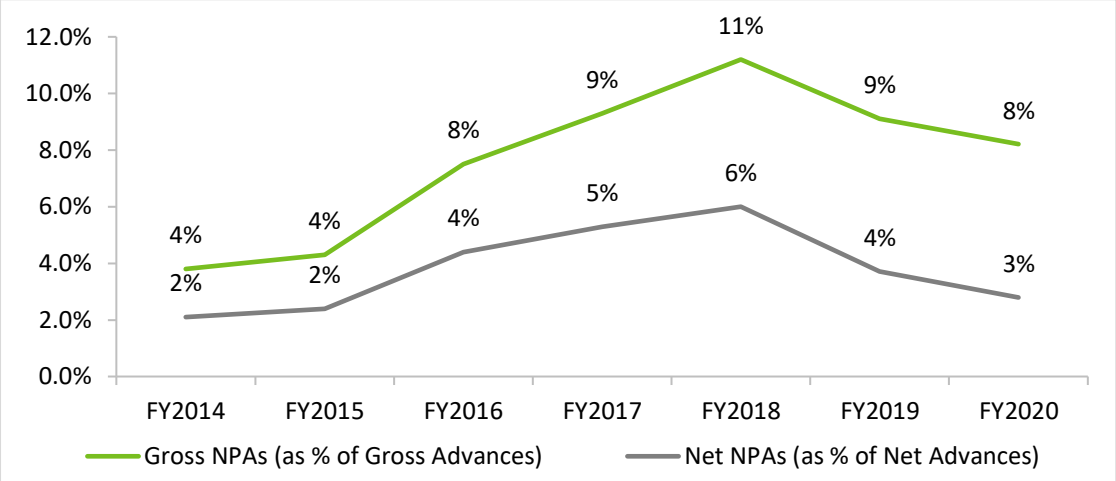


Figure 35. Gross and Net NPAs of Scheduled Commercial Banks [201]

Another limitation that SCBs faced is related to sector exposure norms. RBI has imposed ceiling limits of 15% of capital funds on single borrower exposures (40% in case of a borrower group). However, additional credit exposure is allowed (applicable limits at 20% and 50%, respectively, for single and group borrower) for the extension of credit to infrastructure projects [203]. Internal guidelines and limits to sector and sub-sector exposures hamper the extension of further financing to infrastructure projects.

3.1.2.3. Non-Banking Financial Institutions (NBFI)

NFBIs have served an important role in the Indian economy by providing financial services to specific sectors and target groups, which traditionally have been underserved by the country's banking sector. NBFIs comprise of non-banking financial companies (NBFCs), Housing Finance Companies (HFCs), All-India Financial Institutions (AIFIs), and primary dealers.

NBFCs have outpaced growth in credit disbursement compared to their banking sector peers and have steadily grown their market share over the years. The share of outstanding credit of NBFCs has increased to 24.9% in FY 2021 from 16.7% in FY 2016 of credit extended by SCBs [204]. NBFCs have increased exposure to the infrastructure sector in recent years, which has traditionally been funded by SCBs.

Despite the growth of NBFIs and the resilience of market players, these financial institutions have faced a challenging operating environment in recent years. Default by a large NBFC (IL&FS) in 2018 [205] sent shock waves across the economy, and the sector witnessed several high-profile defaults in couple of quarters that followed. These defaults resulted in a liquidity squeeze and paucity of funds for the sector which relied heavily on short-term borrowings from markets through commercial papers and debentures. The larger NFBCs, often backed by large corporate groups, were still able to access the funds from the market, but at a significantly higher cost than before IL&FS's default. Major challenges that NBFCs would face in mobilizing financing for coal repurposing initiative are included below.

- **High Costs of Funds:** NBFCs depend on banks and capital market borrowings for raising capital. This results in cost of funds being higher for NBFCs as compared to SCBs which are able to mobilize funding through public deposits. Additionally, NBFCs lack refinancing options available

to banks or HFCs. Higher lending rates, driven by high cost of funds, make borrowings from NFBCs commercially unattractive.

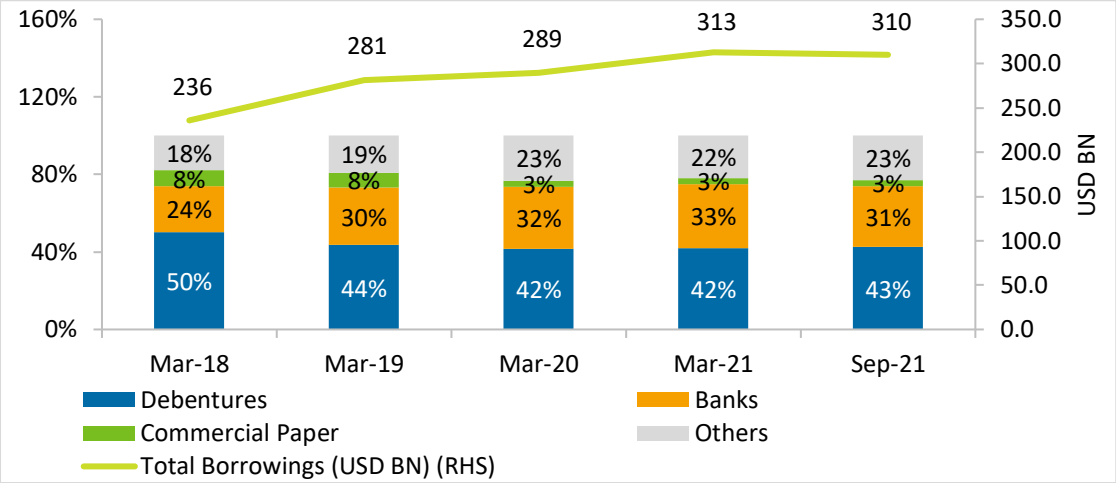


Figure 36. Sources of Borrowings of NBFCs (USD billion) [204]

- **Deteriorating Asset Quality:** NPAs of NFBCs have seen a steady rise driven by the economic slowdown in the country. NFBCs have considerable exposure to unsecured retail and Micro, Small & Medium Enterprises (MSME) loans, consumer durables financing, and microloans to the unorganized sector, which have seen multiple challenges over the years, including demonetization in 2016, and the credit crunch in 2018 This has resulted in a steady rise in the NPAs of NBFCs. The informal sector of the economy, which is a prime target segment of NBFCs, has been disproportionately impacted by the Covid-19 pandemic and has resulted in shifting of focus to collection rather than disbursement.

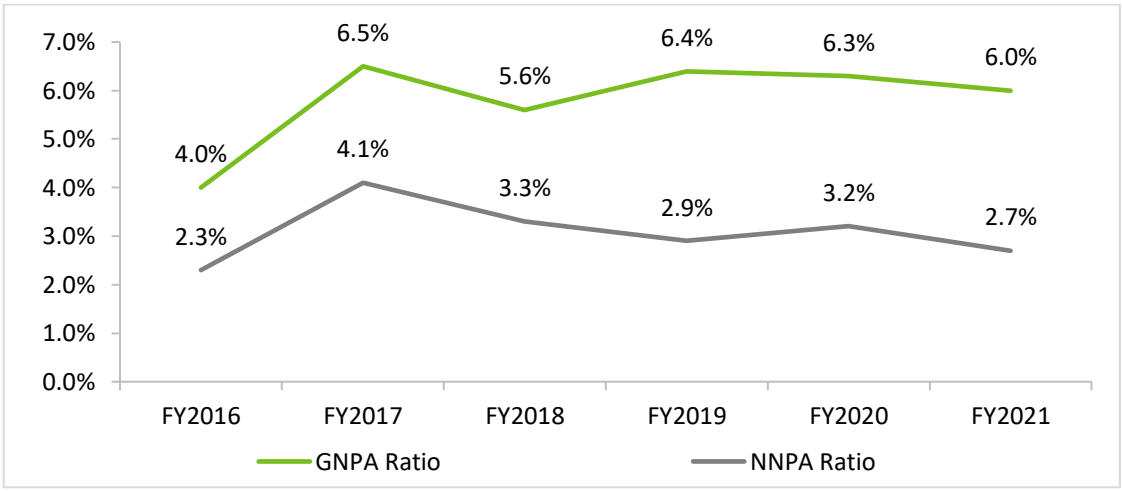


Figure 37. Asset Quality of NBFCs [204]

3.1.2.4. Competitive Landscape in Indian Economy for Renewable Transactions:

The coal repurposing initiatives are aimed at meeting climate objectives by accelerating the retirement of coal-fired power plants and replacing them with a cleaner alternative solutions. A

significant overlap is expected between the investor pool providing capital for coal repurposing projects and renewable energy projects and is expected to follow the trends witnessed for renewable-energy projects over the long-term.

For renewable energy sector in India, DFIs led development of initial pilot projects (setting precedents for other financial institutions). This was followed by increased involvement from public sector NFBCs (PFC and REC) driven by strong governmental push towards the clean energy. The participation of commercial lenders was achieved once sufficient precedents substantiating the technical and commercial feasibility of the renewable projects were established.

Coal repurposing projects are in nascent stage of development currently, with technical and commercial feasibility yet to be demonstrated. So, participation from commercial financial institutions is expected to be low to moderate (subject to DFIs ability to crowd-in commercial lenders through credit enhancement products[7]) at the initial stage. The following figure highlights availability of capital and key financing terms that might be offered by various lenders in near term.

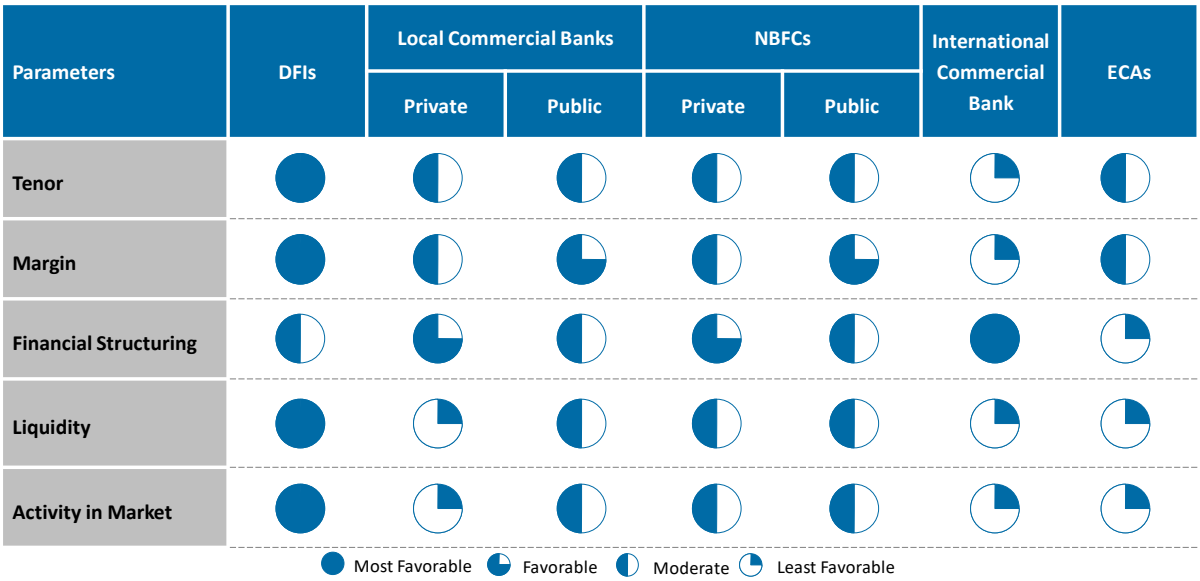


Figure 38. India: Financing Landscape for Financial Institutions (Short Term)

However, as markets mature with sufficient precedents commercial lenders are expected to increase their participations. Over long term, participation landscape of financial institutions is expected to deepen and follow the below trends.

[7] For further details please refer to Section **Error! Reference source not found.** of the report.

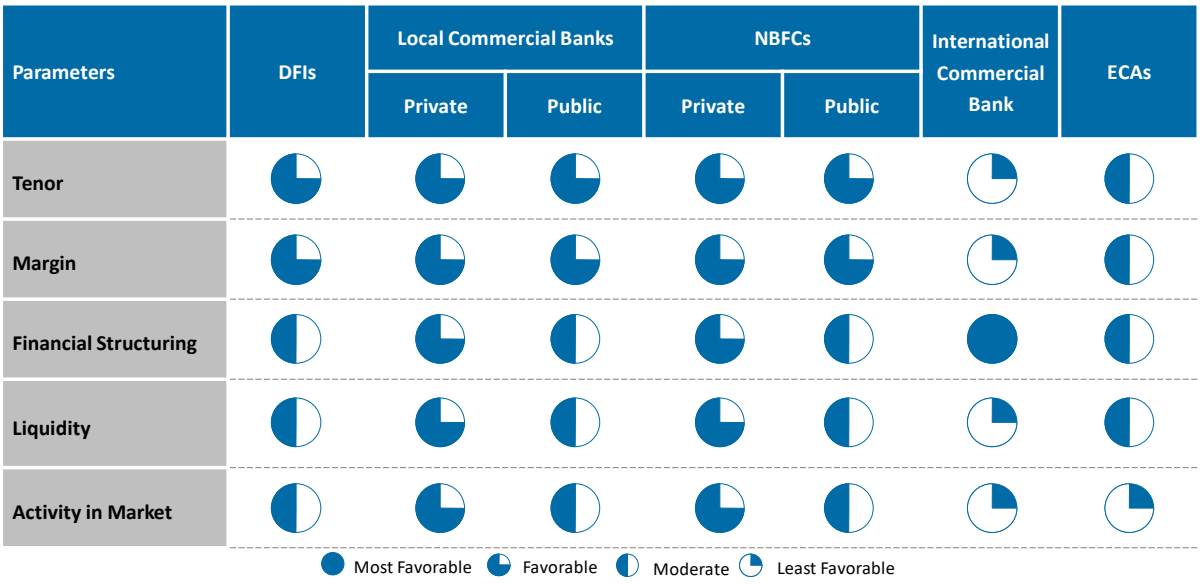


Figure 39. India: Financing Landscape for Financial Institutions (Long Term)

As highlighted in the figures above, DFIs would aim to promote activity and restructuring in the sector and would lead the financing for these repurposing projects in initial stages. However, as markets evolve and witness participation form other institutions, DFIs would adjust tenor and margins to align with the market, while scaling-back liquidity and activity at the same time.

In the short term, private-sector banks are not expected to be aggressive on tenor and margins, with limited liquidity and activity. Exposure is expected to go up with the development of the market, with better tenor and margins. Private NBFCs' participation would follow a similar trend as the participation from private-sector banks. However, market activity and liquidity is expected to be better as compared to private-sector banks during short term, as private NFBCs already have exposure towards the power structure.

The participation from Government-owned banks and NBFCs would be dependent on Government mandate and the intensity with which the Government wants to drive the repurposing initiative.

International commercial banks are expected to have limited appetite for participating in the repurposing projects in India in both, short as well as long term. International commercial banks typically offer shorter tenor of 5 to 7 years for projects in India and carry refinancing risk. This increases the need for sponsor-support for the projects. The financing under ECA covered tranches would be dependent on identified technical solution and equipment import and supply requirements. Given that most of assets are domestically owned, un-tied covers are expected to be limited.

3.1.3. Capital Markets

Indian equity capital markets are fairly developed, with the country ranking sixth globally in terms of market capitalization. Secondary markets are also well-established with ample liquidity and are comparable to other major economies in the region.

Indian bond markets are dominated by Government securities, public sector companies and financial institutions. The non-financial, non-public corporate sector has minimal participation and accounted

for just 17% of resource mobilization in the private placement market from FY 2016 to FY 2021 [201].

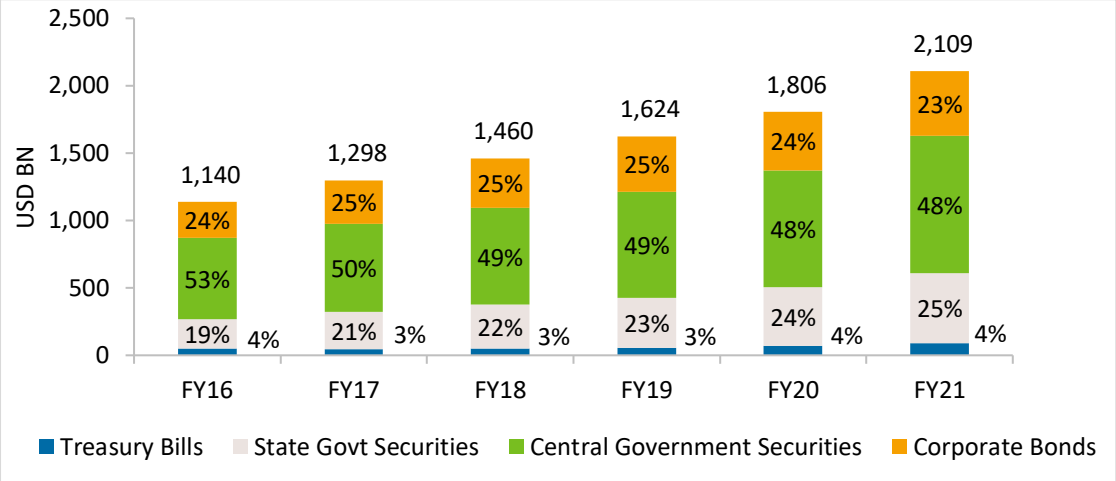


Figure 40. Outstanding Debt Securities (USD billion) [200]

A significant portion of these volumes are generated from bilateral or over-the-counter deals and are wholesale in nature. According to the Economic Survey 2021-22, public issuances accounted for less than 5% of the total nominal capital raised from FY 2016 to FY 2021 [191]. Large institutional investors like pension-, insurance-, and provident-funds prefer to hold securities until maturity, further reducing volumes. Limited trading volumes discourage market-making activities and impact price discovery.

Additionally, many AAA-rated companies offer lower yields on their debt securities than the rates on sovereign or quasi-sovereign instruments like Public Provident Fund (PPF), National Saving Certificates (NSC), etc., which deter retail investors from channeling their savings to debt capital markets directly.

3.1.4. Green Bonds

India is ranked second after China amongst green bond issuances from emerging markets. However, in terms of absolute volume, there is a vast difference between the two countries, with India and China at 18.8 billion and USD 199.1 billion, respectively [173]. The issuance volumes have been irregular in Indian markets, unlike other countries witnessing rapid growth. Additionally, overall issuances have been relatively small, with green bonds accounting for only 0.35% of overall debt markets issuances in 2017 as against 0.58% for South Africa and 0.38% for Mexico [206].

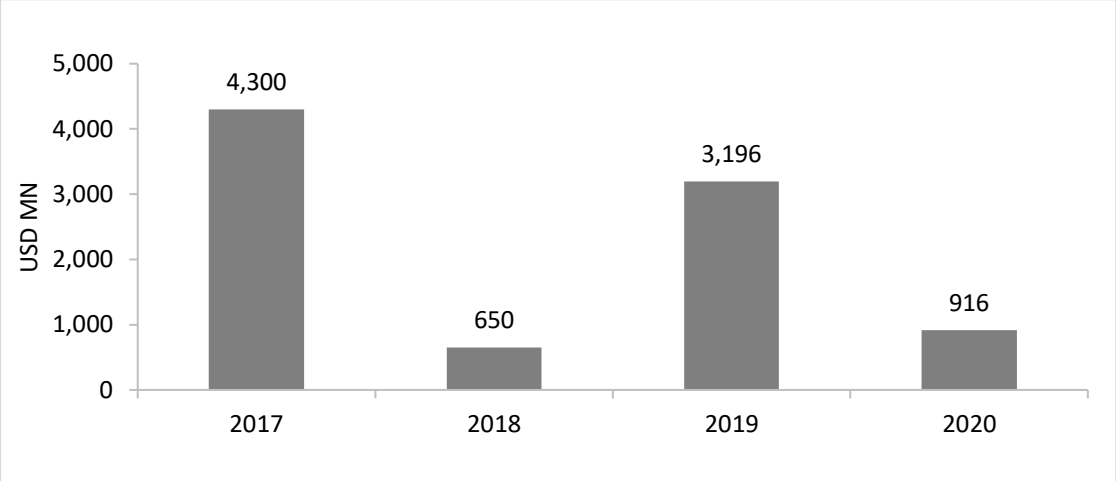


Figure 41. India: Green Bond Issuances (USD million) [207]

The Securities and Exchange Board of India (SEBI), the entity responsible for regulating capital markets, has been regularly developing policy framework to enable growth in the market. SEBI notified disclosure requirements for the issuance and listing of green debt securities in May 2017 [208].

Indian green bond markets have seen significant participation from private non-financial corporates and banks, unlike other emerging market peers where markets are dominated by the national or local government, SOEs, and financial institutions. Some notable green bond issuances in the Indian market have been stated below:

- Yes Bank was the first entity in India to issue green bonds with its inaugural issue of USD 133 million in February 2015, followed by the first non-bank corporate issuance of USD 80 million from CLP India in the same year.
- Axis Bank's maiden issuance of USD 500 million in June 2016 was the first certified green bond by any Asian bank. It was also India's first green bond to be listed on London Stock Exchange [209].
- Greenko has been among the dominant corporate green bond issuers with cumulative issuances of USD 4.5 billion as of FY 2021 by the group through international and domestic issuances [210].
- Indian Renewable Energy Development Agency Limited (IREDA), a Government of India enterprise, has issued green bonds amounting to over USD 500 million until FY 2021 [211].

Green bonds can potentially be explored as a long-term source of financing, post taking into consideration challenges like (i) non-availability of data for deployment and monitoring, (ii) divergence in taxonomies, (iii) plurality of green securities definition, and (iv) certain country-specific challenges, which are discussed below:

- **High Hedging Costs:** The majority of green bonds issued in India are denominated in foreign currencies, with ~76% of issuances since 2015 denominated in USD [212]. Entities issuing green bonds denominated in local currency face high hedging costs, particularly for longer tenors, which reduces their attractiveness to issuers.

- **Poor Sovereign Ratings:** India's sovereign ratings stand at BBB- (Moody's) and act as an effective ceiling on all issuances by domestic entities. Lower credit ratings reduce the pool of potential investors that may otherwise be willing to subscribe to the issue.
- **Shorter Tenor:** While there have been issuances with longer-term durations, such as Adani Green's 20-year USD denominated secured green bonds of USD 362.5 million in 2019, most green bond issuances have had a maturity period of less than ten years [212].
- **Higher Borrowing Costs:** Green bonds in India generally have higher borrowing costs for all maturities when compared to bonds of similar duration issued by corporates or public-sector entities [212]. The only exception is USD issuances with a maturity of 10 years or more, where green bonds had lower average coupon rates compared to corporate bonds.

3.1.5. Emission Trading System

Perform, Achieve, and Trade (PAT) scheme, launched in 2012, is a market-based mechanism, to enhance energy efficiency. The scheme focuses on energy-intensive industries and assigns targets to Designated Consumers (DC) for emission reduction. Overachievers receive tradable Energy Savings Certificates (ESCerts), and underachievers are required to either buy ESCerts from markets or pay a penalty.

PAT scheme is being implemented in cycles of 3 years. The target period for PAT Cycle 1 was FY 2013 to FY 2015, and had recognized 478 DCs across eight industries [213]. A total of 8.67 Mtoe (million tons of oil equivalent) energy savings were realized against a target of 6.69 Mtoe under PAT Cycle 1. PAT Cycle 2, which was run from FY 2016 to FY 2018, expanded coverage to 621 DCs across 11 sectors.

Table 11. Summary of PAT Cycles over the Years [214] [215]

Particular	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 6
Period	FY 2013 to FY 2015	FY 2017 to FY 2019	FY 2018 to FY 2020	FY 2019 to FY 2021	FY 2020 to FY 2022	FY 2021 to FY 2023
Industries covered	8	11	6	8	8	6
DCs covered	478	621	116	109	110	135
Thermal Power Plants Identified	144	154	37	17	17	0
Targeted Savings (Mtoe)	6.69	8.87	1.06	0.70		1.28
Savings achieved (Mtoe)	8.67	13.28	NA	NA	NA	NA
Status	Trading of ESCerts done	Trading of ESCerts done	Under evaluation	Implementation phase	Ongoing	Ongoing

The number of DCs has reduced from Cycle 3 onwards as the majority of DCs identified in Cycle 1 and 2 were not included in subsequent cycles. Only defaulters under the previous cycles are made part of the next cycle.

While the trading markets are still in a nascent phase, these can prove to be a valuable source of capital for coal repurposing activity. However, the following challenges exist and would need to be resolved.

- **Identification as DC under the Scheme:** The regulatory authorities identify DCs and assign targets for emission reduction. The scheme is not available on a voluntary basis as of now. Moreover, there are no precedents available under any of the cycles, where a thermal power plant considering repurposing activity was included as a DC. The inclusion of thermal power plants with the eventual aim of repurposing would be difficult as the scheme primarily targets an increase in energy efficiency rather than emission reduction specifically.
- **Oversupply of ESCerts in Markets with Low Prices and Trading Volumes:** Under PAT Cycle 1, 3.83 million ESCerts were awarded, while DCs falling short of achieving targets were required to purchase only 1.45 million ESCerts. This led to an oversupply in the market with prices quickly reaching a low of INR 200 per certificate from opening day price of INR 1,200 per ESCert during trading for Cycle 1. Trading volumes were low, with 1.30 million certificates trading over the Cycle 1 [216], driven by non-participation of traders as only DCs are allowed to transact and reselling is not allowed. Lower volumes have impacted price discovery and high volatility.

The domestic carbon market is currently in a development phase in India. However, several developed carbon markets exist across the world which have seen significant traction and volumes of trading activity. Such international markets may offer viable financing options for the coal repurposing initiative in India in the longer run.

3.1.6. Conclusion

The following table summarizes the capacity of the financing pool available in the Indian economy to fund the large-scale coal repurposing initiatives.

Table 12. India: Summary of Key Financing Pools

	Capability to Fund Coal Repurposing / Transition		
Sources	**Short Term**	**Long Term**	**Comments**
Government	**Low**	**Low**	• The government of India has limited fiscal room to fund the large-scale coal repurposing initiative as public finances are already stretched thin with a slowdown in the economy in recent years, further exacerbated by COVID-19. • Low government revenue driven by subdued tax collections and delay in divestments, high debt-to-GDP ratio, low credit rating and minuscule participation by foreign investors in the government bond markets limit the Government's ability to borrow additional capital to fund such repurposing.
NTPC	**High**	**High**	• NTPC is well placed to lead coal repurposing initiative driven by (i) sound credit profile coupled with strong government linkages which enables NTPC to access funding at attractive interest rates, (ii) regulated business model, which allows the NTPC to earn assured return on the equity, and (iii) robust operational performance. • While the leverage has increased over recent years, driven by capex to add new capacity, the company is still favorably placed among other utilities.
Other SOEs	**Low**	**Low**	• The majority of other generation companies, particularly state-owned companies, in the country are financially weak and continue to depend on Government support. • Weaker balance sheets and subdued credit ratings leave these companies with very little room to finance any coal repurposing initiative.
PFC and REC	**High**	**High**	• PFC and REC are highly active in the entire value chain of power sector. Further, given that they are majorly state owned and enjoy strong Government support, these institutions enjoy favorable credit ratings. Hence, funds can be mobilized via PEC and REC as long as Government mandates them to lead financing for coal repurposing projects.

	Capability to Fund Coal Repurposing / Transition		
Sources	**Short Term**	**Long Term**	**Comments**
SCBs and NBFCs	**Medium**	**High**	• India has a significantly developed banking sector having a large asset base, which is further supported by the presence of large NBFC segment specializing in micro credit. • SCBs and NBFCs may witness increased participation in coal repurposing projects in the India once precedent is established and risk allocation and commercial feasibility for such projects are set. However, their ability to finance such projects are constrained due to elevated level of non-performing assets in loan books (particularly in the infrastructure sector), rigid regulatory framework and sector or borrower exposure limits.
Capital Market	**Low**	**High**	• Though the corporate bond market has been growing in the recent few years, for coal repurposing projects to tap into this market, more active participation and liquidity is required from the investors. • Further, debt capital markets have traditionally been dominated by Government issuances, with the corporate bond market witnessing issuances only from top-rated corporate and Government-backed public sector companies which might act as a limiting factor. • Green bonds can be explored post addressing certain country specific challenges relating to high hedging costs, shorter tenor of issuances and unattractive yields in the long term.
Carbon Market	**Low**	**Medium**	• Currently, the ESCert markets are illiquid, with discovered prices being very low due to oversupply of certificates, and unable to provide any meaningful capital to fund the repurposing activity. • Moreover, trading platforms lack ample buyers that would be able to absorb the large number of certificates generated by any repurposed asset. • The carbon market will have to be further developed in the long term to generate any significant value for coal transition. The international carbon markets may provide a suitable financing alternative to undertake the coal repurposing activity.

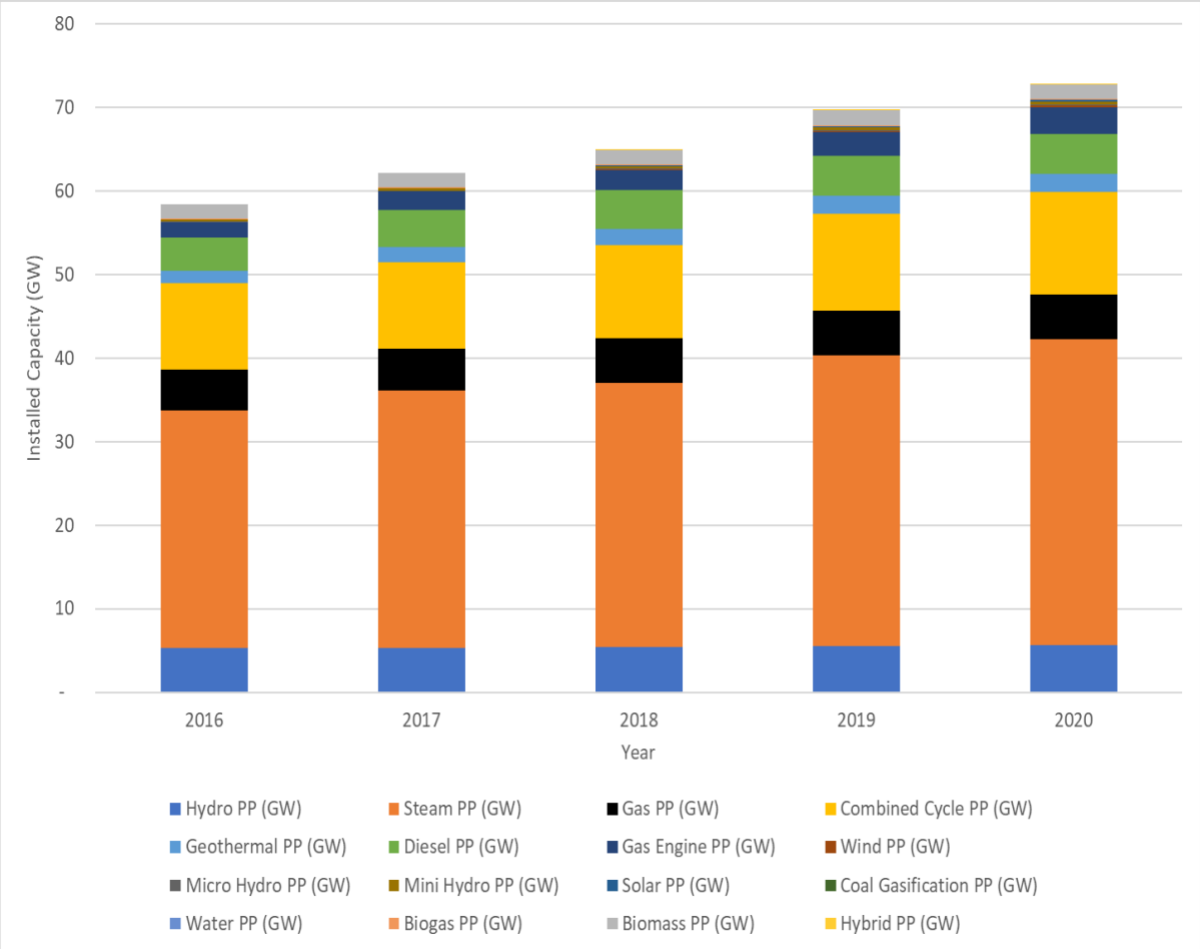
4. Country Overview – Indonesia[8]

4.1. Energy Outlook and Relevance of Coal

4.1.2. Energy Security Outlook of Indonesia

The electricity market in Indonesia is dominated by the coal power generation. The coal power generation assets contribute to the major proportion of the installed capacity and subsequently produces the major proportion of the electricity produced in Indonesia.

In 2020, the total generation installed capacity in Indonesia was 72.8 GW i.e., 25 percent higher than the total generation installed capacity of 58.4 GW in 2016 and 114 percent higher than the total installed capacity of 33.9 GW in 2010. This indicates that a substantial proportion of the generation assets are relatively new and appears to have considerable operational design life left. The installed capacity has been increasing at a rate of ~11.4 percent per year over the last decade. Figure provides an overview of the Indonesia's generation installed capacity for the period of 2016 to 2020.



Source: Ministry of Energy and Mineral Resources, Republic of Indonesia [108]

Figure 42. Power Plant Installed Capacity in Indonesia (2016-2020)

[8] The figures quoted in USD in this section have been calculated using USD/ IDR exchange rate of 14,500

In 2020, the total power generated in Indonesia was 291.9 TWh, which was 18 percent higher than the power produced in 2016 (247.9 TWh) and 72 percent higher than the power produced in 2010 (169.8 TWh). This indicates an increasing trend in the power generation over the last decade except for the year 2020, when the power generation was less as compared to 2019's generation of 295.4 TWh.

A similar increasing trend was observed for the total power consumption in Indonesia. The exception to this trend again being the year 2020 when the total consumption was around 242.6 TWh as compared to 2019's consumption of around 245.5 TWh.

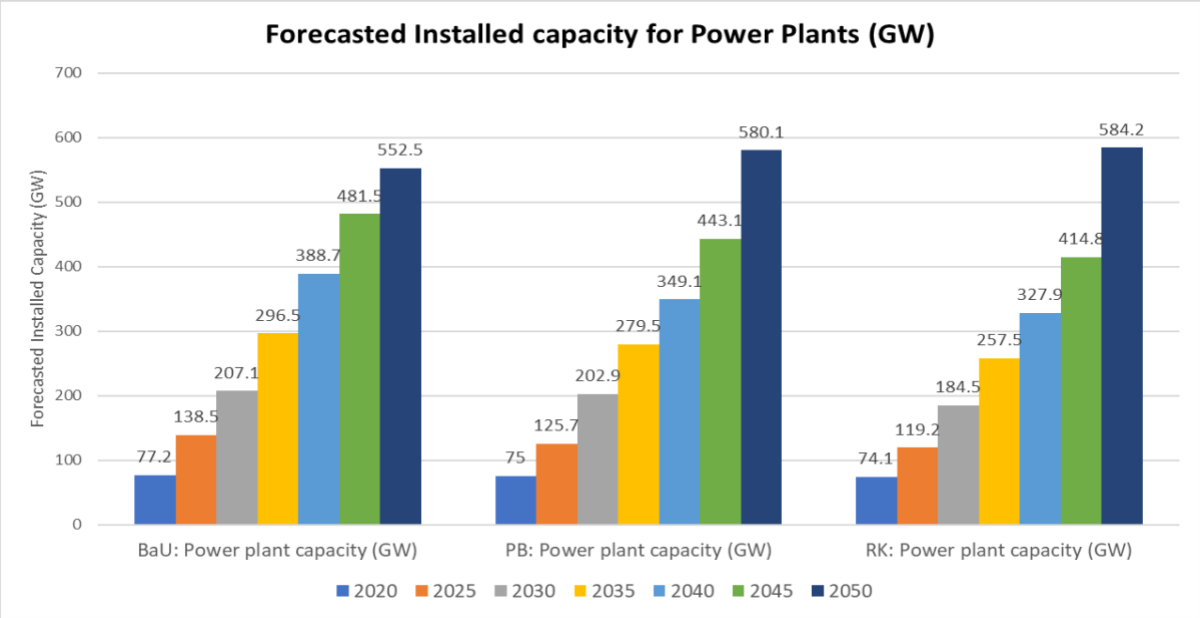
Indonesian electricity market's prime participant was noted as the PLN (Perusahaan Listrik Negara), which is responsible for power generation, transmission, distribution, and sales of energy. In 2020, PLN contributed to around 65 percent of the total power generation in Indonesia. However, the recent trend indicated that the proportion of PLN's contribution in the power generation has reduced from earlier 74 percent in 2016. This trend in expected to continue during the period of 2021-2030. It is expected that during this period IPP's will be responsible for the 65 percent of the new capacity additions whereas PLN will be responsible for the 35 percent of the asset [217].

National Energy Council (DEN) Indonesia conducted a study [218] on future energy demand and supply projection in various situation in Indonesia. Forecasted demand supply analysis was done using the following scenarios presented by the DEN:

- Business as Usual (BaU),
- Sustainable Development (PB) and
- Low Carbon (RK).

Based on the study, it was predicted that the requirement for the power in Indonesia is expected to increase steadily by the year 2050, which requires addition of new power generation facilities. The study indicates that the growing demand is met by a subsequent increase in supply. Moreover, it also indicates that there might be a situation of overcapacity for all the three scenarios.

Figure provides an overview of the forecasted power generation installation capacity for the duration of 2020 to 2050.



Source: Secretariat General National Energy Council [218]

Figure 43. Forecasted Power Plant Installed Capacity (2020-2050)

4.1.3. Relevance of Coal Generated Power

Coal is the mainstay of Indonesia's electricity sector. Historical trends indicate a heavy reliance on the coal power generation units for meeting the country's energy requirements. Coal power plants presently contributes to around 50 percent of the total installed power generation capacity with a cumulative capacity of around 36,668 MW. Installed capacity for coal power plants in Indonesia have demonstrated a rising trend over the last 10 years. However, the rate of growth of new coal facility has substantially reduced in the second half of the last decade as compared to the first half.

In 2020, coal was the primary fuel and contributed to 62 percent (180.9 TWh) of the total electricity generated in Indonesia. This proportion of coal power has increased from 40 percent in 2010 to 55 percent in 2016 and peaked in the year 2020.

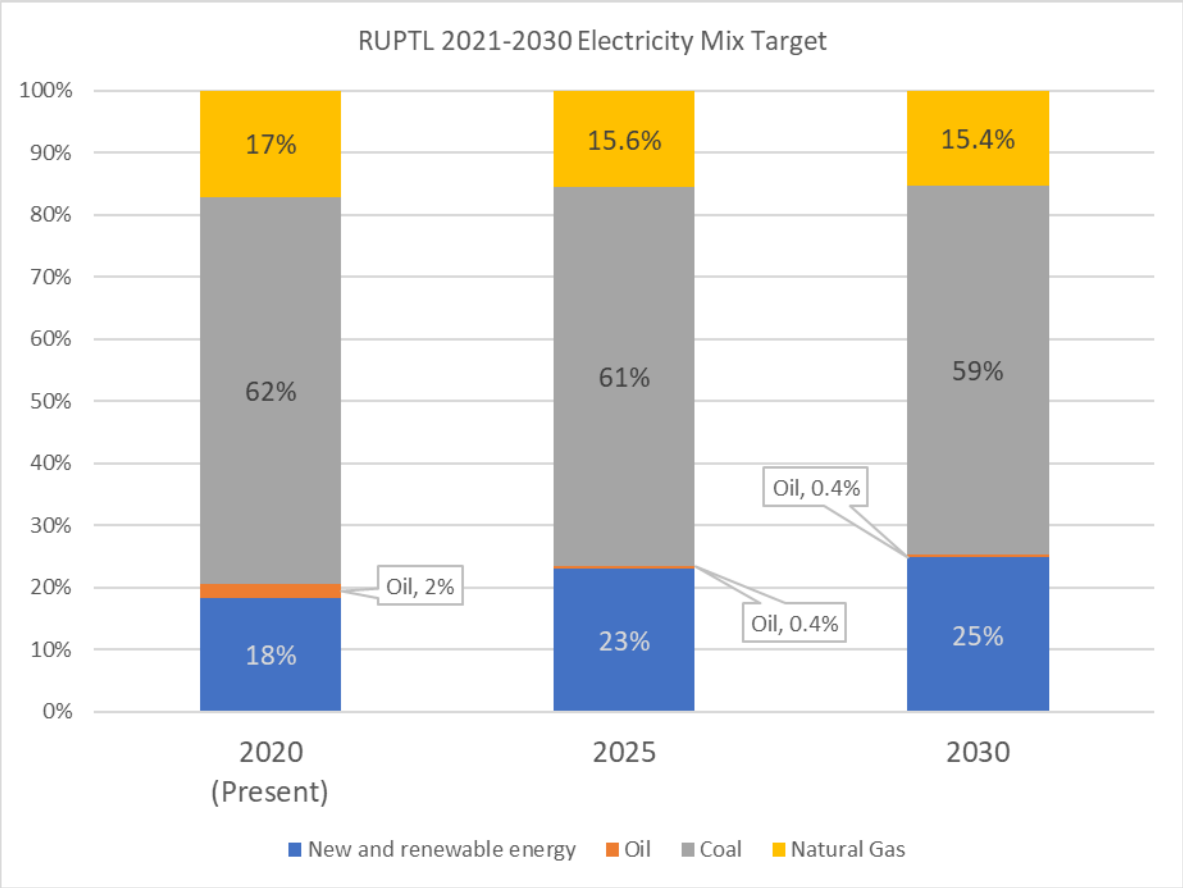
Other major technologies which are contributing to more than 36 percent of the generation capacity includes Combined cycle power, gas power and hydro power with installed capacities of 12,236 MW, 8526 MW and 5639 MW respectively. Combined cycle power plants and hydro power plants contribute about 11.7 percent (34.1 TWh) and 8.4 percent (24.4 TWh).

Renewable power generating facilities had a total installed capacity of 10.5 GW as of year 2020, which was ~14 percent of the total installed capacity during the same period. The renewable power contributes to only 18 percent (53 TWh) of the total electricity mix in 2020. Renewable power has relatively increased since 2018 primarily because of the biomass power plants. Geothermal power plants has ~5.3 percent (15.6 TWh) of the electricity generation share. The proportion of electricity generated by solar and wind have been negligible as compared to the other technologies.

4.1.4. New Capacity Planning

The Electricity mix target set in the '2021-2030 RUPTL' issued by MEMR, Republic of Indonesia [219], which is the electricity supply business plan, suggests plans to lower the contribution of coal in the overall power mix, though marginal.

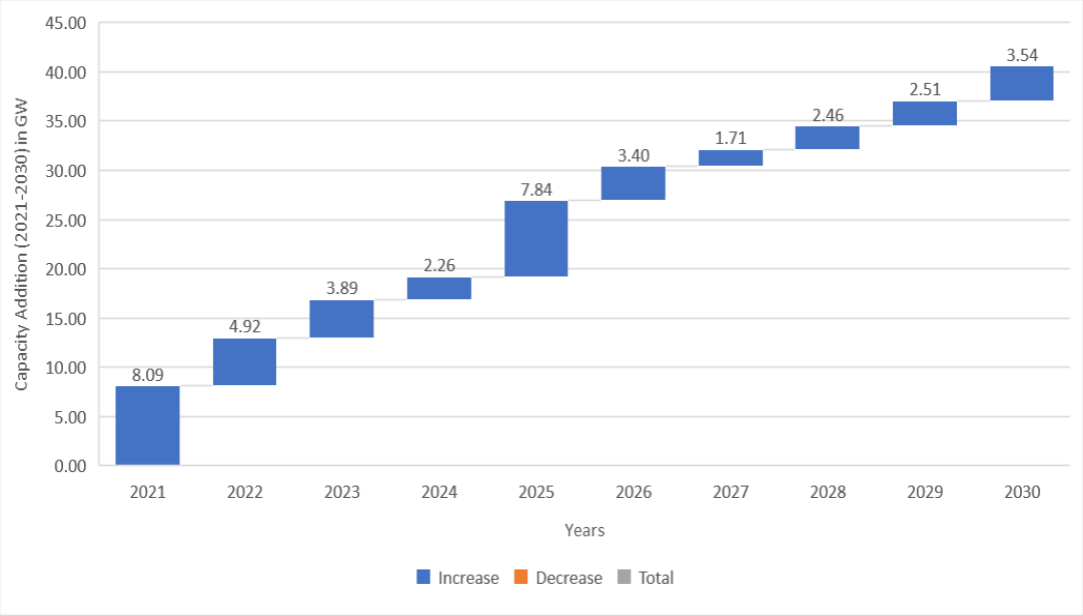
Figure provides an overview of the electricity mix targets as per RUPTL 2021-2030 for the year 2025 and 2030. The share of electricity generated by the new and renewable energy facilities is planned to increase, whereas the proportion of electricity generated using coal, natural gas and oil is estimated to reduce in the total electricity mix.



Source: Ministry of Energy and Mineral Resources, Republic of Indonesia [219]

Figure 44. Electricity Mix Target (2021-2030 RUPTL)

A total of 40.6 GW of new capacity is planned to be added during the period of 2021 to 2030. Coal's contribution in the share of electricity generated will still be significant, however efforts for boosting the renewable's share is observed in the new capacity addition planning in RUPTL 2021-30. Around 52 percent of the new installed generation capacity is planned to be coming from Renewables. Figure provides an overview of the forecasted new installed capacity by timeline during the period of 2021 to 2030 as per '2021-2030 RUPTL'.



Source: Ministry of Energy and Mineral Resources, Republic of Indonesia [219]

Figure 45. Planned New Installed Capacity (2021-2030 RUPTL) by Timeline

4.1.5. Strategic Relevance of Coal

Indonesia is one of the major producers, consumer, and the largest exporter of coal in the world [220]. Coal is thus one of the key economic drivers for Indonesia.

As per the report published by IESR [220] coal has been the primary focus of the energy policies in Indonesia. The present established policies are predominantly incentivizing the use of coal as the primary source of energy. The mining industry in Indonesia has demonstrated contribution of around 5 to 8 percent of country's GDP in the past 10 years, out of which almost 80 percent is contributed by the coal industry. Over the last decade, the proportion of coal in the total energy mix has increased from 24 percent in 2010 to 37 percent in 2020 i.e., 554 Million BOE [108]. Presently it is the most dominant source of energy in Indonesia followed by the crude oil products.

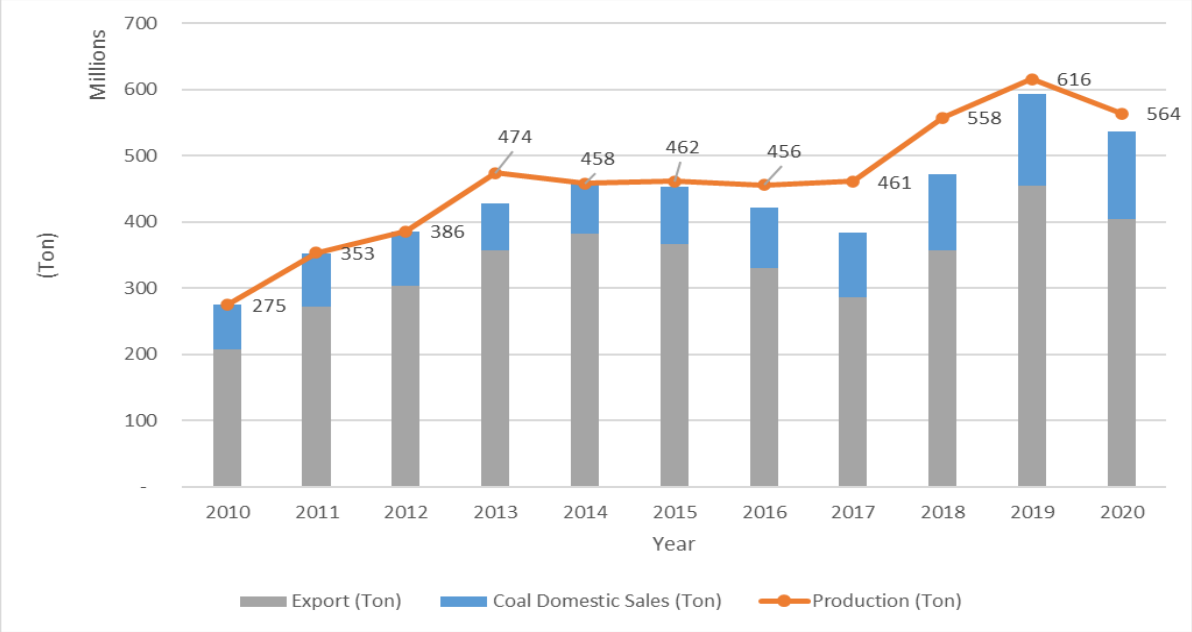
Figure provides an overview of the total coal production, imports and exports scenario for Indonesia in the last 10 years. The coal production in Indonesia has grown from 67 million tons in the year 2000 [221] to 275 million tons in 2010 and peaked to 616 million tons in the year 2019 [108]. However, in 2020, the production of coal dropped to 564 million tons [222]. Over 90 percent of the coal production in Indonesia is contributed by East Kalimantan, South Kalimantan, South Sumatera, and Central Kalimantan [223].

Indonesia is the world's biggest coal exporter [116] and thus coal has been one of the major sources of revenue for Indonesia. In 2019, around 80 percent of the total coal produced was exported [223]. As per the MEMR [108] coal export in the last decade has increased substantially from 208 million tons in 2010 to 405 million tons in 2020 and it peaked during the year 2019 when it exported 454 million tons of Coal. However, the proportion of coal exports (as compared to the total production)

have been reducing marginally on a consistent basis beyond 2013. Refer Figure for the detailed trend in the last decade.

Indonesia's Energy market is dominated by coal. Coal accounts to almost 37 percent of the total energy resource consumed in the Indonesia's Industry sector. Almost 62 percent of the total production of the electricity is from the coal power plants and is expected to marginally reduce in the next decade. The sale of locally produced coal in the domestic market has been increasing constantly in the last decade and accounted to almost 132 million tons for the year 2020 [108]. Around 98 percent of the domestic coal demand in Indonesia is contributed by the Power and Cement industry, where Power industry contributes to 85.5 percent of the coal consumption and cement industry contributes to 12.4 percent [223]. As per MEMR, Republic of Indonesia (RUPTL 2021-2030, 2021) the domestic coal demand in Indonesia is expected to increase to 154 million tons by 2030.

The report cited by Precious Shipping Public Company Limited ("PSL") [224] provides an overview on the global demand and challenges for the coal exporters. As per the report, even though Indonesia has been one of the major exporters of coal, the production of coal is not expected to reach the demand seen for the years prior to 2019. It is because of the global demand which might not grow substantially, and the global coal demand is expected to flatten out at 7.4 billion tons by the year 2025 [225]. Moreover, the coal export sanction imposed by Indonesian government in the year 2021 on the coal producers to meet the Domestic Market Sales Obligation (DMO), resulted in the ban in coal exports for 34 coal producing companies and expected to last until the companies fulfill the obligation [226]. The sanction mandates the coal miners to make a portion i.e., 25 percent of the coal production available for the domestic market before it made available to the international market.



Source: Ministry of Energy and Mineral Resources, Republic of Indonesia [108]

Figure 46. Coal Production and Utilization (Ton) in Indonesia (2010-2020)

4.2. Financing Landscape

The Republic of Indonesia is the largest economy in Southeast Asia with the GDP standing at USD 1,060 billion in 2020 [154]. The country has consistently clocked an economic growth of around 5.0% annually since 2014. Indonesia witnessed its first economic contraction in 2 decades, with the economy declining by 2.1% in 2020 due to the slowdown induced by the Covid-19 pandemic [154]. The growth is expected to be at 3.2% in 2021 and further accelerate to 5.9% in 2022 [154]. The Indonesian economy is dominated by the manufacturing and services industry, with MSMEs contributing over 60% to the GDP [227].

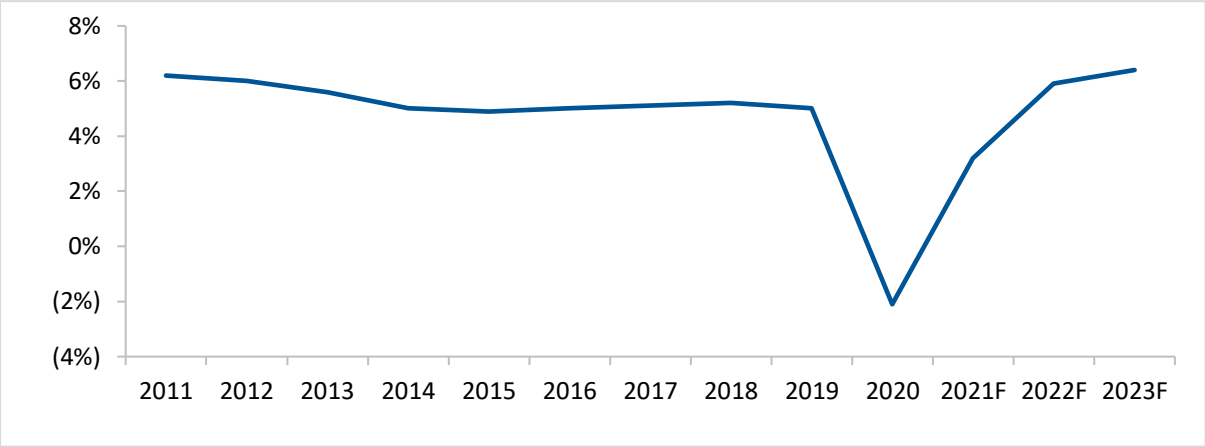


Figure 47. Real GDP Growth Rate (Annual,%) [154]

The National Development Planning Agency (Bappenas) develops, implements, and monitors the progress of 5-year plan for nation development called Rencana Pembangunan Jangka Menengah Nasional (RPJMN). Bappenas has estimated that the country would require infrastructure investment worth USD 444.5 billion, equal to 6.1% of GDP, between 2020 and 2024, up by 34% from USD 330.8 billion (under RPJMN 2015-2019) [228]. As outlined under RPJMN 2020-2024, the Government is expected to bear about 37% of the total funds required, with another 21% being borne by SOEs. The funding gap of USD 186.7 billion shall be provided by the private sector. The increase in envisaged participation of the private sector to 42% under RPJMN 2020-24 from 36.5% under the earlier plan highlights the increasing importance of the participation by the private sector through the Public-Private Partnership (PPP) scheme.

4.2.1. Public Finances

This section provides an overview of public finance sources (Government and Perusahaan Listrik Negara (PT PLN)) and their ability to finance coal repurposing initiatives in Indonesia.

4.2.1.1. Government

Government spending on the infrastructure sector has recently stagnated in absolute terms (USD 27.2 billion in 2020 as against USD 26.3 billion in 2017) and accounts for a low proportion of GDP or overall Government expenditure (refer to the chart below). For 2021, the Government of Indonesia

has budgeted to spend 2.4% of GDP in infrastructure sector to boost the economy [229]. Although it is a move in the right direction, the Government spending on the infrastructure sector still remains inadequate, primarily driven by the below mentioned reasons.

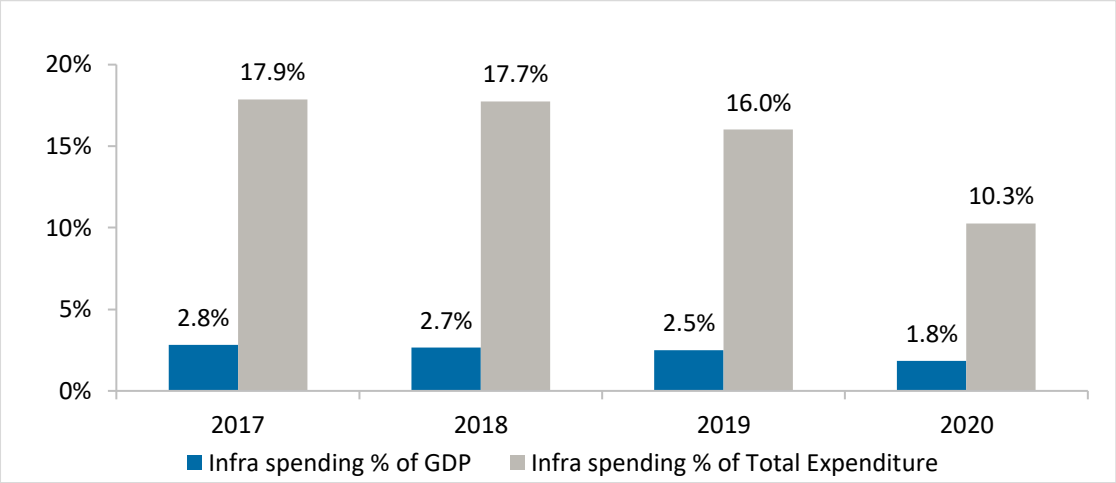


Figure 48. Infrastructure Expenditure by Government [229] [230] [231]

- **Subdued Tax Receipts**: Tax collections have fallen to 9.8% in 2019 from 10.4% in 2016 [230]. Government tax collections remained subdued in 2020 due to the impact of Covid-19, with tax to GDP ratio at 8.3% [230]. Indonesia's tax-to-GDP ratio is among the lowest in Southeast Asian economies [190]. Throughout the years, the overall tax receipts, especially income tax receipts have been below the budgeted amount, as highlighted in the graph below.

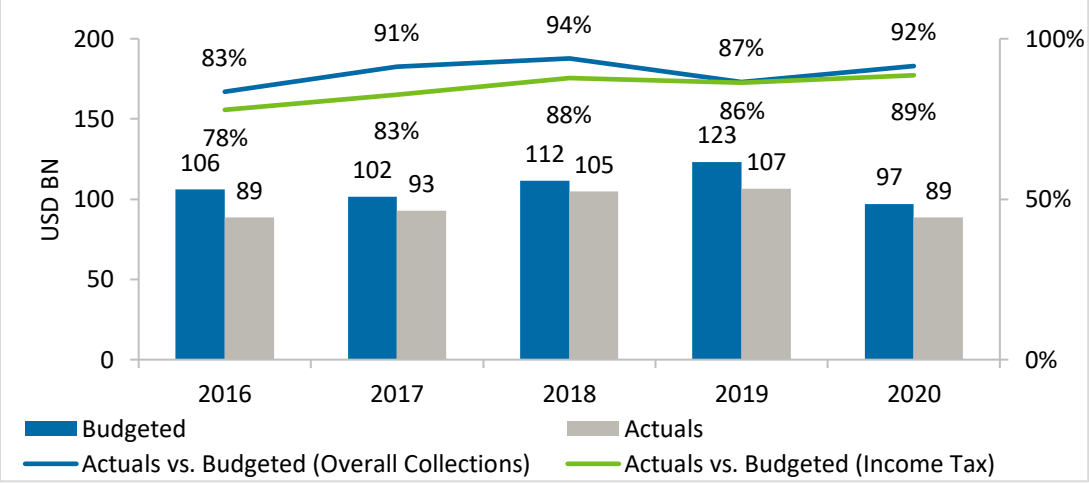


Figure 49. Government Tax Collections: Budgeted vs. Actuals (USD billion) [230]

- **Ceiling on Fiscal Deficit:** Further, as per fiscal rules, adopted in 2003, Indonesia's budget deficit and Government debt cannot exceed 3% and 60% of the GDP, respectively, which further limits the expenditure by the Government. While the budget deficit cap has been temporarily relaxed for 2020-2022, with the aim to provide the necessary support to the residents of the country

and spur the economy in the wake of the negative impacts of the COVID-19, the Government has indicated that the same would be reinstated from 2023 onwards.

- **Significant Dependency on the External Sector:** The Indonesia Government relies heavily on external investment to fund the fiscal deficit (gross borrowings of Government of Indonesia stood at USD 467.5 billion in September 2021 [232]). A significant portion of the debt is denominated in foreign currency (30.9% of the total debt in September 2021). Although the external dependency has reduced in recent years, it is still significantly higher than other developing economies. Coupled with large commodity exports exposure, this leaves Indonesia vulnerable to external shocks.
- **Lower Sovereign Credit Ratings:** The fiscal position of Indonesia is much better when compared to most of its Asian peers, and the country has maintained the lowest Government debt levels among comparable economies in the region. However, the country is still rated at BBB (Fitch Ratings, S&P Global) and Baa2 (Moody's) due to lower tax collections (lowest among the BBB rated countries), lower GDP per capita (USD 4,175 for Indonesia as compared to median of USD 11,428 for BBB category [233]), and its strong dependence on foreign investors for financing Government debt, which leads to a higher cost of borrowings.

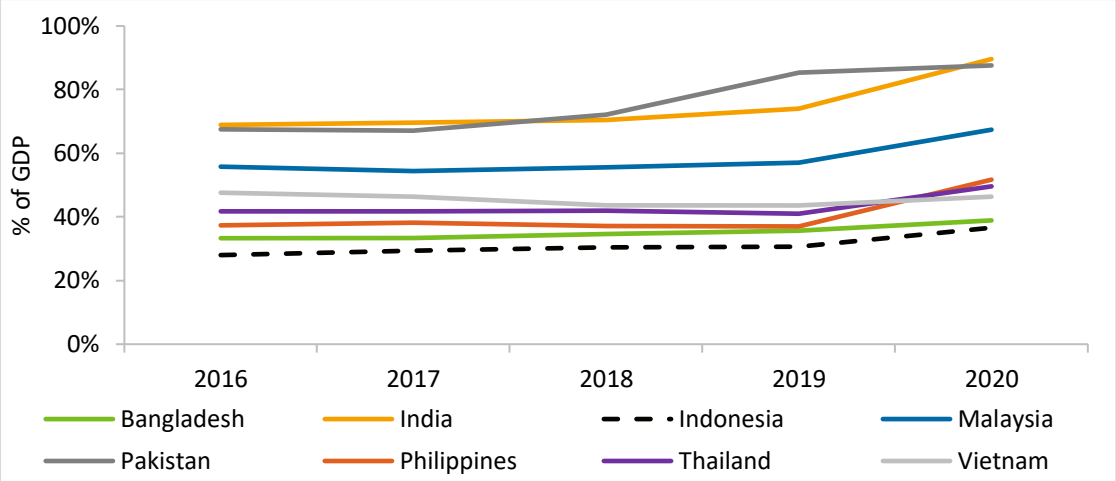


Figure 50. Government Gross Debt (% of GDP) [154]

Given the past trend in the infrastructure spending and the above constraints that the Government faces, the Government is expected to have limited capacity to fund large scale coal repurposing / transition initiatives.

4.2.1.2. PLN

PLN is Indonesia's state-owned electricity utility company, having a near-monopoly over the transmission and distribution segment in the country. PLN owned around three-fourths (45.8 GW) of the country's total installed capacity of 63.1 GW as of June 2021 [234] and was the major purchaser of electricity from IPPs. PLN has significant exposure to coal, which accounts for ~64% of total electricity produced by the PLN in 2020.

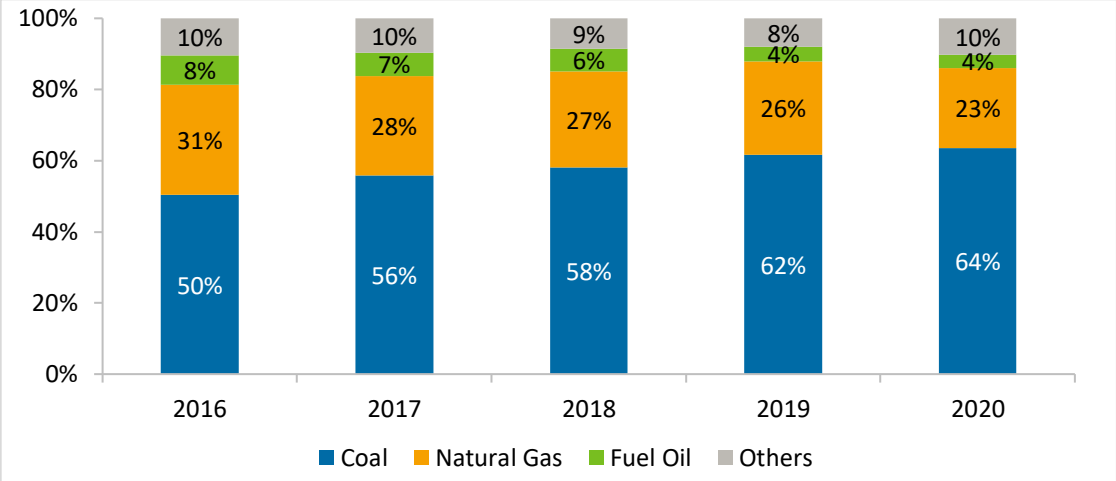


Figure 51. PT PLN Generation Mix by Fuel Type [234]

Considering the vertical integration of PLN in the power sector, its dominant position, and ownership of majority of coal-fired power plants, the financial health of PLN needs to be analyzed to assess its capability to fund large scale coal repurposing initiatives. The following aspects describe PLN's ability to undertake the coal repurposing activity:

- **Non-cost Reflective Tariffs:** PLN has managed to keep production costs low, largely driven by the availability of cheap domestic coal, but tariffs are subsidized for residential consumers resulting in average tariffs charged by the PLN being insufficient to cover its cost of production and operations. However, PLN is recipient of continuous support from the Government to ensure its profitability (Government support accounted for over one-fifth of PLN's revenue in the last three years).

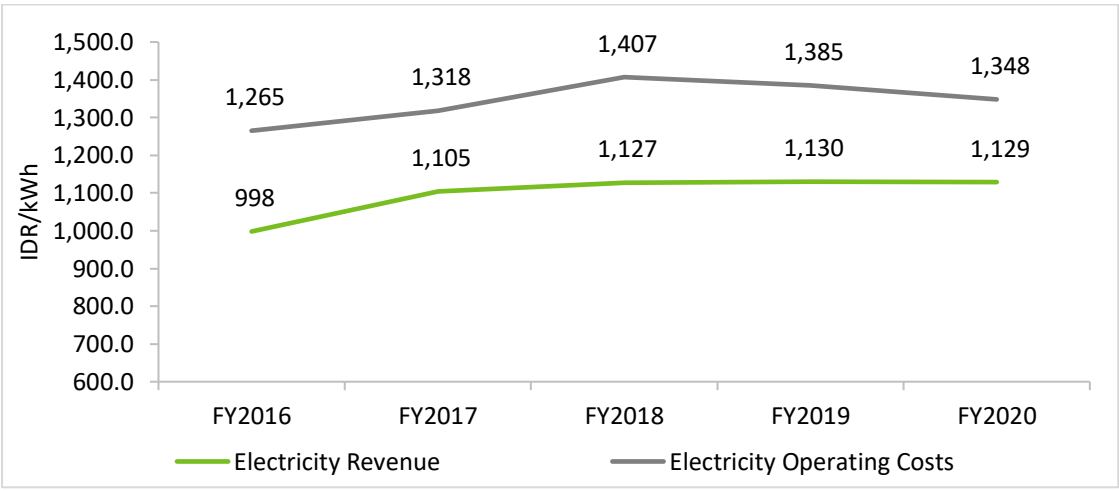


Figure 52. Average Tariff & Costs per Unit (IDR/kWh) [234]

Table 13. PLN (Consolidated) Historical Income Statement [234]

Income Statement (USD million)	2016	2017	2018	2019	2020
Revenue	**19,370**	**20,761**	**23,736**	**24,800**	**23,822**
Electricity Sales	14,768	17,006	18,171	19,039	18,958
Customer Connection Fees	486	491	504	478	22
Government Subsidy	4,003	3,154	3,317	3,566	3,310
Compensation Income	0	0	1,598	1,535	1,235
Other Income	112	110	146	182	297
Operating Profit (with State Support)	**1,822**	**1,763**	**2,482**	**3,046**	**3,063**
% margin	*9.4%*	*8.5%*	*10.5%*	*12.3%*	*12.9%*
PAT	**562**	**305**	**798**	**298**	**413**
% margin	*2.9%*	*1.5%*	*3.4%*	*1.2%*	*1.7%*
Operating Profit (without State Support)	**(2,181)**	**(1,392)**	**(2,434)**	**(2,055)**	**(1,482)**

- **Sharp Jump in Planned Capacity Addition amid Stagnant Power Demand:** The company had installed an additional capacity of 13.8 GW from 2014 to 2020 to cater to rising electricity demand in the country. However, over 98% of the households had received an electricity connection by 2018, with the Government targeting to achieve 100% electrification by 2021 end. Therefore, incremental power demand would stem from an increase in per capita consumption and an increased industrialization of the economy. The stagnation in power demand is already visible from the electricity sales volume of the company, which has increased by a CAGR of only 3.0% in the last four years against an increase of 3.7% in installed capacity. The country expects to add 56.4 GW of capacity between 2018-2028 under the Fast Track Program I (FTP1), Fast Track Program II (FTP2), and National Strategic Program 35,000 MW which may further pressurize the utilization of existing assets.

Table 14. Overview of Electricity Sector in Indonesia [234]

Particular	Units	2016	2017	2018	2019	2020
Electricity Sales	TWh	216.0	223.1	234.6	245.5	243.6
Electrification Ratio	%	91.2%	95.4%	98.3%	98.9%	99.2%
Installed Capacity (PLN)	GW	39.8	39.7	41.7	43.9	44.2
Installed Capacity (IPPs)	GW	11.4	13.3	13.6	17.1	17.7

- **Increasing Leverage and Significant Foreign Currency Exposure:** The debt-to-equity ratio of PLN has been on the rise since 2016, primarily driven by the large capital expenditure that the company is undertaking to expand generation capacity and strengthen the transmission and

distribution network. The company had outstanding borrowings of USD 30.5 billion as of June 2021, with foreign currency-denominated debt accounting for almost three-fourths of the total borrowings. However, PLN still has a relatively lower level of leverage when compared to other utility companies operating in the region.

Nonetheless, elevated levels of foreign currency-denominated borrowings coupled with volatile operating cash flows limit the company's ability to take on additional debt on its books without a Government guarantee.

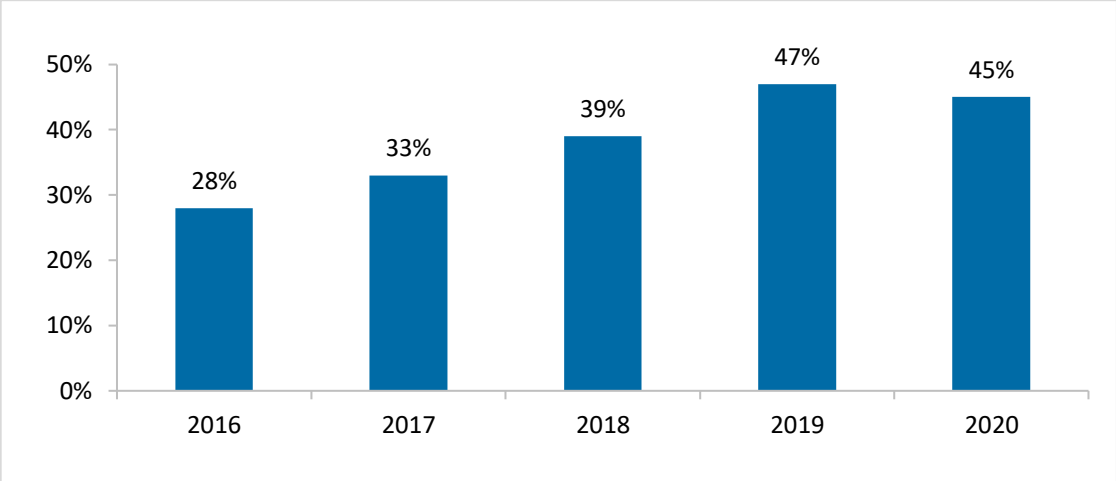


Figure 53. Debt-to-Equity Ratio of PLN (in%) [234]

Table 15. PLN (Consolidated) Historical Balance Sheet Snapshot [234]

Balance Sheet (USD million)	2016	2017	2018	2019	2020
Total Equity & Liabilities	**87,736**	**92,066**	**102,930**	**109,314**	**109,590**
Equity	60,579	59,960	63,960	64,095	64,815
Total Borrowings	16,907	19,933	25,080	29,878	29,476
Other Current Liabilities	5,659	7,393	8,452	8,645	7,553
Other Non-Current Liabilities	4,591	4,780	5,439	6,696	7,747

- **Credit Ratings:** The company's credit ratings stand at Baa2 (Stable), BBB (Negative), BBB (Stable) by Moody's, S&P, and Fitch Ratings, respectively and are aligned with the country's sovereign ratings. Ratings derive comfort from strong state linkages in the form of ownership and control along with the importance of the company to the national economy. The company's Standalone Credit Profile (SCP) stands at bb+ by Fitch, due to increasing leverage, prolonged tariff freeze, and reliance on Government support.

Although PLN faces issue pertaining to given non-cost reflective tariff and high level of debt on the balance sheet, continuous government support that is available to PLN, might lead to the entity

having certain capacity (even though limited) to fund large scale coal repurposing / transition initiatives.

4.2.2. Financial Institutions

The banking sector in Indonesia is substantially segmented with 107 commercial banks and 1,468 rural banks registered with the regulator as of December 2021 [235]. However, markets are dominated by the five largest banks (Bank Mandiri, Bank Rakyat Indonesia, Bank Central Asia, Bank Negara Indonesia, and Bank Tabungan Negara) controlling over three-fourths of the sector's assets. These large banks primarily cater to individual borrowers and focus on SOEs or large corporates in the industrial segment. Bank lending to infrastructure is on a relationship basis and on the strength of the balance sheet of the sponsor.

The banking sector in the country has grown steadily during 2016-2021. Deposits have grown from 38.3% of GDP in 2016 to 42.7% of GDP in 2021 [236]. Credit growth has been relatively subdued over the same period due to challenges relating to economic slowdown induced by the pandemic, tightening regulatory norms, lower margins, and higher costs, and has reduced from 35.5% of GDP in 2016 to 33.9% in 2021 [236]. Outstanding credit to the electricity and gas supply sector reduced to 2.6% of total outstanding credit in 2021 from 3.1% in 2016 [236].

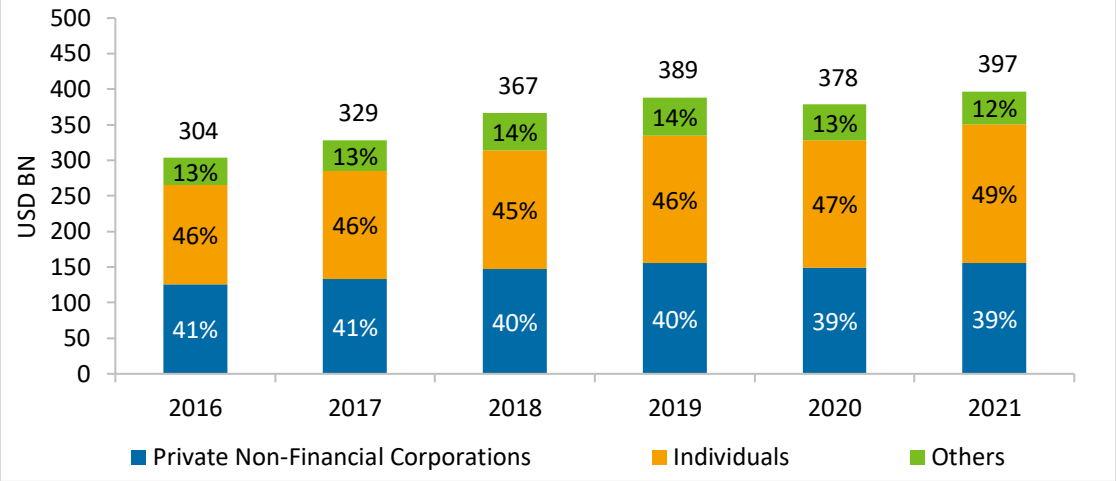


Figure 54. Outstanding Credit classified by Borrower Type (USD billion) [236]

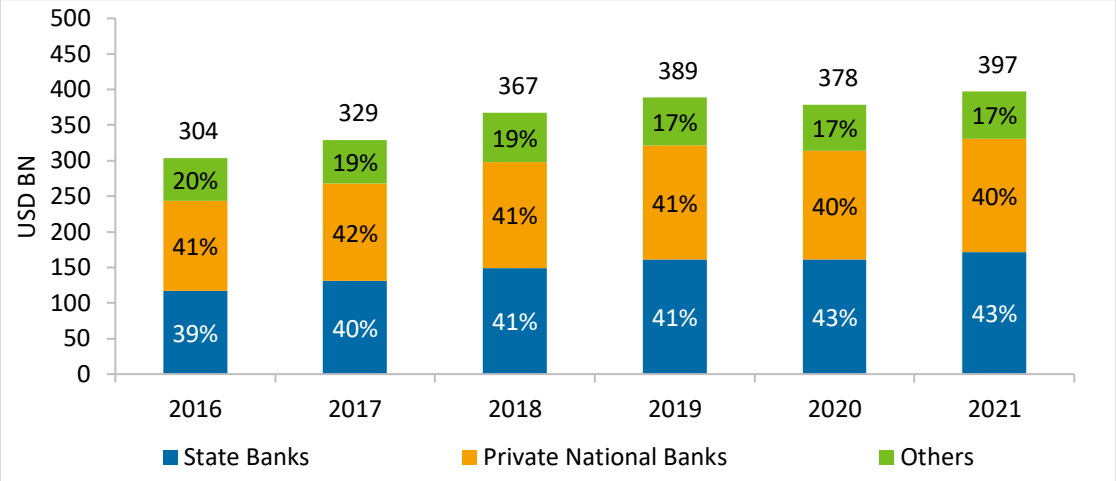


Figure 55. Group-wise Outstanding Credit (USD billion) [236]

Indonesia has a strong and well-regulated banking sector capable of providing large amount of capital required to fund the large-scale coal repurposing exercise.

Competitive Landscape in Indonesia's Economy for Renewable Transactions:

As highlighted in the Section on financing landscape for India, participation of various financial institutions in coal repurposing projects is expected to evolve in line with the curve for participation in case of renewable energy projects in the long term once precedent transactions for coal repurposing are suitably established.

In the near term, the participation landscape of financial institutions is expected to look like following figure.

Parameters	Development Financial Institutions (DFIs)	Local Commercial Banks	International Commercial Bank	Export Credit Agencies (ECAs)
Tenor	●	◐	◐	◐
Margin	●	◔	◔	◔
Financial Structuring	◐	◐	◔	◔
Liquidity	●	◐	◔	◔
Activity in Market	●	◐	◔	◔

● Most Favorable ◔ Favorable ◐ Moderate ◔ Least Favorable

Figure 56. Indonesia: Financing Landscape for Financial Institutions (Short Term)

The following figure highlights the availability of capital and key financing terms that might be offered by various lenders in the long term.

Parameters	Development Financial Institutions (DFIs)	Local Commercial Banks	International Commercial Bank	Export Credit Agencies (ECAs)
Tenor				
Margin				
Financial Structuring				
Liquidity				
Activity in Market				

Most Favorable Favorable Moderate Least Favorable

Figure 57. Indonesia: Financing Landscape for Financial Institutions (Long Term)

As highlighted in the figures above, and earlier sections of the Report, DFIs would lead the coal repurposing activity, and would scale back their participation once the proof-of-concept and market acceptance are established. DFIs would be followed by the local commercial banks, which are expected to extend financing on relationship basis in near term. Local commercial banks are expected to become most active in the market in long-term. International commercial banks and ECAs would join in the later stage of market evolution. International commercial banks may provide capital on an uncovered basis, as has been observed in recent transactions.

4.2.3. Capital Markets

Equity capital markets are underdeveloped in Indonesia (with muted volumes in secondary markets) when compared to other regional peers. While the debt capital markets are showing initial green shoots of development, these are currently unable to offer the depth and breadth that is available in other comparable economies of the region.

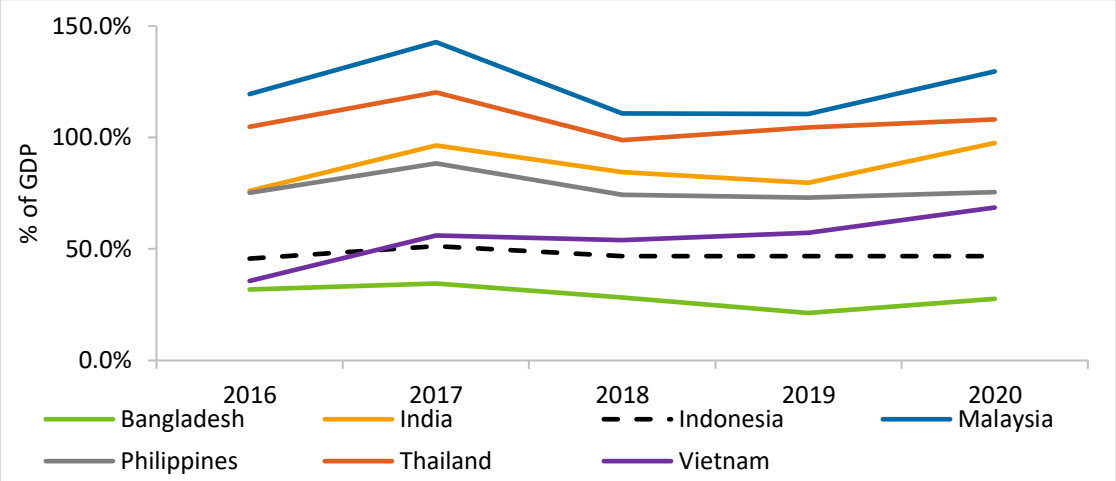


Figure 58. Equity Capital Market Capitalization (% of GDP) [154]

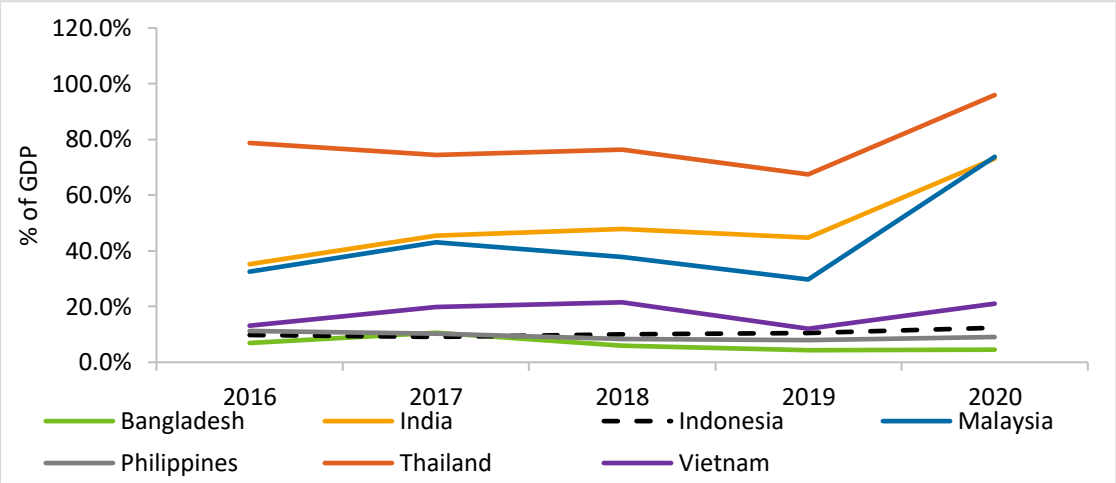


Figure 59. Equity Capital Market Transaction Volumes (% of GDP) [154]

- **Debt Capital Markets are Dominated by Sovereign Issuances:** The notional value of all outstanding bonds stood at USD 468.9 billion in 2020 as compared to USD 268.0 in 2016 [237], indicating a growth of ~75% in 4 years. However, markets are heavily dominated by issuances from the government, with corporate issuers accounting for less than one-fifth of the total outstanding notional amounts. The statistics are more skewed in favor of government bonds for local currency-denominated issuances, where corporate bonds accounted for less than 10% of outstanding bonds.

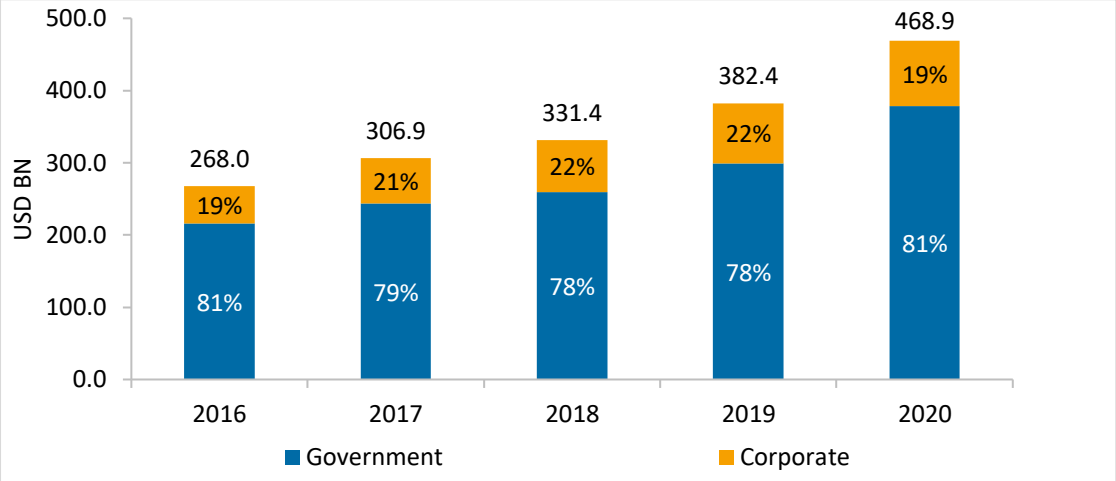


Figure 60. Debt Capital Market in Indonesia: Size and Composition (USD billion) [237]

- **Corporate Bond Markets are Limited to Large Corporates:** Bond markets are highly concentrated, with a handful of issuers accounting for a significant chunk of the overall markets top 10 issuers accounted for over 40% of the market in 2021) [238]. Over half of the outstanding local currency-denominated bonds in 2021 were issued by banks or financial services corporates, and AAA-rated corporates accounted for almost half of the outstanding issuances. Secondary markets are illiquid and witness very low trading activity, particularly for corporate bonds. Turnover in the corporate bond market has stagnated at 0.8 over the years whereas turnover in government bond market witnessed a jump from 2.3 in 2016 to 3.2 in 2021 [237].
- **Country's Sovereign Credit Ratings Act as an Effective Ceiling on Bond Issuances:** Fitch Ratings upgraded sovereign credit ratings of the country in 2011 and later in 2017 and country currently has a rating of BBB. Bonds issued by local entities or by entities whose credit profile is dependent on the local off-taker, will face challenges in receiving optimal credit ratings to attract investors, particularly international investors.

4.2.4. Green Bonds

Financial Services Authority or Otoritas Jasa Keuangan (OJK), issued regulations and guidelines relating to the issuance of green bonds domestically in December 2017. The green bond markets have continuously evolved since the issuance of the guideline. Cumulative green bond issuances out of Indonesia stood at USD 6.3 billion as of November 2021 [239]. Some notable transactions in the green bond domain include:

- Green sukuk issuance of USD 1,250 million by the Government in March 2018 made the country the fifth global economy to issue a green sovereign bond and the first country to issue a green sukuk sovereign bond. [240]
- Star Energy Geothermal is the only corporate which is a repeat issuer of green bonds in Indonesia. The company issued its maiden green bond in April 2018 for a notional amount of USD 580 million with a 15-year tenor. The company further issued USD 1,110 million worth of

green bonds in October 2019, offered across two tranches of USD 320 million and USD 790 million, respectively, having a maturity of 8.5 years and 18 years respectively.

The Government of the Republic of Indonesia has accounted for over two-thirds of cumulative green bond issuances. Markets have remained heavily concentrated, with the remaining issuances dominated by another large private sector issuer. While the markets have been growing since the first issuance in 2018, below are the challenges that the issuers face while issuing green bonds in Indonesia:

- **Underdeveloped and Concentrated Corporate Bond Markets:** Corporate bond markets in Indonesia are underdeveloped relative to the size of the economy and are dominated by a handful of AAA-rated corporates or SOEs. Limited participation has constrained the development of green bond markets in the nation as both issuers and investors have limited knowledge of the issuance process and lack knowledge of market functioning.
- **Elevated Currency Hedging Costs and Illiquid Hedging Markets:** Foreign investors have a limited appetite for local currency exposure and require the presence of robust markets for fulfilling hedging requirements. The maximum tenor of currency hedging products available in the country is limited to 5 years. Illiquid markets often result in the non-availability of hedging solutions for large transactions and high transaction costs.
- **Higher Transaction Costs for Smaller Issue Size:** Except for issuances by the sovereign Government and Star Energy Geothermal, the majority of green bond issuances in the country have had ticket sizes of less than USD 100 million (USD 96 million in February 2018 by Tropical Landscape Finance Facility, USD 35 million by PT SMI in July 2018). Transaction costs associated with smaller issuances, particularly relating to obtaining an opinion and green certification along with post-issuance monitoring, are relatively high and render green financing less attractive for issuers.
- **Lower Country Credit Ratings:** The credit rating of the investment instrument is an important criterion for foreign investors while evaluating an investment opportunity. However, credit ratings of the projects, which otherwise would be considered to have a sound risk allocation matrix and bankable structure, would still be capped by sovereign credit ratings. This effectively results in higher costs of borrowings and a limited investor pool to subscribe to the issue.

4.2.5. Emission Trading Instruments

Indonesia is yet to formally implement an emission trading system. The Presidential Regulation No. 98/2021, signed in October 2021, introduced new set of guidelines for the development of emission trading market [241]. Market structure is expected to be based on cap-and-trade mechanism. The guidelines also state that development of a dedicated trading platform to facilitate trading and full implementation is expected by 2025. However, technical rules and operational procedures for implementing trading markets are still under deliberation [242]. Finalization of regulations and development of trading system is expected to take considerable amount of time and hence this mechanism can potentially be used for undertaking coal repurposing projects at a later stage.

Since the local carbon credit / emission trading market is at an early stage of development, Indonesia may explore the avenue of trading the carbon credits in the well-established international carbon markets. However, as per a recent statement issued by the Finance Minister of Indonesia, it was announced that Indonesia shall not allow cross-border carbon trade until it meets its greenhouse gas reduction targets [243].

4.2.6. Conclusion

A summary of the capacity of various financing pool available in the economy to fund the large-scale coal repurposing exercise is presented in Table 16.

Table 16. Indonesia: Summary of Key Financing Pools

	Capability to Fund Transition		
Sources	**Short Term**	**Long Term**	**Comments**
Government	**Low**	**Low**	• While the Government of Indonesia is comfortably placed in terms of overall debt levels, its capacity to provide capital might be limited due to fiscal constraints and high level of external debt
PT PLN	**Medium**	**Medium**	• PLN faces issue related to non-cost reflective tariff and high foreign debt. However, continuous government support ensures a positive bottom line and sovereign level credit rating • Given the above factors, PLN shall be to able mobilize capital (although limited) towards coal repurposing initiative.
Financial Institutions	**High**	**High**	• The banking sector of the country is well developed and better placed to provide the required capital compared to other potential financiers. The initial developmental effort shall be undertaken by the DFIs to establish a proof of concept. The commercial banks and ECAs are expected to follow suit in the longer run once the proof of concept is established.

	Capability to Fund Transition		
Sources	**Short Term**	**Long Term**	**Comments**
Capital Markets	**Low**	**Medium**	• The equity capital markets are comparatively underdeveloped in the country and hence would find it difficult to support the large-scale repurposing exercise. • Debt capital markets are heavily dominated by the Government sector. Primary markets for corporate bonds are dominated by a handful of large corporates or by the financial sector, with shallow secondary markets which witness minimal trading volumes. The bond issuing capacity of the private entities is also restricted by the low credit rating of the country. • The green bond market is also dominated by the Government issuances (roughly two-thirds of the cumulative issuances). The underdeveloped corporate bond market, costly and illiquid hedging market and low sovereign credit rating are some of the issues prevalent in the green bond market.
Emission Trading Instruments	**Low**	**High**	• Carbon credit or emission trading markets are in nascent stage, with guidelines notified recently in October 2021. • The emission trading system is targeted to be operational by 2025.

References

[1] bp, "Statistical Review of World Energy," 2021.

[2] Global Energy Monitor, "Estimating carbon dioxide emissions from coal plants," 2020. [Online]. Available: https://www.gem.wiki/Estimating_carbon_dioxide_emissions_from_coal_plants. [Accessed 25 January 2022].

[3] IEA, "Technology Roadmap: High-Efficiency, Low-Emissions Coal-Fired Power Generation," OECD/IEA, Paris, 2012.

[4] CEA, India, "Mapping of 85 pulverized coal fired thermal power generating units in different states," April 2020. [Online]. Available: https://cea.nic.in/wp-content/uploads/2020/04/report_85_pul_coal.pdf. [Accessed 27 January 2022].

[5] CEA, India, "Flexibilisation of Thermal Power Plants," 27 October 2017. [Online]. Available: https://cea.nic.in/wp-content/uploads/2020/04/taskforce_report.pdf. [Accessed 27 January 2022].

[6] CEA, India, "REVIEW OF PERFORMANCE OF THERMAL POWER STATION 2017-18," April 2020. [Online]. Available: https://cea.nic.in/wp-content/uploads/opm_grid_operation/2020/07/thermal_review-2018%20(1).pdf. [Accessed 27 January 2022].

[7] Ministry of Power, India, "Power Sector at a Glance ALL INDIA," 2022. [Online]. Available: https://powermin.gov.in/en/content/power-sector-glance-all-india. [Accessed 31 January 2022].

[8] IEA, "Levelised Cost of Electricity Calculator," 2020. [Online]. Available: https://www.iea.org/articles/levelised-cost-of-electricity-calculator. [Accessed 27 January 2022].

[9] CEA, India, "CO2 Baseline Database for the Indian Power Sector," December 2018. [Online]. Available: https://cea.nic.in/wp-content/uploads/baseline/2020/07/user_guide_ver14.pdf.

[10] Volker Quaschning, "Specific Carbon Dioxide Emissions of Various Fuels," May 2021. [Online]. Available: https://www.volker-quaschning.de/datserv/CO2-spez/index_e.php.

[11] N. K. Yadav and S. Arora, "Water-Inefficient Power: Implementing Water Norms and Zero Discharge in India's Coal-Power Fleet," Centre for Science and Environment, New Delhi, 2021.

[12] Eskom, "Sustainability Report 2021," Eskom, 2021.

[13] Y. Zhu, K. W. Hipel, G. Y. Ke and Y. Chen, "Establishment and optimization of an evaluation index system for brownfield redevelopment projects: An empirical study," *Environmental Modelling & Software,* pp. 173-182, 2015.

[14] Ontario Power Generation, "Nanticoke solar facility," [Online]. Available: https://www.opg.com/strengthening-the-economy/our-projects/nanticoke-solar-facility/. [Accessed 3 February 2022].

[15] A. Colthorpe, "LS Power repurposing former New Jersey coal plant site into offshore wind integration hub," 20 September 2021. [Online]. Available: https://www.energy-storage.news/ls-power-repurposing-former-new-jersey-coal-plant-site-into-offshore-wind-integration-hub/.

[16] Brayton Point Commerce Center, "About the Project," [Online]. Available: http://www.braytonpointcommercecenter.com/about/. [Accessed 3 February 2022].

[17] Wärtsilä, "Grid Reliability & Stability for PJM Regional Transmission Beckjord II," September 2020. [Online]. Available: https://www.wartsila.com/docs/default-source/power-plants-documents/downloads/reference-sheets/case-study-duke-beckjord.pdf. [Accessed 3 February 2022].

[18] C. Slattery and J. Fogarty, "Synchronous Condenser Conversions at FirstEnergy Eastlake Plant," October 2015. [Online]. Available: http://cigre-usnc.org/wp-content/uploads/2015/10/Slattery.pdf. [Accessed 3 February 2022].

[19] R. Walton, "Nuclear SMR firm NuScale Power exploring coal to small reactor project in Poland," 24 September 2021. [Online]. Available: https://www.power-eng.com/nuclear/nuclear-smr-firm-nuscale-power-exploring-coal-to-small-reactor-project-in-poland/.

[20] K. Chudy, "Mine Water as Geothermal Resource in Nowa Ruda Region (SW Poland)," *Water,* vol. 14, p. 136, 2022.

[21] M. Geyer, F. Trieb and S. Giuliano, "Repurposing of existing coal-fired power plants into Thermal Storage Plants for renewable power in Chile," Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Santiago de Chile, 2020.

[22] Drax, "How to switch a power station off coal," 22 August 2018. [Online]. Available: https://www.drax.com/sustainable-bioenergy/switch-power-station-off-coal/. [Accessed 3 February 2022].

[23] M. M. Mekonnen, P. W. Gerbens-Leenesa and A. Y. Hoekstraa, "The consumptive water footprint of electricity and heat: a global assessment," *Environmental Science: Water Research & Technology,* pp. 285-297, 2015.

[24] E. G. Hertwich, T. Gibon, E. A. Bouman, A. Arvesen, S. Suh, G. A. Heath, J. D. Bergesen, A. Ramirez, M. I. Vega and L. Shi, "Integrated life-cycle assessment of electricity-supply scenarios confirms global environmental benefit of low-carbon technologies," *PNAS,* pp. 6277-6282, 2014.

[25] Clean Energy Wire, "Clean Energy Wire," [Online]. Available: https://www.cleanenergywire.org/factsheets/germanys-energy-consumption-and-power-mix-charts.

[26] J. Wettengel, "Spelling out the coal exit – Germany's phase-out plan," 03 July 2020. [Online]. Available: https://www.cleanenergywire.org/factsheets/spelling-out-coal-phase-out-germanys-exit-law-draft.

[27] Frontier Economics, "Modern Coal Plants are Top of the List to be Shut Down First".

[28] B. Wehrmann, "First phase-out auction for German hard coal deemed success, modern plants go offline," 01 12 2020. [Online]. Available: https://www.cleanenergywire.org/news/first-phase-out-auction-german-hard-coal-deemed-success-modern-plants-go-offline.

[29] A. ETM, *Energy Transition Mechanism.*

[30] G. Steyn, E. Tyler, A. Roff, C. Renaud and L. Mgoduso, "THE JUST TRANSITION TRANSACTION: A DEVELOPING COUNTRY COAL POWER RETIREMENT MECHANISM," Meridian Economics, 2021.

[31] K. Calhoun, P. Chen, M. Einberger, R. Kansal, T. Matsuo, U. Varadarajan and Udetanshu, "Financing the Coal Transition: Pragmatic Solutions to Accelerate an Equitable, Clean Energy Future," RMI, 2021.

[32] Amundi and IFC, "Emerging Market Green Bonds Report 2020: On the Road to Green Recovery," Amundi Asset Management (Amundi) and International Finance Corporation (IFC), 2021.

[33] H. Ritchie and M. Roser, "Chile: Energy Country Profile," 2020. [Online]. Available: https://ourworldindata.org/energy/country/chile.

[34] Ministry of Energy - Chile, "Plan of Phase-out and / or Reconversion of Coal Units," Mnidtry of Energy - Chile, 2020.

[35] Programa Chile Sustentable, "PLAN FOR DECARBONISATION AND CLOSURE OF COAL-FIRED POWER PLANTS IN CHILE," 2019. [Online]. Available: http://www.chilesustentable.net/wp-content/uploads/2019/09/EN_Minuta_Acuerdos-Descarbonizaci%C3%B3n_VF_CHS_REV2.pdf.

[36] S. Djunisic, "Engie, AES to retire 674 MW of coal capacity in Chile earlier than agreed," Renewables Now, 2019. [Online]. Available: https://renewablesnow.com/news/engie-aes-to-retire-674-mw-of-coal-capacity-in-chile-earlier-than-agreed-679681/.

[37] D. Proctor, "Companies Accelerate Shutdown of Chilean Coal Plants," PowerMag, 2020. [Online]. Available: https://www.powermag.com/companies-accelerate-shutdown-of-chilean-coal-plants/.

[38] IDB Invest, "IDB Invest and ENGIE Chile debut the world's first pilot project to monetize the cost of decarbonization," 2021. [Online]. Available: https://idbinvest.org/en/news-media/idb-invest-and-engie-chile-debut-worlds-first-pilot-project-monetize-cost-decarbonization.

[39] Santander Bank Polska, "Santander Bank Polska supports TAURON’s Green Turnaround. The first sustainability-linked bonds are launched on the Polish market," Santander Bank Polska, 2020. [Online]. Available: https://www.santander.com/en/press-room/press-releases/2020/10/santander-bank-polska-supports-taurons-green-turnaround-the-first-sustainability-linked-bonds-are-launched-on-the-polish-market.

[40] NERSA, "Electricity Overview," [Online]. Available: https://www.nersa.org.za/electricity-overview/. [Accessed 26 March 2022].

[41] DMRE, RSA, "Integrated Resource Plan for Electricity 2010-2030," DMRE, RSA, 2011.

[42] EPRI, "Power Generation Technology Data for Integrated Resource Plan of South Africa," DMRE, RSA, 2017.

[43] Eskom, "Report on High Level Costing for Collector Stations for Generation Prepared for Input Into the Integrated Resource Plan," 2017.

[44] DPME, RSA, "Draft Final Impact Assessment," DMRE, RSA, 2018.

[45] DPE, RSA, "Roadmap for Eskom in a Reformed Electricity Supply Industry," 2019.

[46] DMRE, RSA, " Electricity Regulations on New Generation Capacity," 2016. [Online].

[47] DMRE, RSA, "Electricity Regulation Act, 2006: Amendment of Electricity Regulations on New Generation Capacity, 2011," 2020. [Online]. Available: https://www.gov.za/sites/default/files/gcis_document/202010/43810gon1093.pdf.

[48] IPP Office, "Independent Power Producers Procurement Programme (IPPPP) An Overview," Independent Power Producer Office, Centurion, 2021.

[49] DMRE, RSA, "Licensing Exemption and Registration Notice," 5 October 2021. [Online]. Available: https://www.gov.za/sites/default/files/gcis_document/202110/45266gon1000.pdf.

[50] Republic of South Africa, "South Africa - First Nationally Determined Contribution Under the Paris Agreement," United Nations Framework Convention on Climate Change, 2021.

[51] Eskom, "Eskom's Just Energy Transition within A South African Just Transition Context," October 2021. [Online]. Available: https://www.agbiz.co.za/document/open/eskom-jet-facility-nedlac.

[52] ESRG, UCT, "Technical Analysis to Support the Update of South Africa's First NDC's Mitigation Target Ranges," University of Cape Town, Cape Town, 2021.

[53] DFFE, RSA, "South Africa Low-emission Development Strategy 2050," Department of Forestry, Fisheries and the Environment, 2020.

[54] Eskom, "Eskom's Just Energy Transition (JET) Plans," 30 July 2021. [Online].

[55] DMRE, RSA, "Determination Under Section 34(1) of the Electricity Regulation Act, 2006 (Act No. 4 of 2006)," 25 September 2020. [Online]. Available: https://www.gov.za/sites/default/files/gcis_document/202009/43734gon1015s.pdf.

[56] Centre for Environmental Rights, "Celebrating a major climate victory: Court sets aside approval for Thabametsi coal power plant," 1 December 2020. [Online]. Available: https://cer.org.za/news/celebrating-a-major-climate-victory-court-sets-aside-approval-for-thabametsi-coal-power-plant.

[57] Life After Coal, "Final nail in the coffin for proposed Khanyisa Coal Power Station," 3 June 2021. [Online]. Available: https://lifeaftercoal.org.za/media/news/final-nail-in-the-coffin-for-proposed-khanyisa-coal-power-station.

[58] Department of National Treasury, RSA, "Act No. 15 of 2019: Carbon Tax Act, 2019," Government of Republic of South Africa, Cape Town, 2019.

[59] Eskom, "Integrated Report," Eskom, 2021.

[60] Eskom/Twitter, "Eskom_SA," 17 August 2021. [Online]. Available: https://twitter.com/Eskom_SA/status/1427653886031155207.

[61] Eskom, "Eskom launches tender to 'repurpose' coal plants with low-carbon growth tech," 2020. [Online]. Available: https://www.pv-magazine.com/2020/04/23/eskom-launches-tender-to-repurpose-coal-plants-with-low-carbon-growth-tech/.

[62] Department of National Treasury, RSA, "Draft Green Finance Taxonomy," Department of National Treasury, RSA, 2021.

[63] DFFE, RSA, "Climate Change Bill," 2021. [Online]. Available: https://www.parliament.gov.za/storage/app/media/Bills/2022/B9_2022_Climate_Change_Bill/B9_2022_Climate_Change_Bill.pdf.

[64] European Commission, "France, Germany, UK, US and EU launch ground-breaking International Just Energy Transition Partnership with South Africa," 2 November 2021. [Online]. Available: https://ec.europa.eu/commission/presscorner/detail/en/IP_21_5768.

[65] A. Sguazzin, "Eskom Is Seeking $2.3 Billion From Development Institutions," 5 August 2021. [Online]. Available: https://www.bloomberg.com/news/articles/2021-08-05/eskom-in-talks-to-raise-2-3-billion-from-development-financiers.

[66] Lazard, "Levelized Cost Of Energy, Levelized Cost Of Storage, and Levelized Cost Of Hydrogen," Lazard, 28 October 2021. [Online]. Available: https://www.lazard.com/perspective/levelized-cost-of-energy-levelized-cost-of-storage-and-levelized-cost-of-hydrogen/. [Accessed 28 March 2022].

[67] Lazard, "Levelized Cost Of Energy, Levelized Cost Of Storage, and Levelized Cost Of Hydrogen 2020," Lazard, 19 October 2020. [Online]. Available: https://www.lazard.com/perspective/lcoe2020. [Accessed 28 March 2022].

[68] Lazard, "Levelized Cost of Energy and Levelized Cost of Storage 2019," Lazard, 7 November 2019. [Online]. Available: https://www.lazard.com/perspective/lcoe2019. [Accessed 28 March 2022].

[69] Lazard, "Levelized Cost of Energy and Levelized Cost of Storage 2018," Lazard, 8 November 2018. [Online]. Available: https://www.lazard.com/perspective/levelized-cost-of-energy-and-levelized-cost-of-storage-2018/. [Accessed 28 March 2022].

[70] J. Wright and J. Calitz, "Systems analysis to support increasingly ambitious CO2 emissions scenarios in the South African electricity system," Council for Scientific and Industrial Research, Pretoria, 2020.

[71] Bloomberg, "Eskom shoots down Treasury's power plant sale plan," EGSA, 31 August 2019. [Online]. Available: https://www.egsa.org.za/actors/eskom/eskom-shoots-down-treasurys-power-plant-sale-plan/. [Accessed 28 March 2022].

[72] Ministry of Power, India, "Trade in Electricity," 19 March 2020. [Online]. Available: https://pib.gov.in/PressReleasePage.aspx?PRID=1607177.

[73] Ministry of Power, India, "Responsibilities," 25 March 2022. [Online]. Available: https://powermin.gov.in/en/content/responsibilities.

[74] Ministry of Power, India, "Draft National Electricity Policy 2021," 27 April 2021. [Online]. Available: https://powermin.gov.in/sites/default/files/webform/notices/Inviting_suggestions_on_draft_NEP_2021_0.pdf.

[75] MNRE, India, "The Ministry," 28 March 2022. [Online]. Available: https://mnre.gov.in/the-ministry/what-does-the-ministry-do/.

[76] Ministry of Coal, India, "Functions and Responsibilities," 28 March 2022. [Online]. Available: https://coal.nic.in/en/about-us/functions-and-responsibilities.

[77] MoEFCC, India, "Introduction," 28 March 2022. [Online]. Available: https://moef.gov.in/en/about-the-ministry/introduction-8/.

[78] CEA, India, "Installed Capacity," March 2021. [Online]. Available: https://cea.nic.in/wp-content/uploads/installed/2021/03/installed_capacity.pdf.

[79] CEA, India, "Retirement of power generating units in the country," 25 January 2017. [Online]. Available: https://cea.nic.in/old/reports/others/planning/pdm/retirement.pdf.

[80] MoEFCC, India, "India's Intended Nationally Determined Contribution," 2015.

[81] MEA, India, "National Statement by Prime Minister Shri Narendra Modi at COP26 Summit in Glasgow," 2 Nivember 2021. [Online]. Available: https://www.mea.gov.in/Speeches-Statements.htm?dtl/34466/National+Statement+by+Prime+Minister+Shri+Narendra+Modi+at+COP26+Summit+in+Glasgow.

[82] MNRE, India, "Objective - National Portal for Renewable Purchase Obligation," Ministry of New and Renewable Energy, India, [Online]. Available: https://rpo.gov.in/Home/Objective. [Accessed 31 March 2022].

[83] MNRE, India, "'MUST-RUN' for Renewable Generating Stations," 4 April 2020. [Online]. Available: https://mnre.gov.in/img/documents/uploads/file_f-1586142405322.pdf. [Accessed 31 March 2022].

[84] MNRE, India, "Production Linked Incentive Scheme 'National Programme on High Efficiency Solar PV Modules'," 28 April 2021. [Online]. Available: https://mnre.gov.in/img/documents/uploads/file_f-1619672166750.pdf. [Accessed 31 March 2022].

[85] R. K. Singh, "India to Stick With Plan to Tax Imports of Solar Equipment," Bloomberg, 1 February 2022. [Online]. Available: https://www.bloomberg.com/news/articles/2022-02-01/india-to-stick-with-plan-to-tax-imports-of-solar-equipment. [Accessed 31 March 2022].

[86] Ministry of Power, India, "Guidelines for Tariff Based Competitive Bidding Process for Procurement of Round-The Clock Power from Grid Connected Renewable Energy Power Projects, complemented with Power from Coal Based Thermal Power Projects.," 22 July 2020. [Online]. Available: https://powermin.gov.in/sites/default/files/Notification_dated_22_July_2020.pdf. [Accessed 31 March 2022].

[87] Ministry of Power, India, "Amendments to the Guidelines for Tariff Based Competitive Bidding Process for Procurement of Round-The Clock Power from Grid Connected Renewable Energy Power Projects, complemented with Power from Coal Based Thermal Power Projects," 3 November 2020. [Online]. Available: https://powermin.gov.in/sites/default/files/Resolution_on_Amendments_to_the_Guidelines_for_procurement_of_RTC_power_from_Grid_Connected_RE_Power_complemented_by_coal_based_thermal_power.pdf. [Accessed 31 March 2022].

[88] Ministry of Power, India, " Scheme for Flexibility in Generation and Scheduling of Thermal/Hydro Power Stations through bundling with Renewable Energy and Storage Power," 17 November 2021. [Online]. Available: https://powermin.gov.in/sites/default/files/Scheme_for_Flexibility_in_Generation_and_Scheduling_of_Thermal_Hydro_Power_Stations_through_bundling_with_Renewable_Energy_and_Storage_Power.pdf. [Accessed 31 March 2022].

[89] Ministry of Power, India, "Waiver of Inter-State Transmission Charges on Transmission of the Electricity generated from Solar and Wind Sources of Energy-Amendment thereof.," 21 June 2021. [Online]. Available: https://powermin.gov.in/sites/default/files/Waiver_of_inter_state_transmission_charges_Order_dated_21_June_2021.pdf. [Accessed 31 March 2022].

[90] NITI Aayog, "State Renewable Energy Capacity Addition Roadmap," NITI Aayog, 2017.

[91] MoEFCC, India, "Third Biennial Update Report to the United Nations Framework Convention on Climate Change," United Nations Framework Convention on Climate Change, 2021.

[92] Embassy of the Republic of Indonesia, "Indonesia Facts and Figures," 2017. [Online]. Available: https://www.embassyofindonesia.org/basic-facts/.

[93] Global Peo Services, "Top 15 Countries by GDP in 2022," Global Peo Services, 2022. [Online]. Available: https://globalpeoservices.com/top-15-countries-by-gdp-in-2022/. [Accessed 2022].

[94] Indonesia Investments, "Indonesia Investments," 5 April 2018. [Online]. Available: https://www.indonesia-investments.com/business/commodities/coal/item236.

[95] DEVELOPMENTAID, "DEVELOPMENTAID," 2022. [Online]. Available: https://www.developmentaid.org/#!/donors/view/143865/coordinating-ministry-for-economic-affairs-indonesia.

[96] Sustainable Industrial Areas (SIA), "INDONESIA STATE MINISTRY OF ENVIRONMENT AND FORESTRY," 2022. [Online]. Available: https://www.sia-toolbox.net/organization/indonesia-state-ministry-environment-and-forestry.

[97] DEVEX (MSOE), "Ministry of State Owned Enterprises (Kementerian Badan Usaha Milik Negara Republik) (Indonesia)," 2022. [Online]. Available: https://www.devex.com/organizations/ministry-of-state-owned-enterprises-kementerian-badan-usaha-milik-negara-republik-indonesia-147684.

[98] M. Vagliasindi and J. Besant-Jones, "Indonesia | Power Market Structure," 2013. [Online]. Available: https://elibrary.worldbank.org/doi/10.1596/9780821395561_CH07.

[99] Firmansyah and Rizki Karim, "Thomson Reuters Practical Law," 01 May 2021. [Online]. Available: https://uk.practicallaw.thomsonreuters.com/w-025-0669?transitionType=Default&contextData=(sc.Default)&firstPage=true.

[100] IEA, "Energy Law No. 30/2007," 2017. [Online]. Available: https://www.iea.org/policies/1858-energy-law-no-302007.

[101] Asia Pacific Energy, "Asia Pacific Energy," 2007. [Online]. Available: https://policy.asiapacificenergy.org/node/3027.

[102] Asia Pacific Energy, "Law of the Republic of Indonesia No. 30/2007," 2007. [Online]. Available: http://extwprlegs1.fao.org/docs/pdf/ins79317.pdf.

[103] Republic Of Indonesia, "FIRST NATIONALLY DETERMINED CONTRIBUTION REPUBLIC OF INDONESIA," November 2016. [Online]. Available: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Indonesia%20First/First%20NDC%20Indonesia_submitted%20to%20UNFCCC%20Set_November%20%202016.pdf.

[104] Republic of Indonesia, "UPDATED NATIONALLY DETERMINED CONTRIBUTION REPUBLIC OF INDONESIA," 2021. [Online]. Available: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Indonesia%20First/Updated%20NDC%20Indonesia%202021%20-%20corrected%20version.pdf.

[105] Republic of Indoneisa, "Long-Term Strategy for Low Carbon and Climate Resilience 2050," 2021. [Online]. Available: https://unfccc.int/sites/default/files/resource/Indonesia_LTS-LCCR_2021.pdf.

[106] IEA, "Incentives for biodiesel," 08 July 2021. [Online]. Available: https://www.iea.org/policies/13539-incentives-for-biodiesel?country=Indonesia&page=1&qs=indonesia.

[107] Reuters, "Indonesia weighing subsidy options to support biodiesel programme," 13 May 2020. [Online]. Available: https://www.reuters.com/article/us-indonesia-biodiesel-idUSKBN22P0VE.

[108] Ministry of Energy and Mineral Resources, Republic of Indonesia, "Handbook of Energy & Economic Statistics of Indonesia," 2020. [Online]. Available: https://www.esdm.go.id/assets/media/content/content-handbook-of-energy-and-economic-statistics-of-indonesia-2020.pdf.

[109] Mongabay, "Indonesia says no new coal plants from 2023 (after the next 100 or so)," 12 May 2021. [Online]. Available: https://news.mongabay.com/2021/05/indonesia-says-no-new-coal-plants-from-2023-after-the-next-100-or-so/.

[110] Mongabay, "Indonesia to retire coal-fired power plants while also adding more," 08 June 2021. [Online]. Available: https://news.mongabay.com/2021/06/indonesia-to-retire-coal-fired-power-plants-while-also-adding-more/.

[111] Earth.Org, "Indonesia to Retire Coal-Fired Power Plants While Also Adding More," 11 June 2021. [Online]. Available: https://earth.org/indonesia-to-retire-coal-fired-power-plants-while-adding-more/?gclid=Cj0KCQiAys2MBhDOARIsAFf1D1cWBP8tCuW---KHxcyqfZGhgperfwwsQCKoHoet76MzCEBXuMYqLYMaAkCjEALw_wcB.

[112] PLN, "RUPTL 2021-2030," 2021. [Online]. Available: https://gatrik.esdm.go.id/assets/uploads/download_index/files/38622-ruptl-pln-2021-2030.pdf. [Accessed 2022].

[113] Reuters, "Indonesia could phase out coal by 2040 with financial help, finmin says," 03 November 2021. [Online]. Available: https://www.reuters.com/world/asia-pacific/indonesia-could-phase-out-coal-by-2040-with-financial-help-minister-2021-11-02/.

[114] Pinsent Manson, "Indonesia could retire coal by 2040 with financial help," 05 November 2021. [Online]. Available: https://www.pinsentmasons.com/out-law/news/indonesia-could-retire-coal-by-2040-with-financial-help.

[115] Reuters, "Indonesia introduces carbon trading policy to reduce emission," 15 November 2021. [Online]. Available: https://www.reuters.com/business/cop/indonesia-introduces-carbon-trading-policy-reduce-emission-2021-11-15/.

[116] U.S. Energy Information Administration (EIA), "Country Analysis Executive Summary: Indonesia," 24 September 2021. [Online]. Available: https://www.eia.gov/international/content/analysis/countries_long/Indonesia/indonesia.pdf. [Accessed 31 March 2022].

[117] Argus Media, "Indonesia co-fires biomass at 17 coal-fired plants," 24 June 2021. [Online]. Available: https://www.argusmedia.com/es/news/2227825-indonesia-cofires-biomass-at-17-coalfired-plants?amp=1.

[118] Baker McKenzie, "Indonesian Government Puts the Squeeze on Renewable Energy Tariffs," February 2017. [Online]. Available: https://www.bakermckenzie.com/-

/media/files/insight/publications/2017/02/indonesia-govt-renewable-energy-tariffs/al_indonesia_govtrenewableenergytariffs_feb2017.pdf?la=en.

[119] Baker McKenzie, "Indonesia: Government publishes PLN's 2020 Cost of Generation (BPP) figures," 2020. [Online]. Available: https://insightplus.bakermckenzie.com/bm/projects/indonesia-government-publishes-plns-2020-cost-of-generation-bpp-figures.

[120] Institute for Essential Services Reform (IESR), "Indonesia's Coal Dynamics," March 2019. [Online]. Available: https://www.climate-transparency.org/wp-content/uploads/2019/04/SPM-english-lowres.pdf.

[121] J. Wiseman, S. Campbell and F. Green, "Prospects for a "just transition" away from coal-fired power generation in Australia: Learning from the closure of the Hazelwood Power Station," Crawford School of Public Policy, 2017.

[122] "Philippines: A Whole-of-government Approach to Creating Green Jobs," April, 2021.

[123] R. Bridle, L. Kitson, H. Duan, L. Sanchez and T. Merril, "At the Crossroads: Balancing the financial and social costs of coal transition in China," International Institute for Sustainable Development, July, 2017.

[124] A. Zinecker, P. Gass, I. Gerasimchuk and P. Jain, "Real People, Real Change – Strategies for just energy transitions," International Institue od Sustainable Development, December 2018.

[125] L. Christiaensen and C. Ferre., "Just Coal Transition in Western Macedonia, Greece," The World Bank Group, October 2020.

[126] World Resources Institute, "South Africa: Strong Foundations for a Just Transition," World Resources Institute, 2021.

[127] International Trade Union Congress, "A Just Transition : Fair Pathway to protect the climate change by Trade Unions and Climate Change".

[128] Center for Strategic & International Studies, "Understanding Just Transitions in Coal Dependent Communities – Just Transition Initiative," 2021.

[129] Reuters, "The Cost of Coal in South Africa: Dirty Skies, Sick Kids," 2021. [Online]. Available: https://www.reuters.com/business/cop/cost-coal-south-africa-dirty-skies-sick-kids-2021-11-04/. [Accessed 31 March 2022].

[130] COBENEFITS, "Improving health and reducing costs through renewable energy in South Africa," 25 March 2019. [Online]. Available: https://www.cobenefits.info/resources/cobenefits-south-africa-health/.

[131] M. Ram, J. C. A. A. Osorio-Aravena, D. Bogdanov and C. Breyer, "Job creation during a climate compliant global energy transition across the power, heat, transport, and desalination sectors by 2050," *Energy,* vol. 238, p. 121690, 2022.

[132] IASS and CSIR, "Future skills and job creation with renewable energy in South Africa," IASS and CSIR, Pretoria, 2019.

[133] IASS, TERI, CEEW, and SCGJ, "Future skills and job creation with renewable energy in India," IASS, New Delhi, 2019.

[134] TERI, "Unlocking-co-benefits-decarbonizing-India's-power-sector," TERI, 2020.

[135] R. Gupta, "Mapping the Impact of Coal Mines and their Closure: A Case of Betul," TERI.

[136] National Informatics Center, India, "Kusum Pradhan Mantri Kisan Urja Suraksha Evam Utthan Mahabhiyan," [Online]. Available: https://www.india.gov.in/spotlight/pm-kusum-pradhan-mantri-kisan-urja-suraksha-evam-utthaan-mahabhiyan-scheme.

[137] PAGE, "Indonesia's Transition to a green economy – A stock taking report," United Nations Development Programme, 2019.

[138] A. M. Hernandez and Y. T. B. Prakoso, "Life After Oil – Teaching Indonesia's Energy Transition".

[139] UNEP, "Global Environmental Outlook," 2000.

[140] BillC, "A coal-fired thermal power station," Wikimedia Commons, 24 June 2006. [Online]. Available: https://commons.wikimedia.org/wiki/File:PowerStation3.svg. [Accessed 1 April 2022].

[141] Department of Statistics, RSA, "Time series data – Excel and ASCII format," March 2022. [Online]. Available: http://www.statssa.gov.za/?page_id=1847. [Accessed 25 March 2022].

[142] CSIR, "Forecasts for Electricity Demand in South Africa (2017 – 2050) Using the CSIR Sectoral Regression Model for the Integrated Resource Plan of South Africa," Department of Energy, RSA, 2017.

[143] News 24, "Glossary of terms to assist understanding of Eskom key performance indicators," 25 October 2021. [Online]. Available: https://www.news24.com/news24/southafrica/investigations/eskomfiles/glossary-of-terms-to-assist-understanding-of-eskom-key-performance-indicators-20211024.

[144] Eskom, "Medium-term System Adequacy Outlook 2022 - 2026," Eskom, 2021.

[145] IEA, "African Energy Outlook," 2019.

[146] Wikipedia, "List of power stations in South Africa," 25 March 2022. [Online]. Available: https://en.wikipedia.org/wiki/List_of_power_stations_in_South_Africa#Coal_fired.

[147] DMRE, RSA, "Integrated Resource Plan 2019," Department of Mineral Resources and Energy, Republic of South Africa, 2019.

[148] DMRE, RSA, "Project information on the 8 RMIPPPP's," 29 March 2021. [Online].

[149] DMRE, RSA, "Department of Mineral Resources and Energy Announces Three Additional Preferred Bidders Appointed Under the Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP)," 1 June 2021. [Online].

[150] DMRE, RSA, "Overview of the Request for Qualification and Proposals for New Generation Capacity Under the Risk Mitigation IPP Procurement Programme," DMRE, RSA, 2021.

[151] Department of Statistics, RSA, "Quarterly and Regional Fourth quarter 2020," 2021. [Online]. Available: https://view.officeapps.live.com/op/view.aspx?src=http%3A%2F%2Fwww.statssa.gov.za%2Fpublications%2FP0441%2FQuarterly%2520and%2520Regional_Fourth_quarter%25202020.xls&wdOrigin=BROWSELINK. [Accessed 26 March 2022].

[152] Department of Statistics, RSA, "Mining industry, 2019," Department of Statistics, RSA, 2021.

[153] Provincial Treasury, Mpumalanga, "Socio-economic Review & Outlook of Mpumalanga," 2015.

[154] International Monetary Fund, "World Economic Database (October 2021)," International Monetary Fund, 2021.

[155] South African Reserve Bank, "Quarterly Bulletin – No 302 (December 2021)," South African Reserve Bank, 2021.

[156] Department of National Treasury, RSA, "Annexure D: Public-Sector Infrastructure Update, Budget Review 2021," National Treasury of the Republic of South Africa, 2021.

[157] Department of Public Works and Infrastructure, RSA, "National Infrastructure Plan 2050," Department of Public Works and Infrastructure of the Republic of South Africa.

[158] Department of National Treasury, RSA and South African Revenue Service, "2021 Tax Statistics," National Treasury and South African Revenue Service, 2021.

[159] Department of National Treasury, RSA, "Government Debt and Contingent Liabilities, Budget Review 2021," National Treasury of the Republic of South Africa, 2021.

[160] Department of National Treasury, RSA, "Statistical annexure, Budget Review 2021," National Treasury of the Republic of South Africa, 2021.

[161] Reuters, "S&P, Fitch affirms South Africa's sovereign rating, outlook," Reuters, 22 May 2021. [Online]. Available: https://www.reuters.com/article/safrica-ratings-sp-idUSL2N2N82PV.

[162] Fitch Ratings, "Fitch Revises South Africa's Outlook to Stable; Affirms at 'BB-'," Fitch Ratings, 15 December 2021. [Online]. Available: https://www.fitchratings.com/research/sovereigns/fitch-revises-south-africa-outlook-to-stable-affirms-at-bb-15-12-2021.

[163] Moody's, "Moody's changes South Africa's outlook to stable; affirms Ba2 ratings," Moody's, 1 April 2022. [Online]. Available: https://www.moodys.com/research/Moodys-changes-South-Africas-outlook-to-stable-affirms-Ba2-ratings--PR_464348.

[164] Department of National Treasury, RSA, "Debt Management Report 2020/21," National Treasury of the Republic of South Africa, 2021.

[165] Eskom, "Eskom Financial Statements and Annual Reports," Eskom, 2001, 2006, 2011, 2016, 2017, 2018, 2019, 2020, 2021.

[166] South African Reserve Bank, "Selected South African banking sector trends (November 2021)," South African Reserve Bank, 2021.

[167] South African Reserve Bank, "Prudential Authority Annual Report," South African Reserve Bank.

[168] South African Reserve Bank, "Quarterly Bulletin Publications," South Africa Reserve Bank.

[169] International Finance Corporation, "Emerging Market Green Bonds Report 2018," International Finance Corporation (IFC), 2018.

[170] South African Reserve Bank, "Selected South African banking sector trends (September 2021)," South African Reserve Bank, 2021.

[171] Graduate School of Business, UCT, "Review, Lessons Learned & Proposals to Reduce Transaction Costs, The South African Renewable Energy IPP Procurement Programme," Graduate School of Business, University of Cape Town.

[172] PwC, "Africa Capital Markets Watch 2020," PwC, 2020.

[173] Climate Bonds Initiative, "Climate Bonds Initiative," Climate Bonds Initiative, [Online]. Available: https://www.climatebonds.net/market/data/.

[174] Stockholm Sustainable Finance Center, "Scoping the Sustainable Finance Landscape in Africa: The Case of Green Bonds, July 2020," Stockholm Sustainable Finance Center, 2020.

[175] Climate Bonds Initiative, "Green Bond Fact Sheet," Climate Bonds Initiative, [Online]. Available: https://www.climatebonds.net/files/files/2018-03%20ZA%20Growthpoint%20Properties.pdf.

[176] IFC, "IFC press release dated 6 May 2021," IFC, 2021.

[177] Department of National Treasury, RSA, "Carbon Tax Implementation In South Africa 2020: Stakeholder Consultations," National Treasury, 2020.

[178] Energy Monitor, "Why South Africa's carbon offset market is looking to expand," Energy Monitor, 22 January 2021. [Online]. Available: https://www.energymonitor.ai/policy/carbon-markets/why-south-africas-carbon-offset-market-is-looking-to-expand.

[179] CEA, India, "Long term Electricity Demand Forecasting," Central Electricity Authority, India, New Delhi, 2019.

[180] MoSPI, India, "Energy Statistics India 2021," 2021. [Online]. Available: https://mospi.gov.in/web/mospi/reports-publications/-/reports/view/templateFive/22303?q=RPCAT.

[181] CEA, India, "National Electricity Plan," Central Electricity Authority, India, New Delhi, 2018.

[182] MoSPI, India, "National Accounts Statistics 2021," 2021. [Online]. Available: https://www.mospi.gov.in/web/mospi/reports-publications/-/reports/view/templateFive/22001?q=RPCAT.

[183] MoSPI, India, "Periodic Labour Force Survey 2019-20," Ministry of Statistics and Programme Implementation, India, New Delhi, 2021.

[184] S. Pai, H. Zerriffi, J. Jewell and J. Pathak, "Solar has greater techno-economic resource suitability than wind for replacing coal mining jobs," *Environmental Research Letters,* p. 034065, 2020.

[185] Ministry of Coal, India, "Annual Report 2020-21," 2021. [Online]. Available: https://coal.nic.in/en/public-information/reports/annual-reports/annual-report-2020-21.

[186] Ministry of Finance, India, "Statistical Appendix, Economic Survey 2020-21," Ministry of Finance, India, New Delhi, 2021.

[187] Indian Railways, "Annual Statistical Statements 2020-21," Indian Railways, New Delhi, 2021.

[188] M. Aggarwal, "About 40 percent of India's districts have some form of coal dependency," 1 July 2021. [Online]. Available: https://india.mongabay.com/2021/07/about-40-percent-of-indias-districts-have-some-form-of-coal-dependency/.

[189] Department of Economic Affairs (DEA), India, "National Infrastructure Pipeline," Department of Economic Affairs (DEA), Ministry of Finance, The Government of India.

[190] Asian Development Bank, Key Indicators for Asia and The Pacific 2021, Asian Development Bank (ADB), 2021.

[191] Ministry of Finance, India, "Economic Survey 2021-2022," Ministry of Finance, Government of India, 2022.

[192] Fitch Ratings, "Fitch Affirms India at 'BBB-'; Outlook Negative," Fitch Ratings, 16 November 2021. [Online]. Available: https://www.fitchratings.com/research/sovereigns/fitch-affirms-india-at-bbb-outlook-negative-16-11-2021.

[193] Ministry of Finance, India, "Union Budget 2022-2023," Ministry of Finance, Government of India, 2022.

[194] NTPC Limited, "Exchange Filings and Annual Reports," NTPC Limited, 2017, 2018, 2019, 2020, 2021.

[195] Central Electricity Authority (CEA), India, "All India Installed Capacity of Power Stations, March 2021," Central Electricity Authority (CEA), Ministry of Power, 2021.

[196] Power Finance Corporation Limited, "Annual Reports and Company Filings," Power Finance Corporation Ltd. (PFC), 2018, 2019, 2020, 2021.

[197] Fitch Ratings, "Fitch Affirms Power Finance Corporation at 'BBB-'; Outlook Negative," Fitch Ratings, 26 May 2021. [Online]. Available: https://www.fitchratings.com/research/international-public-finance/fitch-affirms-power-finance-corporation-at-bbb-outlook-negative-26-05-2021.

[198] REC Limited, "Annual Reports and Company Filings," REC Ltd, 2018, 2019, 2020, 2021.

[199] Fitch Ratings, "Fitch Affirms REC Limited at 'BBB-'; Outlook Negative," Fitch Ratings, 16 May 2021. [Online]. Available: https://www.fitchratings.com/research/international-public-finance/fitch-affirms-rec-limited-at-bbb-outlook-negative-26-05-2021.

[200] Reserve Bank of India, "Database on Indian Economy," Reserve Bank of India.

[201] Reserve Bank of India, "Handbook of Statistics on Indian Economy," Reserve Bank of India.

[202] Reserve Bank of India, "Sectoral Deployment of Non-Food Gross Bank Credit – Outstanding," Reserve Bank of India.

[203] Reserve Bank of India, "RBI/2015-16/70, Master Circulars," Reserve Bank of India.

[204] Reserve Bank of India, "Report On Trend and Progress of Banking in India," Reserve Bank of India.

[205] A. Ahmed and N. Verma, "RBI asks IL&FS lenders to classify loans to firm as non-performing: sources," Reuters, 8 January 2019. [Online]. Available: https://www.reuters.com/article/india-cenbank-il-fs-idINKCN1P21TB. [Accessed 31 March 2022].

[206] Climate Transparency, "Brown to Green: The G20 transition to a low-carbon economy (2017)," Climate Transparency, 2017.

[207] IFC and Amundi, "Emerging Market Green Bonds Report," IFC and Amundi.

[208] Securities and Exchange Board of India, "Circular No: CIR/IMD/DF/51/2017," Securities and Exchange Board of India (SEBI).

[209] Axis Bank, "Green Bond Impact Report 2019-20," Axis Bank, 2020.

[210] Greenko Group, "Greenko Group Integrated Annual Report," Greenko Group, 2021.

[211] IREDA, "Annual Report," IREDA, 2017, 2018, 2019, 2020, 2021.

[212] Reserve Bank of India, "Green Finance in India: Progress and Challenges, RBI Bulletin January 2021," Reserve Bank of India, 2021.

[213] Press Information Bureau, "Ministry of Power issued more than 38 lakhs Energy Savings Certificates to Industries," Press Information Bureau, 22 March 2017. [Online]. Available: https://pib.gov.in/newsite/PrintRelease.aspx?relid=159670.

[214] Ministry of Power, India, "Bureau of Energy Efficiency," Bureau of Energy Efficiency, [Online]. Available: https://beeindia.gov.in/content/escerts-trading.

[215] Centre for Science and Environment, "Perform, Achieve and Trade (PAT) Scheme of Thermal Power Plants: A Critical Analysis," Centre for Science and Environment (CSE), 2021.

[216] Indian Energy Exchange, "Market Data, Indian Energy Exchange (IEX)," Indian Energy Exchange, [Online]. Available: https://www.iexindia.com/marketdata/ESCerts_Market.aspx.

[217] CEFIM Programme Manager, "Clean Energy Finance & Investment Mobilisation (CEFIM)," 16 11 2021. [Online]. Available: https://www.oecd.org/environment/cc/cefim/indonesia/RUPTL-2021-30-PLN-steps-up-ambitions-to-accelerate-clean-energy-investments-in-Indonesia.pdf.

[218] Secretariat General National Energy Council, "Indonesia Energy Outlook 2019," 2019. [Online]. Available: https://www.esdm.go.id/assets/media/content/content-indonesia-energy-outlook-2019-english-version.pdf.

[219] Ministry of Energy and Mineral Resources, Republic of Indonesia, "RUPTL 2021-2030," 2021. [Online]. Available: https://web.pln.co.id/statics/uploads/2021/10/materi-diseminasi-2021-2030-publik.pdf.

[220] Institute for Essential Services Reform (IESR), "Indonesia's Coal Dynamics," March 2019. [Online]. Available: https://www.climate-transparency.org/wp-content/uploads/2019/04/SPM-english-lowres.pdf.

[221] N. Coca, "Welcome To Indonesia – Coal's Final Frontier," 21 March 2021. [Online]. Available: https://science.thewire.in/environment/welcome-to-indonesia-coals-final-frontier/.

[222] The Coal Hub: The Coal Industry Portal, "Indonesia's coal exports decline sharply," 2021. [Online]. Available: https://thecoalhub.com/indonesias-exports-decline-sharply.html.

[223] Institute of Essential Services Reform (IESR), "Coal Dynamics in Indonesia," April 2019. [Online]. Available: http://iesr.or.id/wp-content/uploads/2019/03/Coal-Transition-in-Indonesia-Jakarta-April-2019-2.pdf.

[224] I. Walia, "Indonesia's Export Ban," 2021. [Online]. Available: https://www.preciousshipping.com/en/2021/08/10/10-08-2021-indonesias-export-ban-could-add-to-chinas-coal-pain-by-inderpreet-walia-lloyds-list/.

[225] IEA, "A rebound in global coal demand in 2021 is set to be short-lived, but no immediate decline in sight," International Energy Agency, 18 December 2020. [Online]. Available: https://www.iea.org/news/a-rebound-

in-global-coal-demand-in-2021-is-set-to-be-short-lived-but-no-immediate-decline-in-sight. [Accessed 31 March 2022].

[226] Construction World, "Indonesia halts coal exports for 34 mining companies," 2022. [Online]. Available: https://www.constructionworld.in/amp/Latest-Construction-News/indonesia-halts-coal-exports-from-34-mining-companies-/29093. [Accessed 2022].

[227] Ministry of Investment, Indonesia, "MSMEs Receive Strong Support from Government," Ministry of Investment/BKPM.

[228] Bappenas, "Rencana Pembangunan Jangka Menengah Nasional IV 2020-2024 (RPJMN)," Bappenas.

[229] Ministry of Finance, Indonesia, "Advertorial Purposed 2021 Budget," Ministry of Finance, The Republic of Indonesia, 2021.

[230] Bank Indonesia, "Government Finance Sector, Indonesia Financial Statistics," Bank Indonesia.

[231] Bank Indonesia, "Real Sector, Indonesia Financial Statistics," Bank Indonesia.

[232] Bank Indonesia, "Indonesia Public Sector Debt Statistics Quarter III 2021," Bank Indonesia, 2021.

[233] Fitch Ratings, "Fitch Affirms Indonesia at 'BBB'; Outlook Stable," Fitch Ratings, 22 November 2021. [Online]. Available: https://www.fitchratings.com/research/sovereigns/fitch-affirms-indonesia-at-bbb-outlook-stable-22-11-2021.

[234] PT PLN, "Company Disclosures and Annual Reports," PT PLN, 2016, 2017, 2018, 2019, 2020.

[235] OJK, "Indonesia Banking Statistic (December 2021)," OJK, 2021.

[236] Bank Indonesia, "Monetary Sector, Indonesia Financial Statistics," Bank Indonesia.

[237] ADB, "Asian Bond Markets Initiative," ADB.

[238] Indonesia Stock Exchange, "Indonesia Bond Market Directory (2021)," Indonesia Stock Exchange, 2021.

[239] Climate Bonds Initiative, "Green Infrastructure Investment Opportunities, Indonesia: Green Recovery," Climate Bonds Initiative.

[240] Climate Bonds Initiative, "Unlocking green bonds in Indonesia: a guide for issuers, regulators and investors," Climate Bonds Initiative.

[241] Reuters, "Indonesia introduces carbon trading policy to reduce emission," Reuters, 2021.

[242] The Strait Times, "Indonesia delays carbon tax till July to help economic recovery," The Strait Times, 2022.

[243] R. Gayatri Suroyo, "Indonesia to keep carbon trade local until greenhouse gas target met," 19 November 2021. [Online]. Available: https://www.reuters.com/markets/commodities/indonesia-keep-carbon-trade-local-until-greenhouse-gas-target-met-2021-11-19/.

[244] Wikipedia, "Nuclear power phase-out," 2 February 2022. [Online]. Available: https://en.wikipedia.org/wiki/Nuclear_power_phase-out. [Accessed 3 February 2022].

[245] S&P Global Ratings, "S&P reaffirms India's long-term sovereign credit rating, outlook," S&P Global Ratings, 13 July 2021. [Online]. Available: https://www.reuters.com/world/india/sp-reaffirms-indias-long-term-sovereign-credit-rating-outlook-2021-07-13/.

[246] Moody's, "Moody's changes India's rating outlook to stable from negative; affirms Baa3 rating," Moody's, 5 October 2021. [Online]. Available: https://www.moodys.com/research/Moodys-changes-Indias-rating-outlook-to-stable-from-negative-affirms--PR_453291.