State of Transition

How state-owned power companies can drive energy transition in emerging economies

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State of Transition: How state-owned power companies can drive energy transition in emerging economies

July 2025

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Executive Summary

In many countries, state-owned power companies (SPCs) play a critical role in ensuring energy security and supporting broader national development. They also have a major part to play in clean energy transition, particularly in emerging markets and developing economies (EMDEs), where they often form a large share of the energy sector. But to date, there has been limited conversation on their specific role and needs in decarbonization, despite controlling about 50% of global power station capacity and a corresponding level of sectoral CO_2 emissions.

At the same time, in some EMDEs, SPCs have already set ambitious renewable energy targets. NTPC Limited (NTPC) in India, for example, announced in 2021 a target of 60 GW of renewables by 2032. In Indonesia, Perusahaan Listrik Negara's (PLN's) proposed new Electricity Supply Business Plan for 2025–2034 will build 71 GW of new capacity, 70% of which will be renewable.

This report aims to address this gap by analyzing the dynamics of decarbonization facing four of the world's largest SPCs (outside of China), focusing each case study on one specific element of energy transition: just energy transition (JET), deploying renewables, integrating renewables into the grid, and phasing down fossil assets. While each case study is focused on only one element of transition, it is assumed that all elements need to be explored in parallel as part of the full transition journey, and we do not attempt to capture all efforts by each firm in every area. The four SPCs, and the focus element for each case study, are as follows:

- **Eskom Holdings SOC Ltd (Eskom) in South Africa on JET efforts:** An SPC can recognize the importance of JET and internalize responsibility for implementing JET initiatives, even where there are significant financial and operational challenges.
- **NTPC in India on deployment of renewable energy:** A well-run SPC dominated by fossil fuel generation can still be an effective vehicle to advance clean energy investments, including in partnership with the private sector.
- **Vietnam Electricity (EVN) in Viet Nam on integrating incremental renewable energy generation:** An expansion of renewable energy can lead to grid overloading and a need to curtail supply. SPCs can proactively undertake physical grid expansion and network modernization to allow smooth integration of renewables.
- **PLN in Indonesia on early retirement of coal power plants:** In many contexts, SPCs will play a key role in operationalizing government commitments on early retirement of coal plants. This can be a difficult challenge, especially where there is limited drive from government and a lack of sustained, substantial financial support.

In addition to challenges, we find that the energy transition provides SPCs and their government owners with opportunities to better deliver on their core mandate of sufficient, secure, and affordable electricity provision. How can SPCs achieve such goals, considering the technical and financial requirements, the need to revamp business models, and the need for social justice? Some findings from the case studies are set out below, noting, however, that this is a complex area that requires more attention and sharing of diverse experiences.

Table ES1. Summary of case study findings – context, actions, and important lessons

SPC	**Eskom in South Africa**
Focus	JET
Context	Financial difficulties and undergoing restructuring. International support for coal plant closure but domestic opposition from multiple stakeholders—internal and external to Eskom.
Actions	Eskom created a JET Office to address social impacts of energy transition and developed repurposing and repowering plans to close an aging coal power station.
Lessons	1. The Komati power plant shutdown began before multiple JET initiatives were undertaken. SPCs need to coordinate early stakeholder engagement and careful sequencing of JET activities. 2. International finance catalyzed investment and implementation plans, but lack of sustainable local JET finance can reduce the perceived legitimacy of this as a domestically owned agenda. 3. Other SPCs can follow the model of a JET office—operating as a core, strategic function, located separately from the generation division of the SPC, to avoid conflicts of interest. 4. Some media narratives undermined public perception of Eskom's JET efforts. SPCs may need to develop reporting tools to counter misinformation, such as an online dashboard to track progress.

SPC	**NTPC in India**
Focus	Build out of renewable energy
Context	Relatively strong finances, electricity demand outpacing new generation plants.
Actions	NTPC provided early support to ensure the viability of utility-scale renewables (e.g., guarantee of offtake), directly invested in renewables and created a dedicated renewables energy subsidiary, which has also taken on joint ventures and acquisitions with other companies.
Lessons	1. NTPC's partnerships with private developers helped reduce risk on both sides. 2. NTPC helped stimulate early deployment of emerging technologies that address national needs, such as floating solar to address land acquisition challenges. 3. NTPC created its renewables subsidiary to speed up decision making, reduce debt by selling stock in its initial public offering (IPO) and improve access to finance, such as green bonds. SPCs could explore strategies like IPOs or green bonds to restructure finances and improve profits. 4. Joint ventures with domestic public sector entities and international technology providers could help share investment risks, localize innovation, and scale low-carbon infrastructure.

SPC	EVN in Viet Nam
Focus	Grid integration of renewable energy
Context	Complex oversight structure and problems mobilizing capital. Rapid renewables growth in Viet Nam, but mismatched with demand centres, as well as limited grid capacity as of 2020.
Actions	EVN addressed renewables integration with new grid investment, technical solutions (e.g., supply forecasting), network upgrades, and worked with government to improve regulations.
Lessons	1. Geographical mismatch between new generation and grid capacity partly due to insufficient coordination between ministries, provincial government, and implementers (including EVN). 2. Grid subsidiaries may find it easier to access loans for grid upgrades than a parent SPC. 3. Robust regulatory frameworks can help SPCs integrate renewables and their support services. 4. Technological network solutions were important to complement EVN's physical grid upgrades.

SPC	PLN in Indonesia
Focus	Early retirement of coal
Context	Financial challenges, coal subsidies, incomplete legal framework for coal retirement
Actions	To implement government transition targets, PLN has been developing plans for coal plant closure, including pilots for early retirement and financing options (mainly international).
Lessons	1. Regulatory gaps have created uncertainty about PLN's ability to renegotiate legal agreements and its mandate on economic and social impacts. SPCs should address such gaps early. 2. PLN's early retirement plans are not yet publicly available. SPCs can build trust, facilitate negotiation, and improve decision making by increasing transparency on transition strategy. 3. Government subsidies for fossil fuels in Indonesia have slowed investments in renewables. To enable SPC energy transition, public support for energy should align with decarbonization goals. 4. International finance was crucial for PLN's phase-down plans, but it has faced delays. SPCs may need to explore complementary sources of finance, including domestic sources.

Source: Authors.

Cross-Cutting Findings

Across the case studies, there are common features that inform our recommendations.

1. **SPCs can have different but important roles to play in advancing the energy transition.** Expanding renewables is vital—but it is not the only way for SPCs to facilitate decarbonization. Depending on their circumstances, responsibilities, and structure, SPCs may also be able to contribute to just transition, environmental protection (beyond climate change concerns), grid strengthening, and transitioning away from fossil fuels.
2. **Financial position and access to finance are major challenges.** SPCs in EMDEs are often saddled with large debt and difficulties in mobilizing capital. Energy transition expenditure (such as for grid upgrades to support renewable energy) or potential loss of earnings (such as early retirement of coal), can compound this situation. EMDEs may need tailored financial solutions and not rely on the financial norms from developed countries.
3. **SPCs can be constrained by outsized support for fossil fuels in the power system.** Despite governments' high-level support for decarbonization in international processes like the United Nations Framework Convention on Climate Change global stocktake, there is often no clear national roadmap in EMDEs on transitioning away from fossil fuels. Instead, there is commonly widespread political and fossil fuel industry support for their use beyond the technical requirements of the power system.
4. **Opportunity for SPCs to become leaders in low-carbon action.** SPCs may soon be better placed than ever to lead on energy transition: declining costs of clean energy and storage should increasingly allow them to invest in low-carbon technologies while still delivering on their core mandate of delivering secure, reliable, and affordable electricity.

Recommendations

For Governments

Mandate and Support SPCs to Deliver on National Energy Transition Objectives

- enable strong and visionary SPC leadership
- mandate SPCs to deliver a specific share of national targets on emissions reductions
- develop necessary legal and regulatory frameworks, such as for early coal plant closure
- create appropriate financial incentives for SPCs to decarbonize power systems
- set up effective oversight and coordination structures

Shift Public Finance Support Measures and Resources From Fossil Fuels to Clean Energy

- develop mechanisms to increase finance, including efforts to shift public financial support to SPC decarbonization activities, thereby crowding in domestic and international capital.

In Nationally Determined Contributions, Highlight the Contribution That SPCs Can Make to Energy Decarbonization

- For third-generation nationally determined contributions, due in 2025, countries can investigate having SPC-specific emission reductions and policy/financial support mechanisms to help deliver on these.

For SPCs

Collaboratively Develop SPC Plans for Energy Transition

- begin plans early so just transition measures can be properly sequenced
- make plans context specific, minimizing economic and social risks of decarbonization
- align plans with broader national goals by consulting with relevant ministries
- build credibility with stakeholders, particularly for securing finance, by including the following in plans:
    - provisions to ensure socially responsible transition, including coordination with ministries and sub-national authorities where broader economic diversification is needed;
    - forecasting and coordination to match clean energy deployment with grid upgrades;
    - strategies to increase clean energy capacity, which may want to consider the role of private sector development partners. Complementary storage technologies may be essential for addressing the SPC prerogative of security of supply;
    - plans to transition away from fossil assets;
    - financing strategies, including international and domestic sources.

Seek Synergies in Structural Changes That Could Help Financial Position and Renewable Energy Ambitions

- For some SPCs, improving core business operations and efficiency may be essential to deliver on energy transition, particularly to address debt and improve access to finance.
- Equally, for some SPCs, innovations such as acquisitions or creating a new renewables subsidiary (like NTPC did) could be effective in building capacity for transition ambitions.

Create a Strategically Situated JET Office Within the SPC

- This should be a core, strategic function that works with the generation divisions.
- A direct line of reporting to the CEO can help ensure that necessary support is received.
- It may be necessary to contract trained and trusted community engagement professionals.

Complement International Climate Finance Opportunities With Local Solutions

- While there is a clear need for climate finance to support SPC energy transition in EMDEs, particularly for early coal plant retirement, SPCs should also seek complementary finance sources, such as redirected fossil fuel subsidies, carbon taxes or private sector investment.

Improve Data Transparency and Access to SPC Energy Transition Information

- As a core provider of public services, this can help SPCs build stakeholder confidence, facilitate evidence-based decision making, speed up negotiations and attract finance.
- A JET office can be responsible for providing free information in an appropriate language.
- An independently verified, online JET activity dashboard can help to combat misinformation.

For the International Community

Work With SPCs to Design Practical Financial Assistance Mechanisms

- There is a gap in viable financing alternatives to the JET Partnership deals that have been agreed in Indonesia, South Africa, and Viet Nam.
- International public finance institutions should partner with SPCs to design new, innovative options for fast fund disbursement in return for demonstrable progress on decarbonization.
- The total amount of international financial support for SPC energy transition efforts should be increased.

Help Compile Data and Share Lessons on SPC Experiences on Energy

- There is a gap in basic comparable data on SPC ambitions and actions on decarbonization, and the constraints they face. Closing this gap would help SPCs—and governments and state-owned enterprises more broadly—identify leading SPCs and learn from their experiences.
- International platforms should seek to elevate SPC experiences and better support the exchange of knowledge between SPCs and line ministries in different countries.

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Abbreviations and Acronyms

CCUS	carbon capture, utilization, and storage
CFPP	coal-fired power plants
DPPA	direct power purchase agreement
DFI	development finance institution
EMDEs	emerging markets and developing economies
ETM	Energy Transition Mechanism
EVN	Vietnam Electricity
EVNNPT	National Power Transmission Corporation
EWEC	East West Energy and Climate Link JSC
FIT	feed-in tariff
GHG	greenhouse gas
IEA	International Energy Agency
IES	Intelligent Energy Systems
IISD	International Institute for Sustainable Development
IPO	initial public offering
IPPs	independent power producers
ITA	International Trade Administration
JET	just energy transition
JETP	Just Energy Transition Partnership
MDBs	multilateral development banks
MOF	Ministry of Finance
MOIT	Ministry of Industry and Trade
NDC	nationally determined contribution
NGEL	NTPC Green Energy Limited
NLDC	National Load Dispatch Center
NTPC	NTPC Limited
OECD	Organisation for Economic Co-operation and Development
PCC	Presidential Climate Commission
PLN	Perusahaan Listrik Negara

PLTU	Pembangkit Listrik Tenaga Uap
PPA	power purchase agreements
PTBA	PT Bukit Asam Tbk
RUPTL	PLN's Electricity Supply Business Plan
SOEs	state-owned enterprises
SPCs	state-owned power companies

1.0 Introduction

State-owned enterprises (SOEs) are legal entities that are owned, controlled, or significantly influenced by government. They have a critical role to play in the global transition to lower-carbon sources of energy. They are among the largest oil-, gas-, and coal-producing companies and are also major actors in electricity generation, transmission, and distribution, as well as energy-intensive industries in many countries (Benoit, 2019). Estimates suggest that the world's SOEs produce more greenhouse gas (GHG) emissions annually than any country other than China, making them an important grouping for efforts on climate change mitigation (Clark & Benoit, 2022). SOEs are particularly important in emerging and developing economies (EMDEs) where they are often the dominant actor in certain energy sectors or regions, helping support socio-economic development (Kane & Christiansen, 2015).

State-owned power companies (SPCs)[1] are a key subset of SOEs, as they controlled about half of the world's power generation capacity in 2016 (Benoit, 2019), and the majority of SOE emissions are from the SPCs (Clark & Benoit, 2022). In 2017, across Middle East, Central Asia, and sub-Saharan Africa, over 65% of power generation capacity came from SPCs (International Monetary Fund, 2020). In 2024, it was estimated that more than half of all energy investment in EMDEs was made by governments or SOEs, compared with just 15% in industrialized economies (International Energy Agency [IEA], 2024c). Furthermore, over the period 2022 to 2026, about 85% of additional global electricity demand growth is expected to come from EMDEs (IEA, 2024b).

Because SPCs are a clustered set of actors where change can be mandated by government owners, there is also potential for governments to direct their SPCs' efforts on energy transition, if there is the political will to do so. Despite this, there is relatively little conversation about SPCs' influential role in global energy transition and climate change mitigation, and some of the publicly available SPC data is years out of date. When SPCs are mentioned, it is often in relation to developed country examples, and literature from 2018 to 2024 best covers East Asia and Europe. It appears that discussion on the role of SPCs in EMDEs on energy transition and decarbonization is not sufficiently developed (International Institute for Sustainable Development [IISD], manuscript in preparation).

This report aims to address this gap and capture the ongoing experiences of four SPCs in EMDEs, where we look at how each SPC has engaged on a specific element of energy transition.

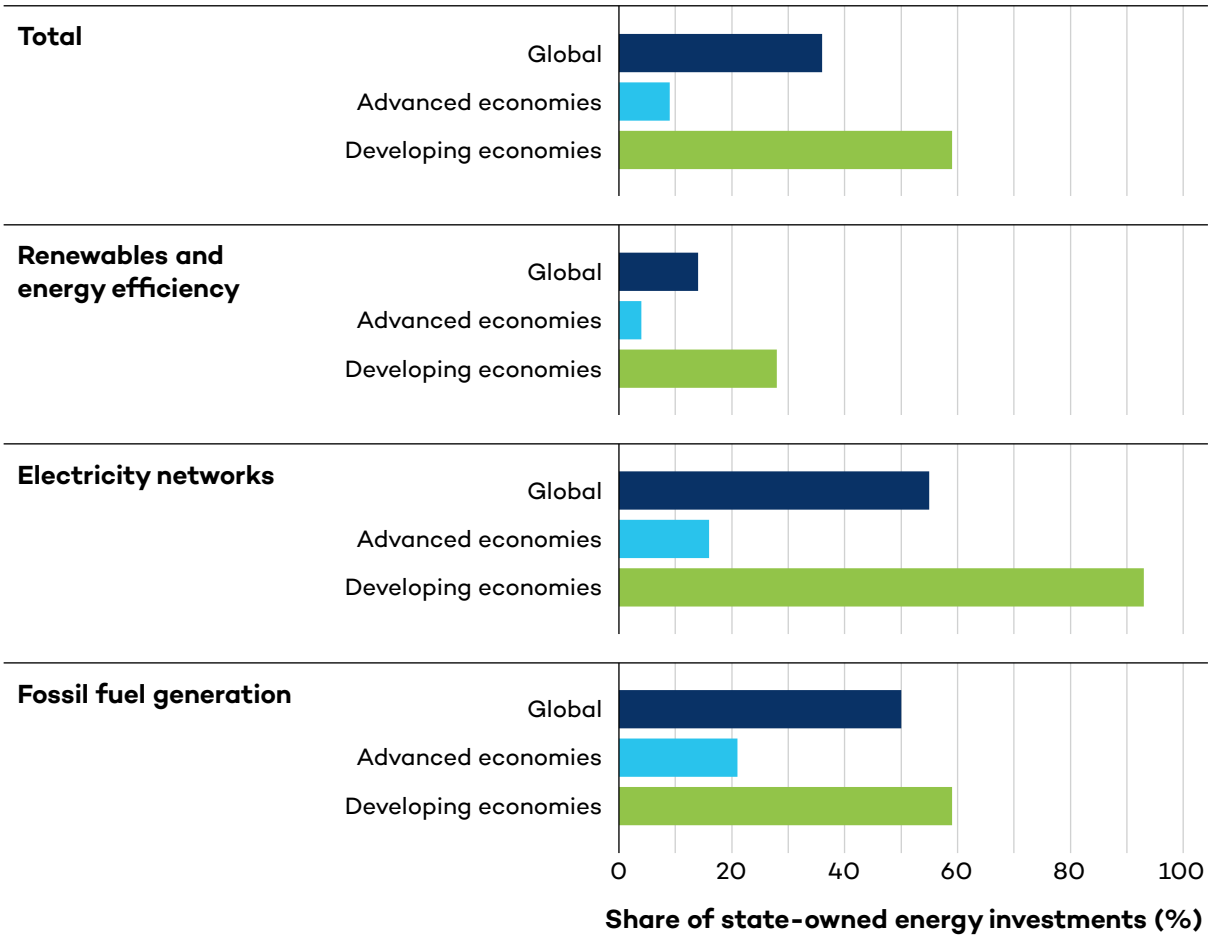
These elements are a) just energy transition, b) deployment of renewables, c) grid integration of renewable energy, and d) early retirement of coal plants. The corresponding four SPCs are Eskom Holdings SOC Ltd (Eskom), NTPC Limited (NTPC), Vietnam Electricity (EVN), and Perusahaan Listrik Negara (PLN), which constitute some of the largest SPCs outside of China.

[1] SPCs may be involved in all, or just some of the power system: generation, transmission, and distribution. They are often also electricity off-takers for private investor independent power producers (IPPs).

2.0 Context

SPCs can play a vital role in changing global electricity systems, but particularly in developing economies. In the absence of more recent comparative statistics, Figure 1 shows the important role of SOEs in developing economies in 2019.

Figure 1. State-owned energy investments by economy type and sector in 2019



Sources: Author figure, using data from IEA, 2020a, 2020b.

In large emerging economies, such as Brazil and China, SOEs also control the majority of large-scale hydropower generation (Benoit, 2019). In EMDEs, they also play a vital role in promoting broader national goals, such as advancing energy security, improving energy access, creating jobs and anchoring development plans.

On the climate change front, SOEs are responsible for at least 7.5 gigatonnes of carbon dioxide equivalent annually in direct (Scope 1) emissions, with about 85% estimated to come from the power sector[2] (Clark & Benoit, 2022). Therefore, SOEs, and SPCs in particular, are

[2] Many SOEs do not disclose data, and the 10% from oil and gas production is likely under-represented.

critical actors in advancing climate action at the scale and speed set out under the 2015 Paris Climate Agreement.

Investment decisions by energy SOEs and SPCs will have a major impact on climate change. However, in G20 countries, SOEs are still making significant investments in fossil fuels. For example, research by IISD found that new capital expenditure by fossil fuel SOEs[3] in G20 countries reached USD 322 billion in 2022. This is more than the 2012–2021 average, suggesting that their investment plans are not aligned with the latest science on meeting climate commitments. Furthermore, only 13% (7 out of 56) of surveyed fossil fuel SOEs in the G20 indicated in their annual reports that they had invested in renewable energy technologies[4] (Laan et al., 2023).

Evidence from the EU suggests that SPCs can even surpass the private sector in undertaking renewable energy investments. A study covering the period 2005–2016 found that in the EU, state-owned utilities have a higher tendency to invest in renewables than private utilities, which is closely related to the existence of pro-climate policies and state enforcement capabilities in their respective countries (Steffen et al., 2022).

The most prominent example of a fossil-dependent state-owned company that transitioned toward renewables is Ørsted (formerly known as Dong Energy), the Danish state-owned utility,[5] which went from being one of the most coal-intensive utilities in Europe to a global leader in offshore wind energy within a decade through visionary leadership and investor action (Srivastava, 2021).

2.1 Future Prospects

SPCs may soon be better placed than ever to lead on energy transition. The overall declining costs of renewable energy and energy storage in many regions could allow for SPC's to invest in low-carbon technologies while still delivering on their core mandate of delivering secure, reliable, and affordable electricity. As the global energy transition gathers pace, it will start to have more impact on the conventional energy sector, which is the core business for SPCs in many EMDEs.

The private sector will also play an important and potentially decisive role in funding the energy transition, given the massive financial requirements that surpass the financial capacity of most EMDE governments and their SPCs. However, notwithstanding the importance of private investors, SPCs will play an important role in EMDEs specifically, partly due to the continued preference by EMDE governments to maintain ownership over strategic power sector assets, as well as their role in complementing and supporting private investment (notably in transmission).

In major emerging economies, SPCs have traditionally been responsible for building and running thermal power plants (predominantly coal- or gas-powered plants). However, several

[3] Fossil fuel SOEs include coal, oil, and gas producers and suppliers of fossil-generated electricity.

[4] This study did not systematically collect data on SOE capex investment in renewable energy.

[5] Ørsted is listed on the stock exchange, but the Danish Ministry of Finance is still the majority shareholder.

SPCs have announced ambitious renewable energy targets, while others are anticipated to do so in the coming years. These are on top of historical investments in utility-scale hydropower, where SPCs have traditionally dominated, as well as in the potentially expanding nuclear power subsector.

For example, NTPC, India's largest electricity generation company, is an SPC that has announced a target of deploying 60 GW of renewable energy capacity by 2032, a significant increase from its current 4.7 GW of renewable energy capacity (NTPC, n.d., 2021b). Similarly, PLN, Indonesia's national vertically integrated utility, has drafted the national electricity plan to include 49.7 GW of new renewable energy capacity[6] by 2034 (Simanjuntak, 2025).

The energy transition creates important opportunities for SPCs in EMDEs to diversify their business models and advance broader national goals of energy security, electrification, and socio-economic development.

[6] Of the total new capacity of 71 GW across all generation technologies, about 60% will be from IPPs.

3.0 Methodology

There are many aspects to an SPC exploring energy transition, and we explore four fundamental ones. Over time, there needs to be an increase in renewable energy generators plus storage and a decrease in fossil fuel generators. Socially, this transition must happen in a just and fair way, and technically, the grid must adapt to handle a higher proportion of intermittent renewable sources. **While many of the actions within these four elements will happen in parallel, and they are highly interdependent, there are principles for an order to address these core elements.**

One key tenet of just energy transition (JET) is that the justice components must be meaningfully included from the outset of the energy transition. The consultation of all relevant stakeholders at the beginning shapes the entire energy transition process, and international experience has shown negative outcomes if these just transition activities are only included later on. For a JET, this report applies the International Labour Organization's interpretation of just transition to the energy sector: "A just transition means greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind" (International Labour Organization, 2024).

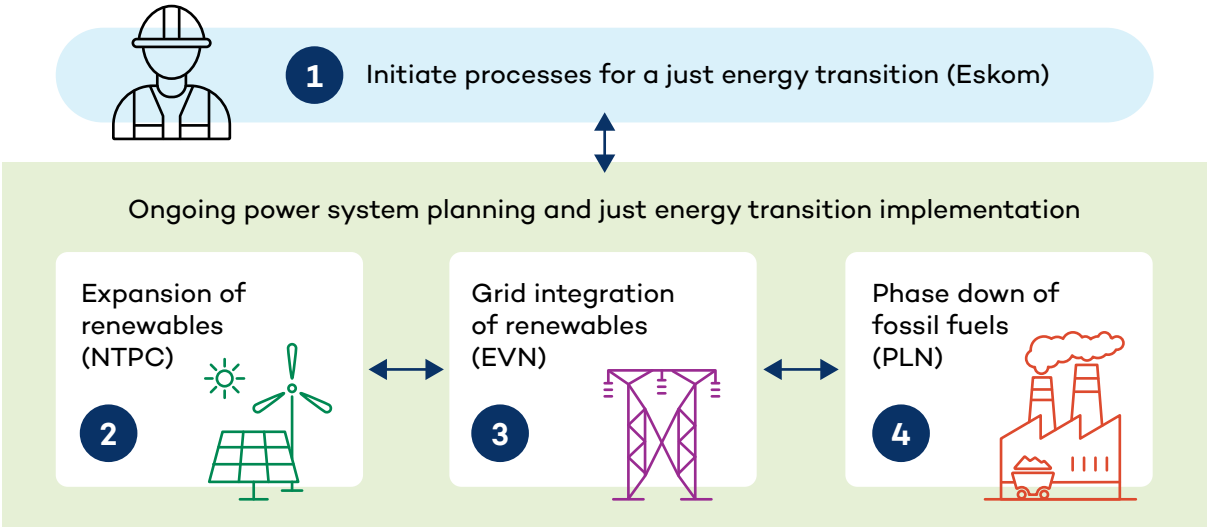
To ensure sufficient grid capacity is available, grid planning (and, potentially, physical expansion) should happen before renewable energy generators are built, whereas their integration into the grid will happen after construction. Finally, in terms of energy security and continuity of employment opportunities, it is often prudent to build more renewable energy before taking fossil fuel units offline. Therefore, we address these core elements in the order shown in Figure 2.

We did not find one SPC in EMDEs that is comprehensively addressing all four elements, but we identified an example for each element. Our selection criteria included: significant ownership of coal plants, dominance in the power system, G20[7] representation, and actions on a core element. The four SPCs selected, providing a diversity of SPC experience, were Eskom in South Africa, EVN in Viet Nam, NTPC in India, and PLN in Indonesia.

The purpose of these case studies is to highlight some of the challenges and successes these SPCs have had, which can provide valuable lessons for governments and their SPCs as they engage further on energy transition.

[7] The G20 is an intergovernmental forum, comprising 19 countries and the European Union, which collectively represent the world's largest economies and work together on global economic, financial, and policy issues.

Figure 2. Case study topic and respective SPCs in order presented in this report



Source: Authors.

The case studies primarily relied on expert interviews and secondary literature. We acknowledge there are divergences between these SPCs based on the country context, as well as their ownership and financial and institutional structure. This report does not undertake a comparative analysis between the four SPCs: instead, it aims to capture their individual experiences, on **one element of energy transition each**, which can provide useful lessons for other SPCs that have announced climate targets or are planning to increase their ambition on energy transition.

All currency conversions in the report are done using the International Monetary Fund exchange rates dataset (updated March 2025) for the appropriate historical time period (International Monetary Fund, 2025).

4.0 Eskom's JET Initiatives in South Africa

Table 1. Case study summary: Eskom

Government ownership	100%
Structure	Transmission separated, ongoing unbundling for generation and distribution assets
Climate targets	Net-zero by 2050 (same as national target)
Eskom power station capacity from fossil fuels	88.7% (2024 data)[8]
Eskom context for just transition	• highly indebted, and debt relief conditions prevent investment in new power plants • frequent power cuts in 2022 and 2023 as electricity supply could not match supply • exemptions granted for regular breaches of the legal minimum air quality standards • monopoly weakening as power market becomes more competitive • coal plant closure is highly contentious, with a political push to extend life of coal plants.
Main Eskom actions to address just transition	Creation of a dedicated JET Office in 2020 • institutionally designed and located to avoid conflict of interest with generation division and to receive sufficient support to act effectively • challenges of limited human resources, internal/external opposition to coal closure • success in pioneering the basis for Just Energy Transition Partnership (JETP) concept for international funding for JET in South Africa Komati coal power station closure • ambitious plans for repurposing and repowering, and comprehensive socio-economic impact assessment studies, but circumstances resulted in issues with coordination, sequencing, and timing (including of financing and implementation) • conflicting narratives on Komati closure—including both positive and negative angles in the media—have made it hard to assess the process

Source: Authors.

[8] Based on nominal capacity data from Eskom's latest annual report (Eskom, 2024).

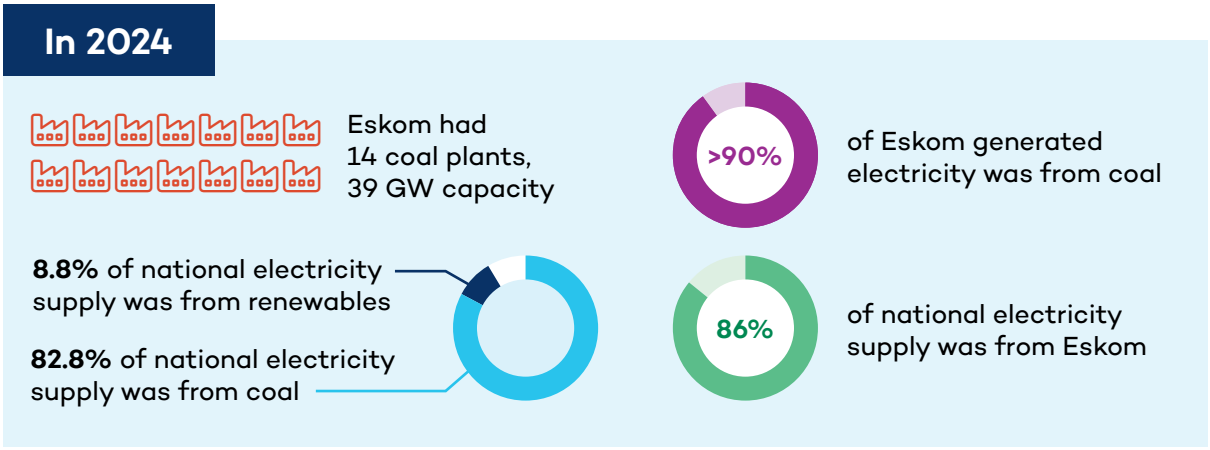
4.1 Key Messages for SPCs on JET

- Correct timing and sequencing of JET activities are crucial. For plant closure, new repowering projects should start construction before existing units are closed.
- Start best practice stakeholder engagement (including access to information) and JET planning as early as possible before any implementation.
- Visionary SPC leadership is required for a JET: to change entrenched operating models, stand up to strong lobby groups and secure trust with potential funders.
- Regional JET includes broad actions like economic diversification, so SPCs will need access to mechanisms for collaboration and accountability with a wide range of actors.
- International finance catalyzed investment and implementation plans, but a lack of sustainable local JET finance can reduce the perceived legitimacy of this as a domestically owned agenda.
- A dedicated JET office is a model other SPCs can follow, where it acts as a core strategic function, reporting to the chief executive officer, and interacts with the generation side of the business.
- SPCs should develop independently verified online platforms to cover their JET activities objectively. This can help counter the twisting of narratives to suit vested interest groups.

4.2 Overview

In 2015, South Africa was the first country globally to commit itself to a just transition in its nationally determined contribution (NDC). However, Climate Action Tracker has rated the latest NDC update from 2021 as "insufficient" (Climate Action Tracker, 2023), meaning more ambitious emissions reductions, linked to decreased reliance on Eskom's coal-fired power plants, are required to meet the Paris Agreement goals on a fair-share basis. Nationally, South Africa's power system is dominated by coal (Figure 3), and regionally, the coal value chain supports the economies of multiple regions in the Mpumalanga and Limpopo provinces.

Figure 3. South Africa's electricity supply is heavily dependent on coal



Sources: Author diagram based on Centre for Renewable and Sustainable Energy Studies, 2024; Eskom, n.d.-a; 2024.

Eskom is the state-owned electricity utility and is the largest GHG emitter in South Africa, accounting for 40.7% of total national GHG emissions in 2022 (Department of Forestry, Fisheries and the Environment, 2024). Therefore, Eskom has a key role to play in meeting both climate change commitments and just transition objectives in South Africa.

As part of Eskom's board-approved 2035 strategy and its JET strategy, nine old coal plants with a capacity of 15 GW will need to be decommissioned by 2035, equating to 38% of the utility's coal capacity in 2023 (Eskom, 2023a). Without intervention, there are 55,000 jobs at risk, so this poses a major JET challenge for the utility (Presidential Climate Commission, 2022).

Eskom is dealing with major operational challenges, such as a massive debt burden, inability to meet electricity demand with supply, and violation of environmental laws at many of its power stations. Despite these circumstances, the utility has taken on several important JET initiatives discussed in this chapter. These include:

- creating an in-house JET Office in 2020
- laying the groundwork for the development of the JETP, signed between South Africa and the International Partners Group in 2021
- repurposing and repowering plans for the Komati coal-fired power station, which was a first for a coal plant in South Africa

There is plenty of published information about the events at the Komati station (as it was initially promoted as a flagship JET project) and the developments around the JETP. Consequently, this case study relies more on evidence from expert interviews that is not available in the public domain to provide an update of the current situation, and the main challenges Eskom faces in undertaking these initiatives.

4.3 Role of Eskom in South Africa's Electricity System

A subsidiary of Eskom is responsible for the transmission grid, and the distribution grid is split between Eskom and municipally run areas. Until renewable energy IPPs came online in 2013, Eskom also had a near monopoly on electricity generation. Eskom now buys electricity from renewable energy and gas IPPs, which, coupled with its own production, is supplied to the grid.

While Eskom supplies electricity, it is not responsible for determining the electricity supply mix in South Africa. This is undertaken by the Department of Energy and Electricity through the Integrated Resource Plan. Thus, while **Eskom is the electricity off-taker for new utility-scale IPPs, it does not choose the projects or set the purchase price.**

A JET involves a change from the status quo, and a few high-level aspects of the Eskom context reveal the complexity of their JET requirements.

Eskom is saddled with enormous debt—over ZAR 412 billion (USD 21.6 billion) at the end of March 2024, with a routine inability to recoup the full owed revenue from direct and municipal customers (Eskom, 2024). As a result, it has a low credit rating and has relied on a series of government bailouts to avoid defaulting on its debt repayments.

The conditions of Eskom's Debt Relief package from the National Treasury in 2023 (unchanged as of January 2025) mean that capital expenditure for new infrastructure is limited to transmission and distribution assets until March 2026 (National Treasury, 2023). These conditions also prevent Eskom from taking on new debt until this date. This effectively excludes Eskom from building new generation projects[9] (including renewable energy, and possibly energy storage) and will hinder diversification of its business model toward clean energy sources over this period.

There have been periods when Eskom has been unable to meet power demand with supply and has instigated rotational power cuts (termed "load shedding"). These became more regular from 2018, with load shedding in 2022 and 2023 becoming a national crisis due to the severity of blackouts (Cowling, 2024). The cause is multifaceted, but two main reasons were a continued decline in the performance of Eskom's existing coal fleet and delays in building new power system infrastructure.

Coal plant closure is highly contentious in South Africa, with many coal value chain workers, communities, labour unions, and even government officials questioning the pace, scale, and even the need for a JET at this point. There are strong domestic narratives that a JET is an agenda being forced onto South Africa by developed nations, and that South Africa should follow its own development pathway that prioritizes energy security over decarbonization.

Units at Eskom coal plants regularly exceed the legal Minimum Emission Standards, and pollution from Eskom plants has allegedly been responsible for over 2,200 premature deaths annually (Holland, 2017). This public health concern is a just transition issue, and so Eskom's JET actions must also tackle air pollution.

Institutional Structure

Eskom is a vertically integrated utility that is in the process of being restructured and split into three entities for generation, transmission, and distribution. In conjunction with the Electricity Regulation Amendment Act, this restructuring aims to create an open market platform that enables competitive electricity trading (South African Government, n.d.). As of February 2025, the National Transmission Company of South Africa has been established and is operating as a subsidiary of Eskom, but further elements of the restructuring are still underway. So, **while engaging with the broader energy transition, Eskom itself is undergoing a structural transition.**

The Government of South Africa is the sole shareholder of Eskom. In August 2024, the oversight of Eskom shifted to the Department of Energy and Electricity, with the aim of better alignment between the utility and its corresponding line ministry (Nyathi, 2024).

[9] Written approval from the Minister of Finance may allow an exception to this condition.

4.4 Eskom's JET Initiatives

The Eskom JET Office

The Eskom JET Office, which opened in 2020 (Eskom, n.d.-b), was likely the first of its kind among SPCs in emerging economies. In South Africa, the petrochemicals company Sasol subsequently also created such an office in 2021 (Sasol Limited, 2023). Internationally, interviewed representatives from countries including India and Viet Nam have engaged with Eskom to learn how to replicate such entities.

The long-standing Eskom Development Foundation, established in 1998 as non-profit company within Eskom (Eskom, 2019), and experts interviewed noted that it also supports Eskom JET initiatives through training and support on community-based sustainability, education, and small business development.

Drivers and Establishment Process

According to experts interviewed, the idea of creating a dedicated JET Office emerged from discussions on overcoming roadblocks in implementing the Eskom JET strategy and other factors, like facilitating direct access to government ministers for Eskom JET-related activities.

The Eskom JET strategy was announced in 2019 and combined work on socio-economic impacts and climate change. Socio-economic impact assessments were being undertaken at the time for the Komati, Camden, and Grootvlei coal-fired power stations, as these three plants were old and next in line for decommissioning (Department of Mineral Resources and Energy, 2019). In addition, a net-zero by 2050 goal for Eskom was included in the JET strategy and signed off by the board. (Eskom, 2023b). Following the launch of the JET Office, the socio-economic impact and climate change work remained as corporate functions in the operations side of Eskom, and the new JET Office was a separate entity that reported directly to the CEO.

The reason for keeping the JET Office separate from the generation side of the business was to avoid a potential conflict of interest, as the JET Office mainly deals with a transition away from coal. In contrast, the vast majority of Eskom generation is from coal. This structure was inspired by what the Polish power company PGE had done: separating the new renewables business from the existing thermal generation as part of its transition plan. Experts interviewed noted that the motivation for reporting directly to the CEO was to ensure that the JET Office received the necessary attention and resources to ease implementation.

Following a change in Eskom leadership in 2023, and with Eskom restructuring underway, the JET Office has been moved into the generation division, which has raised concerns among funders and other stakeholders about potential conflicts of interest in the utility's transition away from coal. In interviews, some stakeholders reported having less ability to engage with the JET Office following this move.

Challenges

Initially, the JET Office had only three full-time and four part-time staff, which presented a human resource constraint. By January 2025, the Office had 14 staff. According to experts interviewed, it also took some time for the office to gather internal support within Eskom. Severe load shedding in 2022 and 2023 resulted in significant political and societal pressure against closing operational Eskom coal plants (and by extension, some of the work of the JET Office) when replacement generation capacity had not come online. Conversely, the failure of most Eskom coal plants to comply with the Minimum Emission Standards caused increased pressure from human rights and environmental groups to close the power stations. The Eskom JET Office was thus dealing with pressure in opposing directions in terms of coal plant closure.

The Eskom JET Office is also responsible for supporting job creation. Expert interviews suggested that labour unions were resistant to engaging with the Office on alternative livelihoods, since **new jobs could be created outside of the coal sector, which would fall under the purview of a different union**, regardless of the quality or number of jobs.

The Eskom JET Office faces further challenges around JET finance options and the Komati power station, which are discussed in the relevant sections.

Successes

The Eskom JET Office provided an opportunity to drive change from within the utility. In addition, the basis of the South African JETP was developed within the original JET Office, which was discussed with international funders and ultimately led to the development of the political declaration signed in 2021 (The Presidency of the Republic of South Africa, 2021).

This preparatory work for the JETP by Eskom's JET Office included rigorous modelling that provided data on emissions reductions and costing that potential funders were interested in. The JET Office has also established good working relationships with international financial institutions, increasing the degree of collaboration and trust in Eskom's transition process.

Closure of Komati Power Station

Drivers, Timing, and Sequencing

By 1966, Komati had nine units with an installed capacity of 1,000 MW. In the late 1980s, it was taken out of service due to a mismatch in supply and demand but conserved so it could be used again. In the early 2000s, a return-to-service decision was made, and all units were back in operation by 2012.

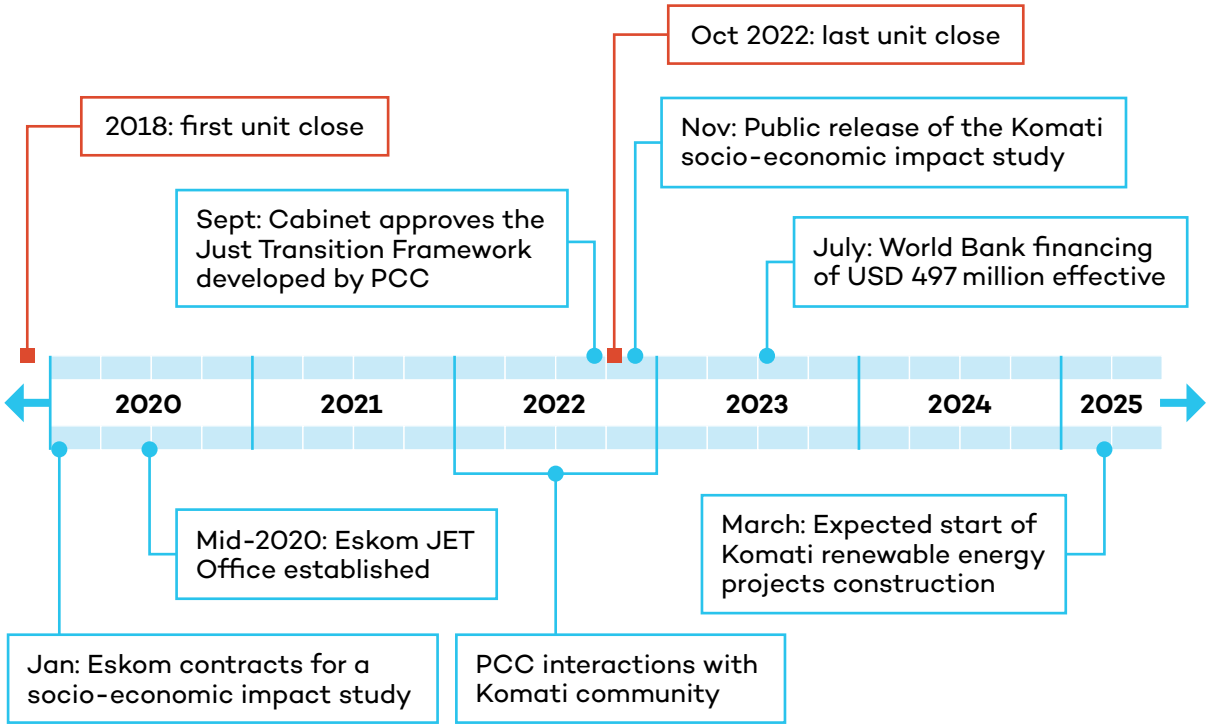
By 2017, Eskom had started looking at a final shutdown plan for Komati, primarily for economic and legal reasons. The plant was old (although refurbished before return-to-service), inefficient, and had high mechanical failure rates.[10] Interviews revealed that to

[10] According to interviewees, the Komati strategy in its later years was to not spend capital on general overhauls but rather run to failure until final shutdown based on turbine hours.

continue operating, it would have required extensive overhauls with huge costs and long periods of unit downtime.

One of the challenges was that the shutdown process started before the multiple JET initiatives were undertaken.

Figure 4. Timeline of JET initiatives at Komati power station



Source: Author diagram based on research interviews, along with Presidential Climate Commission (PCC), 2023[11] & Urban-Econ Development Economists, 2022.

Status Quo and Future Plans

Eskom's plan for Komati included decommissioning of the old plant, repowering initiatives (150 MW solar photovoltaic, 70 MW wind,150 MW/600 MWh battery storage, conversion of generators to synchronous condensers), repurposing activities (microgrid assembly and agrivoltaics), and a renewable energy training facility (PCC, 2022). While there seems to be broad acceptance that the projects are progressive and needed, community members and interviewees have raised concerns around how these initiatives were finalized (type of consultations) and the delays in implementation.

In 2022, the final socio-economic impact assessment report for Komati power station estimated that against a 2020 baseline, if there were no mitigation measures taken, the closure of the plant would decrease national GDP by ZAR 1.7 billion (USD 104 million), decrease

[11] The purpose of the PCC is to oversee and facilitate a just and equitable transition toward a low-emissions and climate-resilient economy in South Africa (PCC, 2023).

the local municipal economy (Steve Tshwete) by 0.7% and decrease provincial employment in Mpumalanga by 0.3%.

However, the effect on Komati Village and surrounding settlements would be much more severe, as they are heavily reliant on the power station, not just for employment but even basic services like water (Urban-Econ Development Economists, 2022). There appears to be a lack of detailed analysis to quantify the impacts to the areas immediately surrounding the power station (affecting over 3,000 people), from just prior to the first unit closure in 2018 to April 2025.

In July 2024, visitors to the site reported that many of the repowering or repurposing projects had not started. This gap has caused frustration in the local community. Eskom have said that none of their workers lost jobs and were redeployed elsewhere or kept on site. According to interviewees, Komati contracts were based on the closure date (October 2022), and the majority were national contracts that allowed for redeployment to power stations where the service providores were required.

Box 1. Worker and community concerns

Much of the criticism of what has happened at Komati can be grouped into several themes (Hallowes & Munnik, 2022; PCC, 2022, as well as research interviews):

- **quality of stakeholder consultations:** While various consultations and surveys were undertaken by Eskom and the World Bank, several stakeholders felt they did not meet the requirements of procedural justice.[12] Some Eskom representatives and PCC reports have agreed with this opinion. In some cases, communities viewed engagements as a "tick-box" exercise after planning work related to the plant shutdown had already been completed.
- **key information not available in the public domain:** Community members have indicated that they did not always have access to the relevant documents, or only received access during meetings, so they could not prepare in advance. This includes details on financing arrangements and World Bank loan conditions.
- **vagueness on accountability:** Communities had said they were often unsure who was responsible for different activities related to the Komati plant shutdown (e.g., Eskom, World Bank, local government, labour unions, PCC).
- **link between Eskom and coal value chain:** Community representatives have said they felt there was insufficient communication, and they expressed not knowing if, or how, the power station and coal suppliers were working together on just transition planning.
- **agenda setting:** Civil society groups have raised concerns around the potential divergence between local and donor interests for the Komati plant shutdown, with fears that external agencies were driving the agenda.

[12] "Procedural justice refers to the perceived fairness of the procedures used to design a just transition and all the steps taken to implement such plans. It requires that all stakeholders participate in a just process and are treated as equal partners, having the same capacity to influence decisions" (Banerjee & Schuitema, 2022, p. 3).

Interviewees suggested that the rest of the coal value chain and the local economy in Komati have suffered since the plant closed. For example, local accommodation and retail businesses are struggling because people in the supply chain are no longer visiting the town. While the repowering and repurposing plan is intended to improve the overall situation in the Komati region (such as employment rates), the benefits are not yet being felt. Two years after the last unit closure, in November 2024, none of the planned renewable energy capacity had started construction, according to interviewees.

Mostly, the points reflected in these opinions (Box 1) can occur when the basic components of a sequential framework for just transition are not followed sufficiently. This includes the timing and nature of consultations (Halsey et al., 2019).

While these opinions on the consultations are important, there is another side to the story. The Komati socio-economic impact assessment details the many engagements that were done, as do the World Bank reports. Interviewees have pointed to examples where people claimed not to have been consulted, but their signatures were found on meeting registers.

So, while there are lessons for improved consultation methods, this should not negate the work that was done at Komati, as a first-of-its-kind process for South African power plant closure.

The general consensus among interviewed experts is that the **JET planning (including stakeholder engagement) started too late**, resulting in a misalignment between the shutdown schedule and the implementation of JET activities, which caused other problems in the Komati region. This includes a lack of alternate employment and economic opportunities generated in the area by the time the last unit closed. However, the context is important. Prior to Komati, Eskom had no obligation or government mandate to do any JET activities, and the requirement to do so only came about after the shutdown timeline had been established based on legal and economic reasons.

Narratives and Misinformation

A major challenge with assessing the Komati situation is the wide spectrum of opinions, narratives, and misinformation in the media. Commentary around the JET initiatives at the Komati plant shutdown have ranged from it being a flagship project with the potential for replication, to not being "just" and even a "disaster" (Evans, 2022; Omarjee, 2023a, 2023b).

Senior Eskom representatives have even spoken out strongly against their own project (Naidoo, 2024). These conflicting messages make it hard to get an objective sense of what has really happened. Many of the portrayals of Komati town after the power station closure omit the status quo ante, mainly that in 2017, when the plant was running at full capacity, there were also very high levels of unemployment and poverty in the surrounding region.

Interviewees suggested that **part of the reason for an overly negative narrative around Komati could be driven by the influential coal lobby in South Africa**, with potential connections in government and the labour unions. Interviewed experts suggested that to safeguard their vested interests in keeping the coal value chain going as long as possible, it suits these lobbies if the Komati shutdown is seen as a failure.

Table 2. Examples of misleading narratives about Komati power station closure

Narrative based on misinformation	Explanation*
Claims that power station was closed because of pressure from developed nations' pressure to decarbonize (van Diemen, 2023; Nyathi, 2023).	The closure decision was based on economic and legal reasons linked to the plant's age and performance, even though some funding has come from the World Bank.
In 2023, it was claimed that the power station could be reopened (Nyathi, 2023) and a protest march was held to demand that the plant resume operations (Newzroom Africa, 2023).	Since 2018, parts from retired units have been used as spares for maintenance on other stations, so it is not economically feasible to reopen the plant.
It was claimed in October 2022 when the power station closed, South Africa lost 1,000 MW of capacity (Neethling, 2023).	Since early 2021, only one unit of 125 MW had been running, the others had been closed over time from 2018.

*Explanation based on the corresponding references in column 1 or from research interviews.
Source: Authors.

Some narratives also overstate Eskom's responsibilities at Komati. Interviewees noted that a just transition in the broader Steve Tshwete municipality, where Komati power station is located, will require a wide range of stakeholders to work together on the region's structural transformation, including economic diversification, infrastructure development, and job creation.

A Process to Learn Lessons From

Many efforts have been made at Komati, despite the shortcomings highlighted in the previous sections. As such, Komati should be taken as an experience that offers lessons to Eskom and other utilities on both the positive and negative aspects, rather than as a template or demonstration for how a JET at a coal plant should be done.

According to interviewees, senior management from the Camden and Grootvlei coal power stations, which are preparing for closure and decommissioning, have also visited Komati to discuss learnings with its employees.

Box 2. Finance proposals and options for Eskom just transition initiatives

In 2020, the Congress of South African Trade Unions (2020) proposed the use of funds from the Public Investment Corporation, a state-owned asset management firm, of up to ZAR 250 billion (USD 15.2 billion) to repay some of Eskom's debt. While this would not directly finance JET initiatives, it would lower the utility's debt (of ZAR 450 billion at the time) and create fiscal space for Eskom to take on new JET projects. The Public Investment Corporation proposal was not premised on any adjustments to the planned decommissioning dates of Eskom power stations and has not gained traction since 2020.

The Just Transition Transaction was a proposal incubated by the think tank Meridian Economics in 2018. Here, international climate finance would provide the concessional share of a blended finance instrument in exchange for an accelerated coal phase-down pathway that aligns with the Paris Agreement (Steyn et al., 2021). This was presented to the Eskom Sustainability Task Team and promoted in 2019 by the President of South Africa (Ramaphosa, 2019). However, interviewees noted that after the JETP was announced in 2021, further development of the Just Transition Transaction went dormant.

The JETP political declaration from 2021 eventually led to an investment plan (2022) and implementation plan (2023). However, numerous concerns have emerged around the development of these plans, the very low proportion of grant funding, slow progress, and lack of prioritization of "justice elements" within the agreement (Halsey, 2022).

Two further issues linked to the evolution of the JETP undermine its potential to be an avenue for Eskom to fund JET initiatives.

First, many of the initial safeguards to ensure accountability were removed in the final political declaration that was signed. For example, as noted by interviewees, the JETP was intended to have a stage-gate approach, where the disbursement of funds was contingent on demonstrable progress to meet objectives.

Second, since the JETP was initiated, the Eskom Board and National Cabinet have approved a decision to extend the life of some coal plants (Creamer, 2024). However, interviewees indicated that these life extensions are a material change from the terms agreed between Eskom and the JETP partners, which undermines the partnership's premise, introduces significant reputational risk for all parties, and sets a damaging precedent for JETPs in other jurisdictions. Interviewees observed that it is unclear at this stage how the JETP partners plan to deal with this breach of the original JETP agreement. Moreover, our interviews revealed that internal Eskom analysis has demonstrated that these extension projects are not economically prudent.

In terms of multilateral development banks (MDBs) and development finance institutions (DFIs), Komati has a range of potential financial supporters, including the World Bank, African Development Bank, Kreditanstalt für Wiederaufbau, and the Development Bank of Southern Africa. There have been challenges associated with the MDBs' cumbersome processes and timeframes for Eskom to access funding, which creates a bottleneck for project implementation. For example, the World Bank approved funding in November 2022 for the Komati plant, but the financing arrangements only became effective at the end of July 2023. Moreover, in this case, the finance was only approved after the last

unit at Komati had already closed, so this reinforces the point around the need for early planning and sequencing. A further concern is that the JET process can become about what donors want. According to interviewees, there were plans at Komati that local stakeholders wanted, but the World Bank was not prepared to fund.

Interviewees noted that MDBs and DFIs can be in a difficult position requiring a carefully balanced approach, either being seen as too strong (dictating the agenda of local transitions) or too weak (allowing SPCs to bend loan conditions and backslide on commitments).

4.5 Lessons From Eskom's JET Initiatives

The just transition literature provides many lessons for South Africa on coal phase-out from other countries and defined geographical regions[13] (Halsey et al., 2019). Despite this, several studies on Komati and the interviews for this research reveal that many of these basic lessons were not heeded for Komati plant closure.

The lessons regarding the implementation of just transition initiatives are as follows:

Appropriate Timing and Sequencing of Planning and Engagement

This lesson applies across planning, engagement, finance, and implementation of just transition and phase-out initiatives. It is essential to start planning as early as possible with meaningful stakeholder engagement. Workers and communities must be able to influence the plan from the outset in a meaningful way, and not be consulted after the plan has largely been developed.

Similarly, socio-economic impact assessments of plant closure must start several years before shutdown is scheduled. These must also be made public before implementation, so that affected people can provide input, unlike what took place at Komati, where the studies were released after the first unit was shut down in 2018. Repowering and repurposing projects should commence well before decommissioning to avoid a gap in economic activity and job opportunities: estimates suggest that the Komati repowering projects are about 4 years behind where they should be.

Follow Best Practices in Engagement and Access to Information

In hindsight, Eskom representatives acknowledge that they did not allocate sufficient resources to proper communication and consultation for Komati. However, this must be balanced with a realistic assessment of what quantity of engagement is possible. Appropriate and trusted representatives must speak for those who cannot give input directly. Follow-up and feedback mechanisms must also be built into the engagement process. Providing free access to necessary information in an appropriate language is a basic principle of just transition, and yet this was still claimed to be an issue at Komati.

[13] Including the United Kingdom, Spain, Netherlands (Limburg region), Germany (Ruhr region), Canada (Alberta and Ontario), Australia (Latrobe Valley), the United States, and Poland.

Visionary Leadership and Trust

SPCs have often been relying on a set model for many years and face resistance to moving away from fossil fuels, particularly in the presence of strong lobby groups, as is the case with Eskom. JET strategies require visionary leadership to drive implementation at the county level and within the SPC. Trust comes into play, particularly in securing finance for JET initiatives, and the funders must believe that that proposals will be taken forward and are not empty promises. In addition, funders must accept that these transitions are very complex and involve socio-economic dimensions that constrain the ability of SPCs to deliver.

Build Effective Mechanisms for Multistakeholder Collaboration and Accountability

In the case of Komati, as with any power plant, the overall JET process will need to include a range of economic activities, such as building resilience, creating alternative industries, and upgrading infrastructure. As such, there must be an effective way for all stakeholders to collaborate. This is not just an SPC's responsibility—business, all levels of government, labour unions, funders, and local communities are all part of the process.

Moreover, with multiple stakeholders involved in the Komati plant closure, there needs to be a clear articulation of which agency is responsible for which parts of the process. Communities around Komati have expressed frustration at not knowing who to approach for different issues.

Balance JET Actions, Climate Finance Opportunities, and Domestic Financial Support

JET strategies require coordinated domestic action with timely international financial support. Experts interviewed observed that the coal plant life extension ambitions in South Africa conflict with the JETP, are not supported by internal Eskom economic analysis and could scupper future climate finance opportunities. Countries and their SPCs must be aware that continuing to expand the fossil fuel asset base is unlikely to be compatible with accessing finance for JET activities.

While MDBs, DFIs, and JETP-like programs can provide a basis for funding JET projects and derisk them, a lack of sustainable local JET finance can reduce the perceived legitimacy of this as a domestically owned agenda. SPCs should look to find local avenues to supplement finance needs in a way that does not increase debt. These could include negotiating changes to taxes (e.g., carbon tax) with government, encouraging private sector investment in bankable repowering projects that will provide revenue streams and potentially exploring carbon markets.

Establish Appropriate Internal Institutional Arrangements for a JET Office

Creating a dedicated JET office is a model that other SPCs can replicate. The advice from experts involved in the Eskom JET Office is to follow their model and create a dedicated JET office for planning and specific activities, and not cover legislative and operational functions, such as reporting on environmental compliance and monitoring emissions.

The JET office is a strategic function and should be part of the utility's core business strategy. As such, the entity should be located within the SPC in a way that avoids any potential conflict of interests (such as with the fossil fuel generation department), and to ensure that it receives the required institutional support to work effectively.

Develop Platforms to Objectively Cover Progress of JET Activities

The twisting of narratives to suit vested interests and misinformation has been a major challenge in the Komati case. A potential solution could be to have an independently run online dashboard to monitor JET activities to provide an objective account for the public to follow what is happening.

5.0 NTPC's Contribution to Renewable Energy Expansion in India

Table 3. Case study summary: NTPC

Government ownership	51%
Structure	Focused on generation
Climate targets	No net-zero target (national target net-zero by 2070)
NTPC power station capacity from fossil fuels	89.6%[14]
NTPC context for scaling up renewable energy	• National electricity demand grew 3.5% faster than capacity additions from 2021 to 2024. • By 2024, utility-scale solar was cheaper than new coal (on a levelized cost basis) in India and without government subsidies. • NTPC is the largest electricity generation company in India, contributing 24% of national supply. It also has one of the strongest financial positions among SPCs in India. • NTPC has a target of 60 GW of renewables by 2032, but also 26 GW of new coal by the same date. As of 2024, NTPC has 11 GW of renewables and hydro under construction.
Main NTPC actions to scale up renewable energy	NTPC helped expand utility-scale renewables in India in "Developer Mode"[15] via • Buying electricity from solar sources, bundling with thermal, and selling to distribution companies at a lower price than solar alone, helping catalyze growth of solar sector. • Acting as a guaranteed electricity off-taker, reducing risk for private developers. By 2013, NTPC was also investing directly in renewables (in addition to Developer Mode projects) and was the biggest winner in utility-scale auctions across FY 2023 and FY 2024. • Included investment in emerging technologies like floating solar and hybrid wind and solar plants, and in renewables enabling technology like battery storage. In 2022, created a renewable energy subsidiary, NTPC Green Energy Limited (NGEL). • In 2024, a portion of NGEL's shares were sold (USD 1.2 billion) via an IPO to reduce company debt and raise capital for further renewable energy expansion. • NGEL has done renewables joint ventures and acquisitions.

Source: Authors.

[14] Includes operational joint venture and subsidiary plants, excludes Developer Mode projects (NTPC, n.d.).

[15] Developer Mode does not mean NTPC was the developer but rather facilitated their development by IPPs.

5.1 Key Messages for SPCs on the Expansion of Renewable Energy[16]

- Other SPCs could reduce off-taker risks for renewables projects by signing power purchase agreements (PPAs) with private companies that develop the projects.
- NTPC helped to stimulate early deployment of emerging clean technologies that address national needs, such as floating solar to address land acquisition challenges.
- Setting up dedicated renewable energy subsidiaries could allow SPCs to have faster decision making, increase expertise, and improve access to climate finance.
- SPCs could investigate what type of shareholder investment strategies (such as selling shares in a subsidiary IPO) will be effective in their regional circumstances to improve their financial position and ability to execute renewable energy projects.
- Joint ventures with domestic public sector entities and international technology providers can help share investment risks, localize innovation, and scale low-carbon infrastructure.

5.2 Overview

In 2021, India committed to achieving net-zero GHG emissions by 2070. This long-term goal is complemented by specific targets in India's updated NDC from 2022, including 50% cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030. As of October 2024, India achieved 46.3% of its total installed energy capacity from renewable sources (Ministry of New and Renewable Energy, 2024).

NTPC Limited, formerly known as the National Thermal Power Corporation,[17] is **India's largest electricity generation company** and a central SOE (referred to as a Public Sector Undertaking in India) under the purview of the Ministry of Power. NTPC plays a critical role in meeting India's growing electricity demand, with an installed capacity of over 75 GW (17% of India's installed capacity in FY 2024),[18] the majority of which are thermal power plants. NTPC provides 24% of national power generation (NTPC, 2024c).

Although NTPC has traditionally lagged private companies in investing in India's renewable energy sector, it has recently stepped up its ambition. In 2021, **NTPC set a target of deploying 60 GW of renewable energy capacity by 2032**, which will entail a significant acceleration from its current 4.7 GW of solar and wind capacity (NTPC, n.d., 2021). To help achieve a target of 45%–50% of non-fossil-based capacity by 2032 (NTPC, 2024d), a renewable energy subsidiary (NGEL) was created in 2022 to mobilize capital for clean energy deployment and to separate its renewable energy and core thermal businesses.

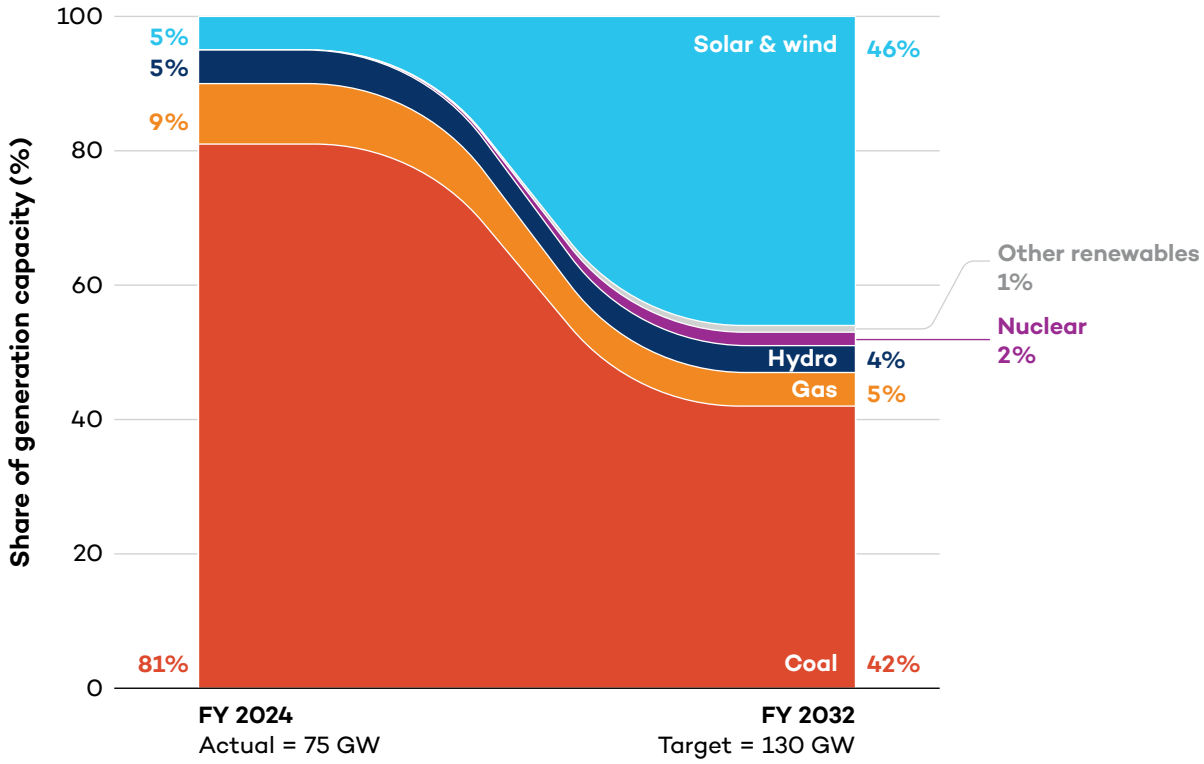
[16] NTPC is highly profitable, so other SPCs may need financial support for such actions.

[17] In 2005 the company formally changed name, so in this report NTPC is used as a shortening for NTPC Limited, not as an abbreviation for its previous name.

[18] "FY" refers to the financial year, and in the Indian context FY 2024 runs from April 1, 2023, to March 31, 2024.

Historically, NTPC has been synonymous with thermal power plants, predominantly coal plants. It started out in the renewable energy sector by working with private companies in setting up renewable energy power plants. However, NTPC has recently shifted its business model significantly by investing directly in renewables to support India's broader energy transition.

Figure 5. NTPC installed generation capacity in FY 2024 and targeted capacity in FY 2032



Source: Author diagram based on NTPC, 2022a, 2024b.

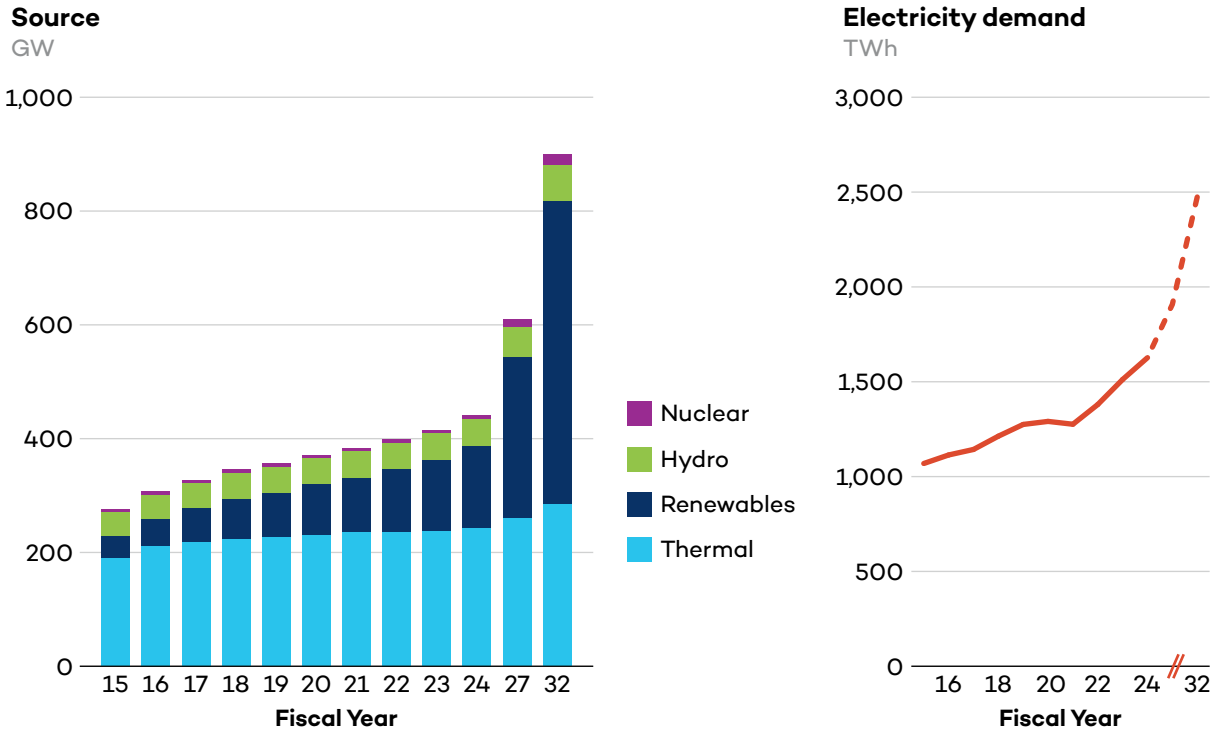
Energy Transition in India

In 2023, India emerged as the third-largest solar power generator globally, with solar electricity output increasing from 6.6 TWh in 2015 to 113 TWh—a 17-fold expansion. Despite this significant growth in renewable energy, coal continues to dominate, accounting for 75% of India's electricity generation. India produced 1,480 TWh from coal in 2023, the second-highest in the world after China (Wiatros-Motyka et al., 2024).

The peak demand for electricity has averaged 8.5% annual growth between 2021 and 2024, while installed electricity capacity has only increased by 5% in the same period (Figure 6).

Government officials have highlighted that while India remains committed to its long-term renewable energy goals, the sharp rise in electricity demand can cut into electricity supply reserve margins and necessitates continued public investments in thermal power plants for grid stability and energy security (Ministry of Power, 2023).

Figure 6. India's installed electricity generation capacity by source (in GW) and electricity demand (in TWh)



Note: Actuals for FY 2015–FY 2024 and projections for FY 2027 and FY 2032.
Source: Author diagram based on CEA, 2023, 2024a, 2024b.

5.3 Role of NTPC in India's Electricity System

NTPC's primary business is power generation, which helps shield it from the significant losses incurred by state-level utilities operating in the transmission and distribution segments. As of 2024, coal makes up 81% of its power station capacity, with the company owning or operating 60.8 GW of coal-fired power plants (CFPPs) across India (NTPC, 2024a). The sustained trend of falling renewable energy costs is putting pressure on the economic viability of new coal power projects. For example, by 2021, solar power tariffs (per kWh) were already cheaper than the variable costs per kWh of CFPPs, which excludes the capital costs for building the CFPPs (Shah, 2021).

NTPC has one of the strongest financial positions among electricity generation companies in India. It has a domestic credit rating of AAA from Crisil Ratings and ICRA Limited reflecting its stable cash flows and robust financials (Crisil Ratings, 2024; NTPC, 2024b). Internationally, NTPC's credit rating is equivalent to India's sovereign credit rating

(FitchRatings, 2024a). Experts interviewed suggested that this high credit rating allows NTPC to access capital at one of the lowest borrowing costs in the industry, supporting its expansion and modernization efforts.

The weighted average cost of debt for NTPC has fallen from 8% in FY 2015 to 5.9% in FY 2022 (NTPC, 2022b), primarily due to the overall decline in interest rates in India.

NTPC's earnings are partly driven by long-term PPAs, ensuring steady revenue streams. The Tripartite Agreement between NTPC, state governments, and the central government has further bolstered its financial health by limiting its potential risk if India's indebted state distribution companies default on their payments (FitchRatings, 2024a).

Institutional Structure

The Government of India is the majority shareholder of NTPC, with a shareholding of 51%. As NTPC is a publicly listed company, the remaining shares are held by institutional investors, banks, and the public. The Ministry of Power is responsible for overseeing NTPC, with its representatives nominated to the board of directors. The company has nine independent directors and two directors nominated by the government. The independent directors are also appointed through a search committee helmed by the government.

NTPC's government-designated status grants it significant financial and operational autonomy, including the ability to establish joint ventures and subsidiaries without government approval. At the same time, being a publicly listed company subjects it to stock exchange corporate governance norms, which enhance transparency and accountability in its decision-making processes. Together, these factors help limit political interference and support more agile operations.

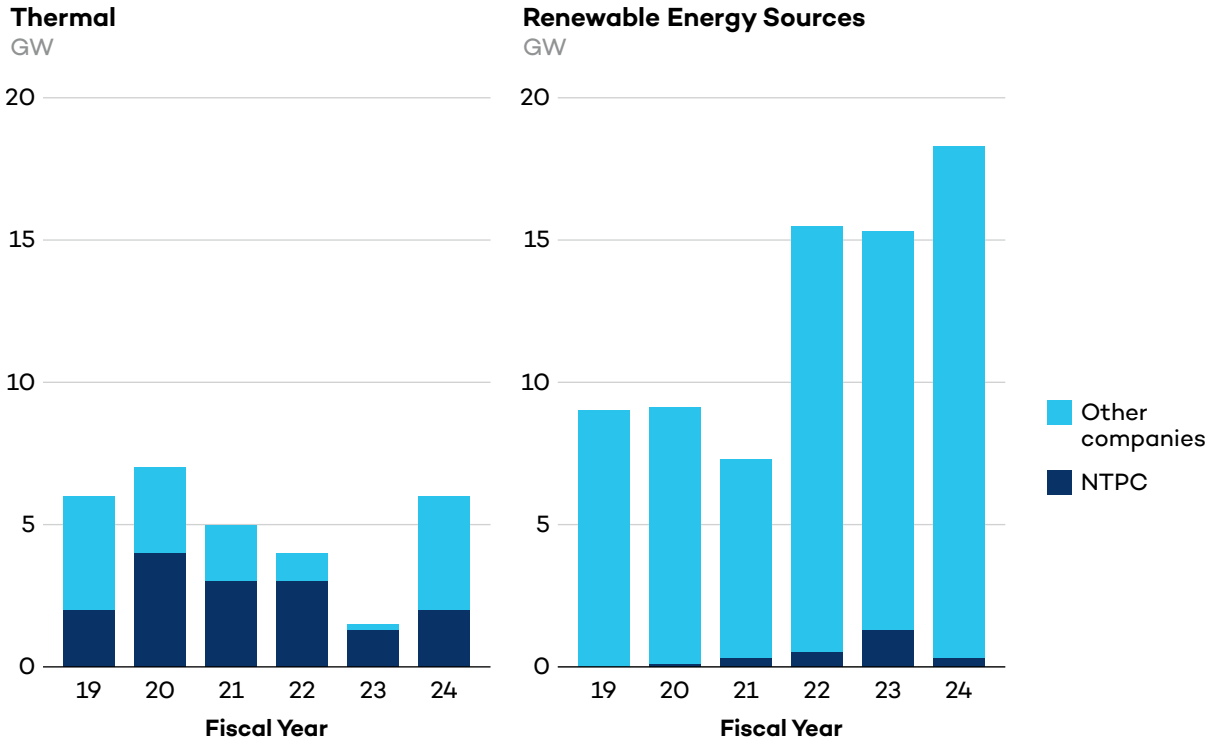
As a publicly listed company with independent directors, NTPC operates as an SOE with private sector characteristics, such as autonomy in making investments, profit motivation, and exposure to competition, likely contributing to its strong operational and financial efficiency (Benoit et al., 2022).

5.4 NTPC's Transformation in the Renewable Energy Sector

As of February 2025, NTPC's installed renewable energy capacity is around 4.7 GW, a relatively small fraction of India's total renewable energy capacity of over 150 GW. **NTPC has traditionally trailed private companies in adding renewable energy capacity** (Figure 7). Experts suggested that private companies have taken the lead in deploying renewables in India due to their ability to tap low-cost international capital at more competitive rates than domestic financial sources (allowing them to bid at lower tariffs in competitive auctions), and NTPC's earlier risk-averse approach in making investments into emerging technologies.

Following the announcement of India's updated NDC targets and net-zero commitments by 2070, NTPC has laid out plans to increase its renewable energy capacity to 12 GW by the end of 2025 and 60 GW by 2032, representing a dramatic shift in its energy mix.

Figure 7. Thermal and renewable annual capacity additions by NTPC and other companies, FY 2019–FY 2024



Source: Author diagram based on CEA, 2024b.

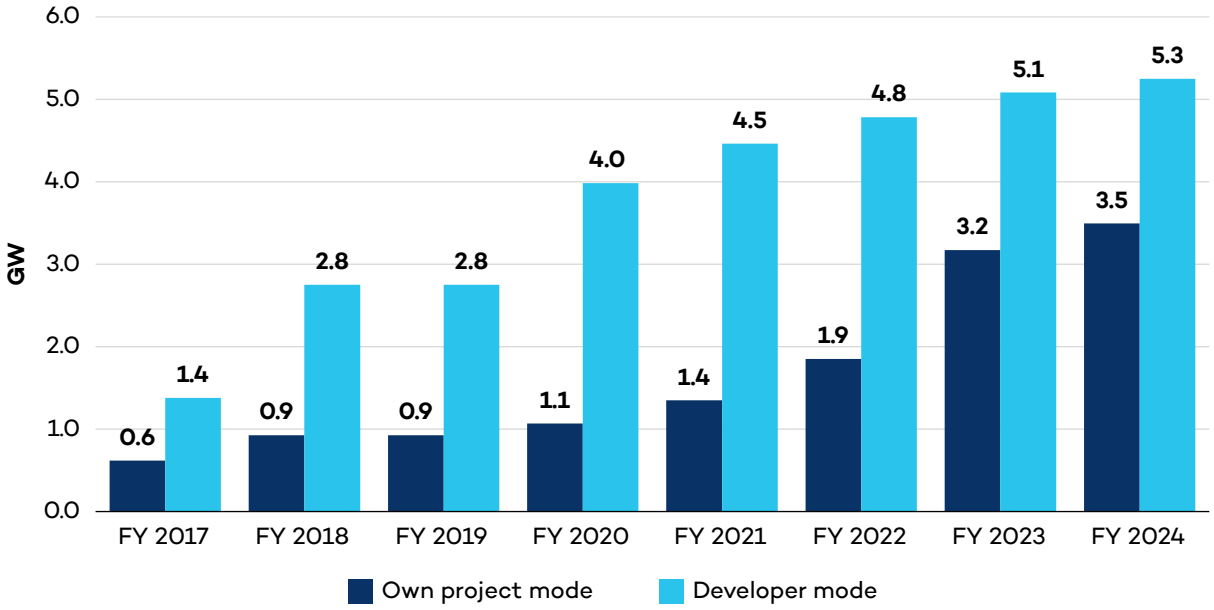
As of 2024, NTPC has 11 GW of renewable projects under construction and 20 GW in various stages of tendering (NTPC, 2024b). Interviewees suggested that the pivot toward renewable energy is critical to achieve NTPC's ambitions to maintain market share, given that its current renewables capacity trails leading private companies in India, such as Adani Green Energy and ReNew Power.

NTPC's Role in Developer Mode

NTPC played an important role in the implementation of early government-led renewable energy schemes, particularly the Jawaharlal Nehru National Solar Mission launched in 2010. Here, NTPC was appointed the nodal agency for bundling solar power with conventional power. This consisted of selling electricity to distribution companies at a single price that had **bundled the lower cost of thermal power and the higher cost of solar power into a weighted average that was lower than the price of solar power alone.** Although bundling solar power with cheaper thermal power negated some of the emission benefits, NTPC enabled state utilities to procure solar energy at competitive rates, promoting the growth of India's solar sector.

This strategy aligned with the broader objectives of the National Solar Mission, which aimed to make India a global leader in solar energy. Under this scheme, NTPC's renewable energy capacity from Developer Mode projects has surpassed the renewables capacity it has directly invested in, which has nevertheless experienced accelerated growth over the past 3 years (Figure 8).

Figure 8. NTPC renewable energy installed capacity under own project mode and developer mode



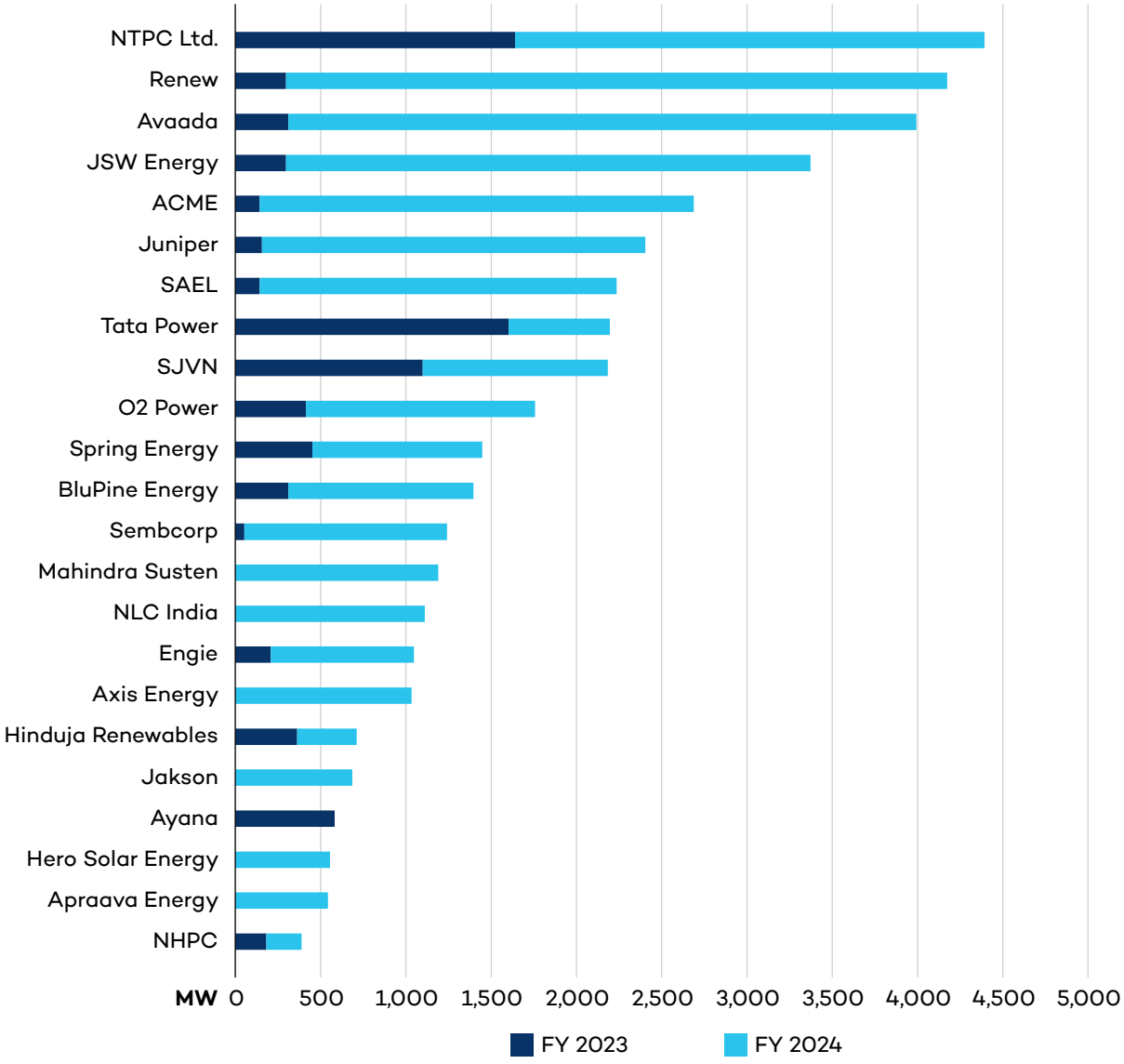
Source: Author diagram based on NTPC, 2021a, 2022b, 2023a, 2024a.

NTPC has also played a significant role as a procurer of renewable energy through tenders and PPAs, enabling more competitive renewable energy auctions. For example, the PPA prices in solar auctions held in the year 2015–2016 were lower by INR 0.29/ kWh when NTPC was the off-taker (Shrimali, 2021). **NTPC's presence reduced offtake risk for private developers and ensured that developers had a guaranteed buyer for their power output**, making renewable energy projects more financially viable.

NTPC's Shift in Directly Investing in Renewable Energy

NTPC's growing interest in renewable energy closely followed national climate commitments and the drastic reduction in the cost of solar and wind power. Between 2010 and 2020, solar costs in India dropped by more than 80%, making solar projects financially viable without large government subsidies (IEA, 2021). After trailing private companies in adding renewable energy capacity, NTPC has emerged as the biggest winner in utility-scale auctions between FY 2023 and FY 2024 (Figure 9).

Figure 9. Capacity allocations to winning bidders in utility-scale auctions (FY 2023–FY 2024)



Source: Sharma et al., 2024.

Interviewees suggested that NTPC's focus on renewable energy is a strategic shift due to changing economic and environmental considerations. They also noted that as fossil fuels become less financially attractive and face increasing regulatory pressures, NTPC has diversified to help ensure long-term competitiveness and sustainability. **Despite this, NTPC still plans to build 26 GW of new coal power plants by 2032, and is also growing its coal mining business** (Sharma, 2024).

Diversification Into Emerging Renewable Energy Technologies

NTPC has broadened its renewable energy portfolio by venturing into emerging clean energy technologies, such as floating solar and green hydrogen. It has invested in India's largest 92 MW

floating solar project at Kayamkulam in Kerala (NTPC Renewable Energy Limited, n.d.), which maximizes the use of water bodies and avoids the challenges of land acquisition. NTPC has also invested in pilot solar-wind hybrid projects to assess solutions that address the intermittency challenges with renewables and is exploring green hydrogen production (Table 2).

NTPC is also investing in battery energy storage systems and pumped hydro storage projects, enabling energy generated during peak renewable hours to be stored and used when demand is high or when renewables are unavailable. Given its strong finances, NTPC can play an important role in the driving the early adoption of these emerging technologies and improving their viability.

Table 4. NTPC's investments across renewable energy technologies, FY 2024

Stage of activity	**Solar** GW	**Wind** GW	**Hydro** GW	**BESS** GW/GWh	**PHS** GW/GWh	**Green hydrogen** tonnes/yr
Commissioned	3.3	0.2	3.8	-	-	0.365
Under construction	7.0	1.5	2.3	-	1/6	124
Under tendering	3.8	5.6	-	2/12	3/18	73

Notes: BESS = battery energy storage system; PHS = pumped hydro storage.
Source: Authors, based on NTPC, 2024b.

NTPC's Creation of a Green Subsidiary: NGEL

In 2022, NTPC created a wholly owned subsidiary, NGEL, to consolidate and accelerate its renewable energy ambitions. This included housing a prior subsidiary called NTPC Renewable Energy Limited. This step involved the transfer of all its renewable energy assets to NGEL, which now serves as the dedicated arm for NTPC's green energy projects. Based on our consultations with experts, the rationale behind creating a separate green energy entity is multifaceted:

- **focused growth:** By spinning off its renewable energy assets into NGEL, NTPC aims to bring a sharper focus on scaling renewable energy without the complexities and slower growth associated with its thermal power business. This also allows for more nimble decision making in the highly competitive renewable energy space.
- **better financing options:** NGEL is better positioned to raise capital specifically for renewable projects. Green energy projects often have different financing structures with a higher share of debt (debt–equity ratio of 80:20), which enables NGEL to access green bonds and other climate-focused funds. As NTPC continues to build more coal plants, some experts interviewed questioned whether this will affect international financial institutions' willingness to invest in NGEL.
- **asset monetization:** In 2022, NTPC announced plans to list 20% of NGEL's shares as part of its asset monetization strategy. This was designed to unlock value for shareholders and raise capital for further renewable energy expansion. In November

2024, an IPO raised about INR 100 billion (~USD 1.2 billion), of which about 75% was earmarked for debt reduction, and the rest to be reinvested into NTPC's growing renewable energy portfolio (NGEL, 2024).

The IPO provides NGEL with better visibility in the renewable energy market, attracting investors interested in clean energy growth. It also represents an opportunity for NTPC to monetize its renewable assets without relinquishing control, as it will still retain majority ownership in NGEL.

NGEL invested INR 20.24 billion (~USD 233 million) in just the first quarter of FY 2025, nearly 40% of its full-year capex in FY 2024. This surge reflects NTPC's strategy to channel renewable energy growth through NGEL as it works toward its 60 GW target by 2032. This scale-up is backed by strong operating cash flows, with INR 6.85 billion (~USD 79 million) generated in Q1 FY 2025, almost matching NGEL's total for FY 2023, signalling a financially sustainable growth trajectory (NGEL, 2024).

Joint Ventures

NGEL is strategically expanding its renewable energy footprint through joint ventures and acquisitions with other SOEs and SPCs in India (such as the Oil and Natural Gas Corporation), as well as signing memoranda of understanding with private renewable energy companies such as Greenko ZeroC. Collaborations like the term sheet with Greenko ZeroC for round-the-clock energy supply to a green ammonia plant also position NGEL to serve industrial decarbonization needs.

These state entity partnerships enable NGEL to share project risks, access land, transmission infrastructure, and public funding channels, and accelerate the deployment of large-scale renewable energy projects. The private sector partnerships allow NGEL to align with sector-specific expertise (e.g., chemicals, transport), and enhance bankability through co-branding with credible private entities (NTPC, 2023b; Power Technology, 2024).

NTPC's Role in International Renewable Energy Markets

On the international stage, NTPC has been an active player in the International Solar Alliance, an initiative led by India to promote solar energy globally. NTPC's involvement in the alliance has included technical collaboration and assisting in the deployment of 6.6 GW of solar projects in member countries, particularly in Africa (NTPC, 2024b). These engagements highlight NTPC's focus on sharing lessons from India's solar success with countries across the Global South.

Lack of Progress in Decarbonizing NTPC's Thermal Portfolio

NTPC's decarbonization strategy for its thermal power fleet focuses on biomass co-firing, the flexible operation of coal plants, constructing new supercritical and ultra-supercritical plants, and exploring carbon capture, utilization, and storage (CCUS) in certain projects (NTPC, 2024b). These have been outlined in its sustainability strategy, called The Brighter Plan 2032. The initiative relies on a reduction in emission intensity by 17%, with 54% of its coal fleet

having either supercritical or ultra-supercritical technology and a 30% share of non-fossil-based generation capacity by FY 2032 (Ray, 2024).

Since the power plant fleet in India is relatively young, **early retirement poses a financial risk, which would need to be compensated through JETP or international finance to gain any traction.** In the absence of international finance, technological solutions are thought of as interim solutions to still generate revenue but aim to reduce emissions. Furthermore, there is a strong narrative on energy security in India, which must be addressed in discussions on coal retirement.

Several interviewed experts have raised concerns that these strategies are likely to face constraints regarding cost-effectiveness, scalability, and long-term sustainability. A study by Carbon Tracker (Ray, 2024) has also suggested that NTPC's current decarbonization trajectory is not aligned with international benchmarks, such as the Paris Climate Agreement and the IEA's Net Zero by 2050 roadmap.

NTPC's continued reliance on coal-based thermal assets may put its future cash flow at risk, as global and domestic markets increasingly prioritize clean energy. Studies warn that significant portions of NTPC's under-construction coal portfolio face the risk of asset stranding, with potential carbon prices and regulatory changes likely to impact future profits (Viswanathan et al., 2022). The absence of a plan to phase down NTPC's thermal plants, suggests that without a stronger shift to renewable energy, the SPC may face increasing carbon transition risks.

5.5 Lessons From NTPC's Embrace of Renewables

NTPC has demonstrated that a major coal SPC is able to pivot swiftly to renewable energy, where faster execution of projects is required. Below are some lessons from this transformation.

Market Facilitator by Leveraging Public–Private Partnerships and Outsourced Development

In the initial phase of India's renewable transition, NTPC acted as a facilitator by bundling costlier renewable power from private developers with NTPC's cheaper thermal power. This approach enabled India to increase its renewable energy penetration and allowed private developers to contribute significantly to renewable capacity.

NTPC has developed over 5.3 GW of renewable capacity through the outsourced model, where private developers execute projects, and NTPC secures long-term PPA. This model enabled faster capacity additions without NTPC needing to bear the entire development risk. SPCs could partner with private developers under similar models: leveraging public–private partnerships frameworks and reducing project execution risk, without significant upfront capital expenses for the SPC. Such arrangements will depend on the financial position of the SPC, and the level of government backing.

Diversifying Its Renewable Energy Portfolio by Embracing Technological Innovations and Storage Solutions

NTPC has focused on maintaining a diverse renewable portfolio, including solar, wind, and hybrid energy projects. This diversification helps reduce its dependence on one source and better manage intermittency in renewable energy generation. NTPC has made initial investments in hybrid (wind–solar) projects and is focusing on round-the-clock renewable energy power with battery storage and pumped storage plants to help manage the variability of renewable generation. Investing in floating solar projects also maximizes the use of water bodies and avoids the challenges of land acquisition.

Developing Strong Internal Capabilities on Renewable Energy

NTPC established a dedicated subsidiary, NGEL, to focus solely on renewable projects, allowing it to specialize in execution, financing, and policy navigation. This allows for faster decision making and specialized expertise in renewable energy technologies and the ability to raise financing from a diverse pool of sources. It can also help prevent a conflict of interest between the core business interests in thermal power plants and renewables.

Investigate Options for Shareholder Investment

The high demand for NGEL's shares demonstrates investor confidence in this state-backed renewable venture. A significant portion of NGEL's IPO proceeds was used to lower debt, making it a financially healthier company. As this is a recent development, time will tell if this model can consistently create value. Nonetheless, other SPCs could explore what similar capital-raising avenues would work in their jurisdictions, and whether they can use IPOs or green bonds to restructure finances and enhance profitability.

Strategic Use of Joint Ventures and Partnerships

For other SPCs, NTPC's joint venture model illustrates how choosing the right partner for the right technology—and structuring flexibility into the collaboration—can unlock capital, capability, and speed in renewable energy deployment. SPCs can form joint ventures with domestic public sector entities and international technology providers to share investment risks, localize innovation, and scale low-carbon infrastructure across sectors.

6.0 EVN's Efforts to Integrate Renewable Energy Into the Grid in Viet Nam

Table 5. Case study summary: EVN

Government ownership	100%
Structure	Vertically integrated utility: own generation and sole off-taker for IPPs, with monopoly over transmission and distribution.
Climate targets	No net-zero targets (contributes to national target)
EVN power station capacity from fossil fuels	50.8% (2025 data)[19]
EVN context for renewable energy integration	• Complex institutional, administrative, and oversight structures that hinder ability to quicky make strategic investments, underinvestment in the grid between 2016 and 2020. • Rapid growth in utility-scale renewables and rooftop solar from 2020, largely due to the introduction of feed-in tariff (FITs)[20] and tax, lease, and local content exemptions. • Utility-scale renewable energy projects concentrated in regions of best resource potential but geographically mismatched with demand centres. • Renewable energy FITs ended by 2022, and new renewables projects stalled. • EVN has had difficulties in mobilizing capital due to lack of government guarantees, the national debt ceiling reached, and posting significant losses in 2022 and 2023.
EVN actions to address renewable energy integration	• Since 2023, investment in the grid has been prioritized by the government, resulting in network upgrades, substation automation, and new transmission lines (ahead of schedule). • investment in technical solutions to manage renewable resources, such as renewable energy forecasting and automatic generation control for real-time grid management. • implementation of a smart grid roadmap for network modernization, including smart metering, remote control of grid facilities, and energy management systems. • collaboration with government entities to enhance regulatory frameworks (e.g., amending laws for private investment into the grid) and streamline administrative approval procedures.

Source: Authors.

[19] Operational capacity of EVN and EVN subsidiaries. Data from Global Integrated Power Tracker (April 2025 update) as EVN annual report does not separate its own capacity by type (Global Energy Monitor, 2025).

[20] FITs are a policy mechanism that guarantees fixed payments to electricity producers.

6.1 Key Messages for SPCs on Integrating Renewable Energy

- For successful spatial and temporal management of grid requirements relative to new generation facilities and load centres, SPCs need to coordinate strongly with line ministries, provincial governments, regulatory bodies, and local implementation agents.
- Transmission or distribution subsidiaries with their own financial accounting and credit rating may access commercial loans for grid upgrades easier than the parent SPC.
- Develop robust regulatory frameworks for renewable energy integration that include support for and other features that help manage renewable energy intermittency (e.g., market flexibility, ancillary services, energy storage).
- In addition to physical upgrades/expansion, SPCs can deploy smart grid technologies in monitoring, remote control, and automation to improve existing grid function.

6.2 Overview

Over the past decade, Viet Nam's power sector has experienced significant growth and transformation, driven by rapid economic expansion and increasing electricity demand. In 2021, the country announced a commitment to achieve net-zero emissions by 2050, reinforcing it with an updated NDC in 2022. The NDC aims for a 7% unconditional reduction in total GHG emissions from the energy sector compared to a business-as-usual scenario by 2030, and up to an additional 17.5% with international support (Government of Viet Nam, 2022).

Viet Nam's electricity market is dominated by the state-owned utility, EVN, which is tasked by the government with the production, buying, selling, importing, and exporting of electricity, as well as investing in electricity projects and managing the national grid (Nhan Dan Online, 2023). **EVN holds a direct monopoly on transmission and distribution, making the integration of new renewable energy capacity a major responsibility for EVN and its subsidiaries** (International Trade Administration [ITA], 2024).

The use of FITs to incentivize renewable energy uptake resulted in the addition of significant capacity in 2020 for solar and in 2022 for wind, mainly in the South Central and Central Highland regions. The aging grid had insufficient capacity to absorb this surge in additional renewable energy supply, resulting in grid congestion and curtailment[21] of wind and solar plants to ensure grid stability.

In recent years, EVN has managed to undertake technical, political, and financial solutions to ease grid congestion, integrate renewable energy capacity, and operate the power grid reliably.

[21] Decease in electricity demand cased by the COVID-19 pandemic also contributed to curtailment.

EVN's effort to upgrade the grid to accommodate renewable energy will need to be increased as Viet Nam has set ambitious climate and energy goals. The solutions undertaken by EVN—as well as emerging challenges—can serve as lessons for other state-owned utilities in managing their country's energy transition.

Energy Transition in Viet Nam

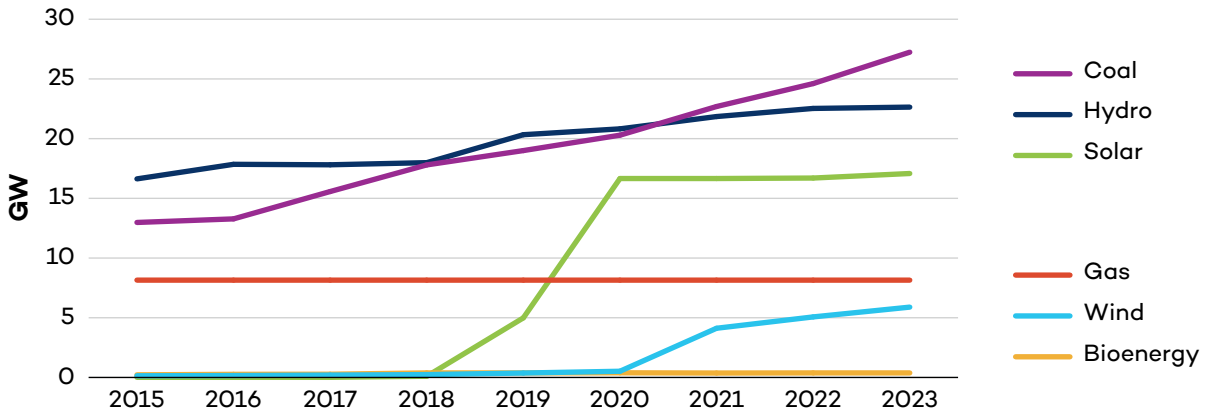
Historically, the country's energy system has relied heavily on coal, gas, and hydropower (Figure 10). However, **since 2020, Viet Nam has made significant strides in diversifying its energy mix with a sharp increase in renewable energy capacity**. Solar capacity (both utility scale and rooftop) grew from less than 0.1 GW in 2016 to 16.6 GW by the end of 2023. Similarly, wind power capacity expanded from 0.2 GW in 2018 to 5.6 GW by 2023 (EVN National Load Dispatch Center [NLDC], 2024; Setyawati, 2023). By the end of 2023, solar and wind together accounted for approximately 27% of the total installed electricity capacity and the equivalent of nearly 14% of total power generation (EVN, 2024).

In support of the country's NDC targets, the Power Development Plan for 2021–2030 (PDP8) was approved in May 2023. Although the PDP8 originally aimed for a modest amount of new solar capacity by 2030 (Government of Viet Nam, 2023), discussions in February 2025 indicate this will increase significantly, with solar making up 45% of all new capacity by 2030 (Thy Nguyet, 2025).

6.3 Role of EVN in Viet Nam's Electricity System

EVN held a monopoly in electricity generation until 2006, following which the government decided to liberalize the generation market. The establishment of a competitive generation market in 2012 and government incentives for renewable energy led to private ownership in power generation surging from less than 10% in 2012 to nearly 42% by the end of 2023. IPPs hold about a third of generation capacity (EVN, 2024; Hoai Thu & Ngoc Ha, 2023; Tri Lam, 2023).

Figure 10. Power generation capacity in Viet Nam

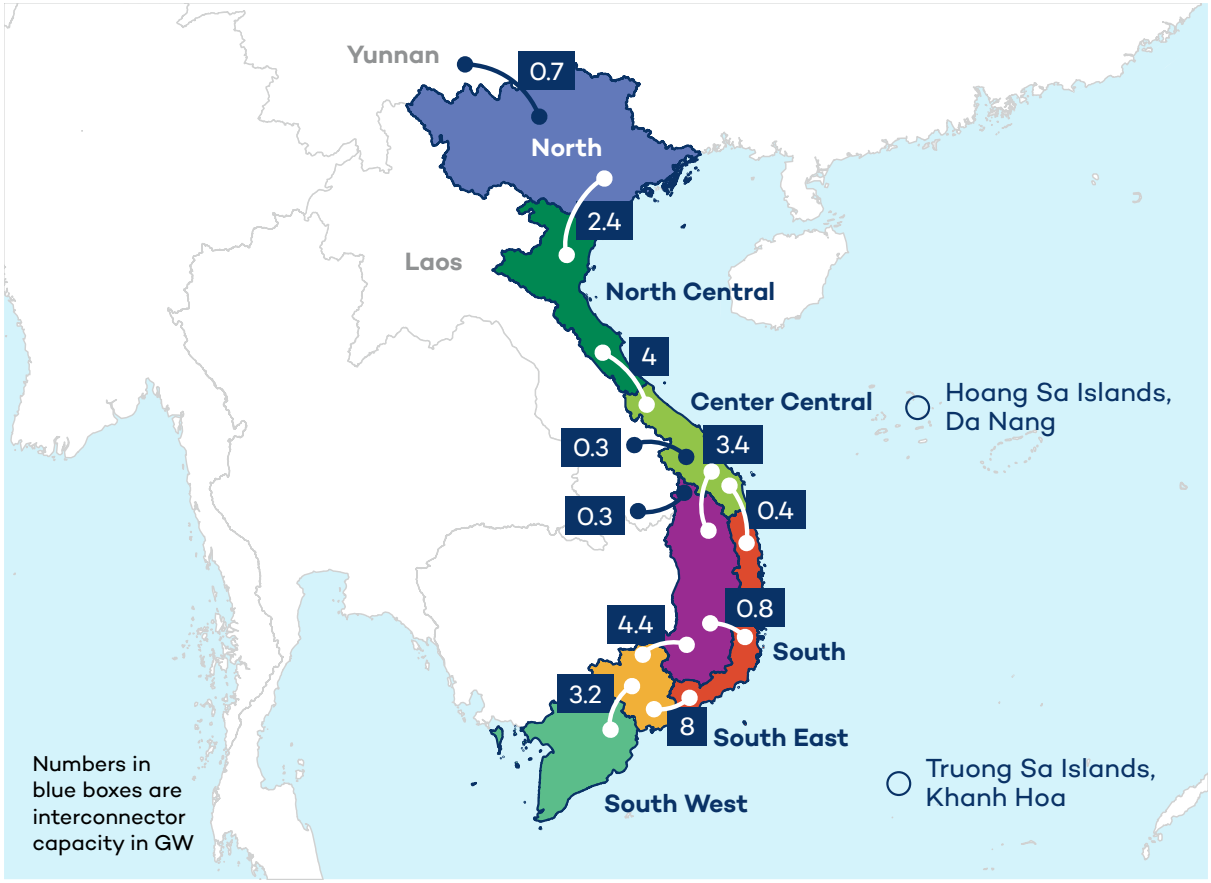


Source: Author diagram based on Ember, 2024. Solar is a combination of utility scale and rooftop.

At the end of 2023, EVN and its generation subsidiaries collectively operated a total of 29.9 GW power plants, representing 37% of the national generation capacity (EVN, 2024).

The National Power Transmission Corporation (EVNNPT), a subsidiary of EVN, operates 153 substations and 25,236 km of transmission lines (ITA, 2024).

Figure 11. Viet Nam transmission network in 2022



Source: Author diagram based on Electricity and Renewable Energy Authority & Danish Energy Agency, 2024.

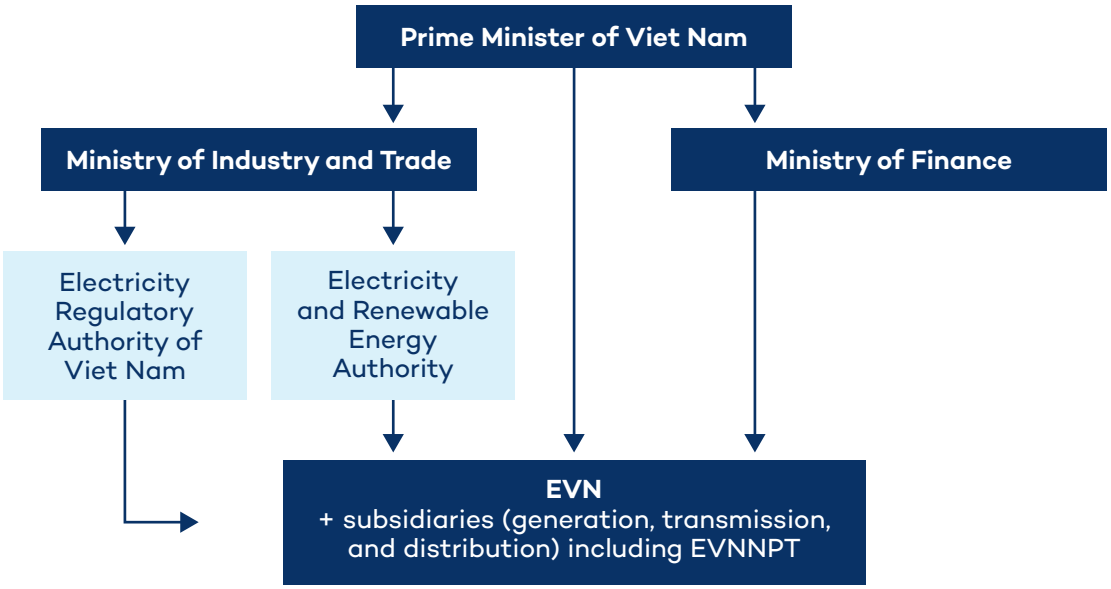
Institutional Structure

The management of EVN reports directly to the Prime Minister as well as two key governmental bodies: the Ministry of Finance (MOF) and the Ministry of Industry and Trade (MOIT).

MOF is primarily responsible for overseeing the state's capital in EVN and other large SOEs. Acting as the state's representative, the MOF manages and supervises EVN's strategic decisions, investments, and restructuring efforts. MOIT, on the other hand, serves as the regulator and planner for the power sector. It manages the broader electricity market and sets policies related to energy production, distribution, and consumption.

EVNNPT is a wholly owned subsidiary of EVN responsible for the development and operation of the national transmission system.

Figure 12. Outline of EVN's governance structure



Source: Adapted and updated from Intelligent Energy Systems & East West Energy and Climate Link JSC (IES & EWEC), 2023.

Together, this **creates a complex institutional structure for EVN to operate within, and reduces its ability to make swift, strategic investments, including for grid upgrades and extensions**. Projects must be undertaken in accordance with MOIT's plans, while the capital for these investments must be approved by MOF. EVN's projects, including for grid work, rely on government will and instruction, and what the regulations allow.

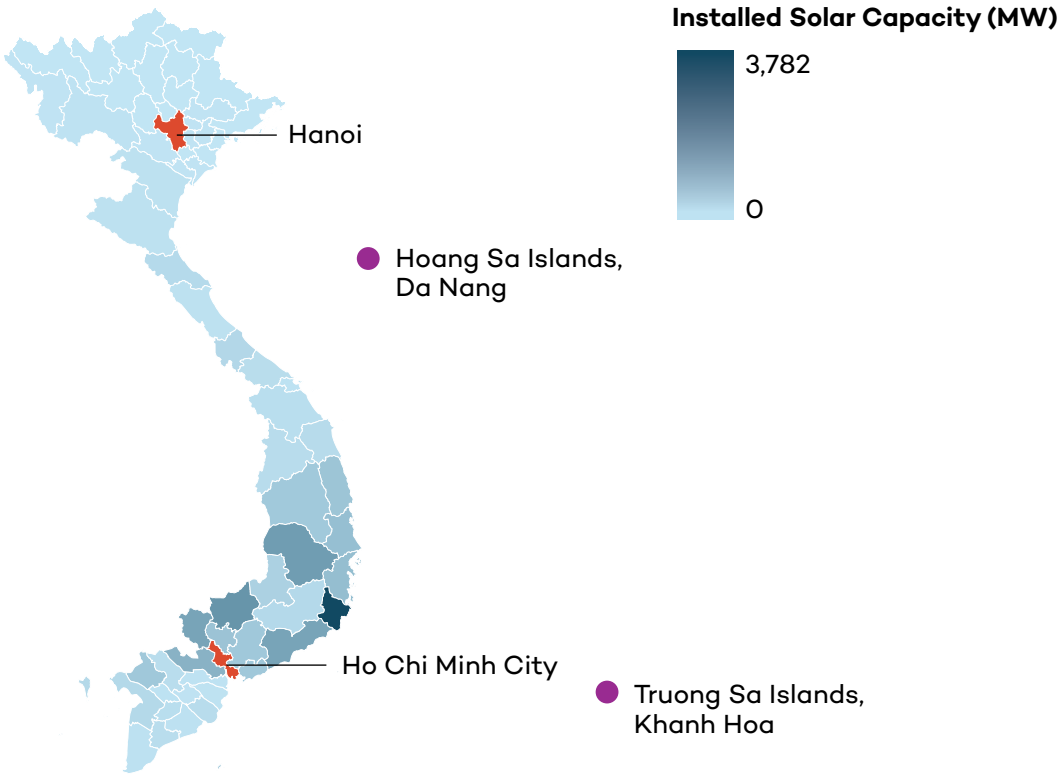
6.4 Integrating Renewable Energy Into the Grid

Rapid Renewable Energy Growth but Insufficient Grid Capacity Where Needed

The rapid development of renewable energy in Viet Nam between 2019 and 2022 can be largely attributed to a highly favourable domestic policy environment. **One of the key drivers was the introduction of attractive FITs for solar and wind energy**, which spurred significant investment in the sector. Starting in 2011, the Government of Viet Nam introduced a FIT for wind power, which was increased in 2018 and included on-shore, near-shore, and offshore installations (Government of Viet Nam, 2011, 2018). From 2017, government decisions also offered FITs for three types of solar installations: ground mounted, floating, and rooftop (Government of Viet Nam, 2017, 2020).

Additional favourable policies, such as lease exemptions, the absence of local content requirements, and tax exemptions for renewable energy equipment, further enhanced the competitiveness of renewable energy compared to fossil-based generation.

Figure 13. Installed solar capacity in Viet Nam (ground mounted and rooftop solar) in 2024



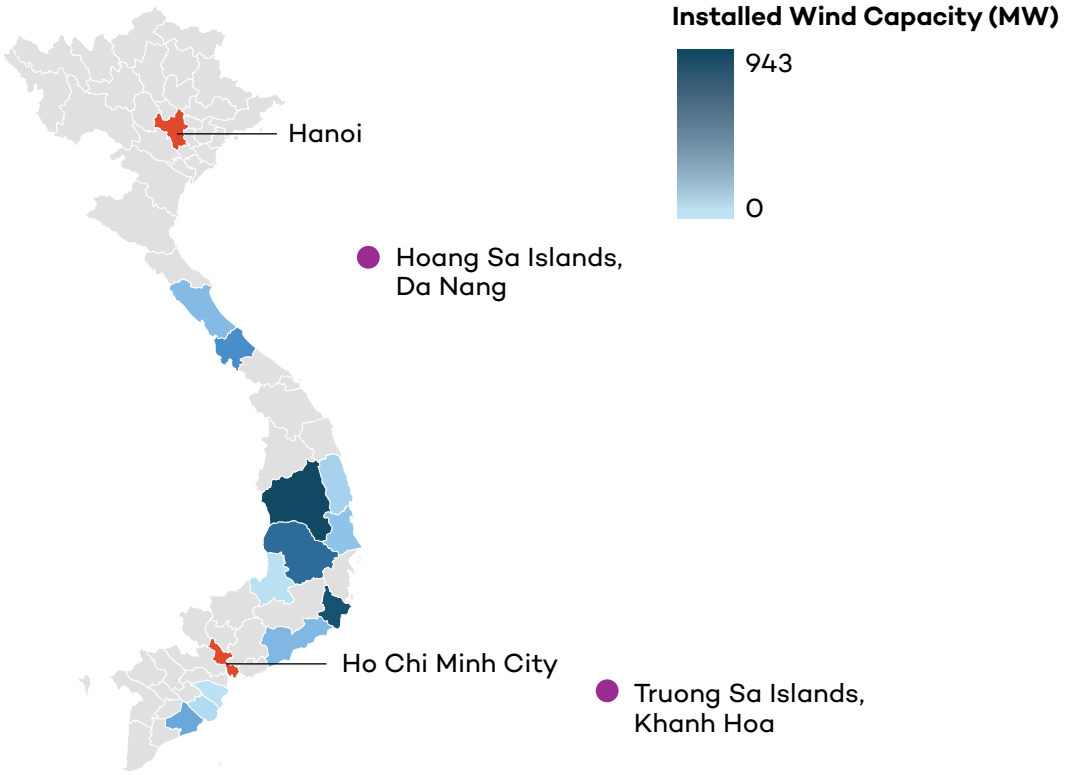
Source: Author diagram based on data from Global Energy Monitor, n.d.-a.

As a result, Viet Nam added 11.6 GW of solar capacity in 2020 and 3.6 GW of wind capacity in 2021 (Figure 10). Interviewees noted that this rapid growth in renewable energy was primarily concentrated in the South Central and Central Highlands regions due to high solar and wind potential, low population density, and land prices. However, this renewable energy capacity overburdened the existing grid infrastructure in these areas, and the major load centres are located near the urban clusters of Hanoi (North) and Ho Chi Minh City (South), **leading to a geographic mismatch.**

The transmission of renewable energy capacity from the South to the North is hampered by an aging 500 kV transmission line that fails to support long-distance power transmission (Nguyen, 2023). Furthermore, as more distributed rooftop solar came online in December 2020, the distribution grid faced additional strain in some provinces, according to experts interviewed.

In 2020, approximately 364 GWh of solar energy was curtailed, resulting in significant financial losses and wasted power resources (Ketelsen et al., 2023) . By the end of 2023, the NLDC reported 20 overloaded points on the 220/110 kV transmission lines and transformers, along with 220 renewable energy plants that had to cut production due to grid congestion (EVN NLDC, 2024).

Figure 14. Installed wind capacity in Viet Nam in 2024



Source: Author diagram based on data from Global Energy Monitor, n.d.-b.

In addition to congestion, several technical challenges, such as limited renewable energy forecasting and a lack of support for ancillary services to stabilize frequency and voltage, further increased the pressure on EVN and its subsidiaries to manage and operate the grid effectively.

This FITs for solar and wind applied to projects commissioned by the end December 2020 and 2023, respectively (Enerdata, 2020). The lack of an alternative pricing mechanism after the FIT expiration, contributed to a slowdown in renewable energy capacity additions that would sell to EVN (IEA, 2024a). However, in July 2024, the Government of Viet Nam issued a decree permitting direct PPAs for renewable energy between private project developers and private energy consumers (including for privately developed transmission lines). This new legislation could spur a new wave of rapid renewable energy development in Viet Nam (Hauber, 2024).

Challenges for Initial Integration of Renewable Energy Into the Grid

Viet Nam's success in rapidly expanding its renewable energy capacity has posed grid-related challenges due to several factors. Experts suggest that the lack of coordination between EVN and the MOIT and a lack of comprehensive planning from the MOIT (which is responsible for the development of the PDP8) resulted in these mismatches between energy generation and grid capacity.

The national grid still requires significant investment to provide sufficient capacity for supply and demand requirements. Construction of new lines on the 500 kV grid has been relatively slow, and it is nearing full capacity. Only 78% and 74% of the planned 500 kV and 220 kV lines, respectively, were added to the system between the start of renewable energy expansion in 2016 and when renewable energy needed to be curtailed in 2020 (Ketelsen et al., 2023). **Due to regulatory, financial, and institutional challenges, there was an underinvestment into Viet Nam's grid infrastructure from 2016 to 2020.**

In 2019, the MOIT had an opportunity to address some of these issues through the first draft proposal for the second round of FITs for solar power, circulated in February 2019. This draft suggested a zonal approach, where the provinces with the highest solar radiation and existing renewable energy capacity would receive the lowest FIT rates (Viet Nam Energy Partnership Group, 2019). The intention was to promote areas with less solar potential and capacity through a higher FIT rate. However, the final decision did not incorporate this zonal approach, leading to continued concentration of renewable energy projects in the same high-stress regions, further aggravating grid congestion issues.

Another issue with power planning in Viet Nam is the mismatch between provincial and national power development plans, particularly in the placement of substations, the direction of power transmission, and the approval of project designs. For example, the national plans cover the number of new substations and the length of new power lines, but provincial plans decide the location of new infrastructure, and the Provincial People's Committees handle the land allocation for these projects. The lack of coordination between the national government and Provincial People's Committees creates delays and inefficiencies in upgrading the grid to accommodate existing and new renewable capacities, further contributing to grid congestion and curtailment issues (Viet Nam Energy Online, 2024).

Investing in the grid is critical for Viet Nam's efforts to integrate and operate a modern electricity system with high renewable energy penetration. According to PDP8, the total investment required for the development of the grid from 2021 to 2030 amounts to USD 14.9 billion (Ketelsen et al., 2023). This will put a significant strain on the state budget. Not many investors have come forward to invest in merchant lines (those connecting private projects to the existing grid) due to the low transmission tariffs (paid by the customer) as well as challenges in transferring ownership of the grid to EVN after being built. Only Trung Nam Group has successfully built a 500 kV transmission line. Although in use, legal issues have prevented the transfer to EVN (Ngoc Anh, 2024).

EVN's Solutions for Integrating Renewable Energy Into the Grid

EVN has gained considerable experience in operating a grid with a high renewable energy share after 2019, particularly from solar and wind sources. During this time, the company has made significant strides in building its technical capacity to better manage the grid and ensure more efficient renewable energy integration. In addition, **EVN has actively worked with the government and the National Assembly to enhance regulatory frameworks,** paving the way for improved renewable energy integration into the grid. For example, EVN lobbied the government to allow private investment into the grid and then the transfer of the grid assets

to EVN.[22] Furthermore, EVN was instrumental in the consultation for the amendment of the Electricity Law in 2024 to further allow private investment in generation and the grid.

A key achievement has been the successful deployment of advanced technical solutions to manage renewable energy sources more effectively. The company has invested in information technologies, particularly to improve forecasting accuracy for solar and wind energy. For example, EVN NLDC developed an in-house forecasting model through collaborations with multiple data providers. As a result, the daily forecast error for renewable energy improved, and now consistently stays below 10% (EVN NLDC, 2024), with global leaders aiming for 5%–10%. Incentivizing rooftop solar generators to provide a net production forecast could further improve overall forecast accuracy.

EVN has also made substantial progress on grid modernization, particularly through steps of implementation of a Smart Grid Roadmap, across transmission and distribution. These advancements include improved metering, energy management systems, and the deployment of Supervisory Control and Data Acquisition (which allows for the automatic collection of data). These technologies enable EVN to monitor critical technical aspects of the grid, such as system inertia, voltage, and frequency, ensuring stable grid operations and preventing failures (Tuyen, 2023)

Furthermore, according to experts interviewed, as of 2023, EVN has fully integrated 100% of utility-scale renewable energy power plants into its automatic generation control system, allowing real-time grid management and control of generation outputs. The technical solutions implemented by EVN and its subsidiaries have dramatically increased the grid's reliability and security (IES & EWEC, 2023).

Additionally, EVN and its Power Corporation successfully ensured that 100% of 100 kV substations were operating in compliance with fully automated operation procedures, with 79% of 220 kV substations operating without any staff (IES & EWEC, 2023). EVN has taken steps to retain and retrain employees when substations are automated. For example, when converting to unmanned substations, EVN Central Power Corporation (2022) reduced the number of substation operators by nearly 50%, but the company still guarantees working positions and carries out the retraining of these employees for new positions.

Beyond technical solutions for renewable energy management and forecasting, EVN has also invested heavily in upgrading physical grid infrastructure. In 2023 alone, the company completed and operationalized 187 power grid projects, including substations and transmission grids (EVN, 2024). Notably, EVN successfully completed the installation of 519 km of Quang Trach–Pho Noi 500 kV transmission lines ahead of schedule in 2024. This project received strong political support from the government, as it aimed to prevent the northern part of the country from experiencing an electricity shortage like in the summer of 2023.

In the future, EVN plans to improve grid operations by implementing customer net metering and demand–response measures. Additionally, EVN is completing several 500 kV transmission and substation projects and has plans to develop high-voltage direct current transmission lines to support the transfer of renewable energy capacity from southern to northern Viet Nam.

[22] Still requires a mechanism to account for the investment cost of transmission projects in the PPAs.

Box 3. Finance and investment for grid infrastructure

The Resource Mobilization Plan for Viet Nam's JETP, launched in 2023, includes USD 15.8 billion to support Viet Nam's energy transition (European Commission, 2023). Key priorities include investments in power transmission, energy storage, and offshore wind development (Larasati & Fajrian, 2024). However, the share of funds allocated to each of these priority areas remains undefined by February 2025, creating uncertainty about the scale of financial support for grid infrastructure.

While the JETP may offer backing for Viet Nam's energy transition, EVN faces difficulties in raising capital. Its ability to secure sovereign loans is constrained by the absence of government guarantees, according to experts interviewed. A further challenge for commercial loans arise as EVN posted significant losses (VND 47,500 billion, ~USD 2 billion) in 2022 and 2023 (Viet Nam News, 2024).

Non-sovereign loans are an option, and in 2022, the French Development Agency agreed to provide EVN with an EUR 80 million loan without a government guarantee for investments in the distribution grid in southern Viet Nam (Viet Nam Law Online, 2024). However, it is one of the few organizations offering this type of financing.

As a subsidiary of EVN with separate financial accounting, EVNNPT can also access loans directly. From 2019 to 2024, the Standalone Credit Profile of EVNNPT (bb+) was higher than EVN (bb) with the Fitch credit rating agency (FitchRatings, 2024b). In 2022, EVNNPT reported arranging a USD 2 billion official development assistance loan from a group of MDBs and bilateral development agencies (EVNNPT, 2022). Furthermore, EVNNPT has proactively sought partners and expanded relationships with foreign commercial banks and international financial organizations to secured loans equivalent to USD 650 million, contributing toward increasing the investment capital of EVNNPT (EVNNPT, 2022).

Commercial loans from domestic banks can be an important source of funding for grid upgrades, and supported the construction of the Quang Trach–Pho Noi 500 kV lines. However, obtaining such loans still requires political backing from the government, along with a strong credit rating for EVNNPT (Viet Nam Energy Online, 2023).

As nearly USD 1.5 billion per year is needed for grid upgrades in Viet Nam until 2030, the following steps have been taken to increase private investment into the grid:

1. Resolution 55 of the Politburo of the Communist Party has permitted private investment into grid infrastructure, and paves the way for further laws, decrees, and decisions.
2. The amended Public and Private Partnership Law encourages the privatization of transmission and distribution substations (ITA, 2024).
3. The Government also issued Decree 02/2024/ND-CP, allowing the transfer of public and private grid infrastructure to EVN for management as well as for operation and maintenance.

The Government of Viet Nam currently regulates electricity retail prices, with adjustments based on recommendations from the MOIT and approved by the Prime Minister. MOIT and EVN are working on a roadmap to gradually increase electricity prices and phase out government subsidies (ITA, 2024). This policy is a positive step toward reducing subsidies and improving EVN's financial sustainability while preparing for a more market-driven electricity pricing system.

6.5 Lessons From EVN's Integration of Renewable Energy Into the Grid

Strengthening Coordination With Government and Regulatory Bodies

For SPCs, successful grid integration of renewable energy requires strong coordination between the utility, line ministries, local governments, and regulators. EVN's experience shows the importance of proactive planning that balances grid capacity and renewable energy potential in specific regions, as well as regulatory support for grid upgrades and new energy technologies. Interconnection with the cross-border transmission grid could help transfer surplus renewable energy to other countries.

Unlocking Financing for Grid Infrastructure, Including From the Private Sector

Access to international financing and government-backed guarantees is important to support grid expansion. However, SPCs should also work with governments to develop and implement policy mechanisms that can help secure commercial and non-sovereign loans, along with mechanisms to encourage private financing for grid development. Private capital constitutes an under-exploited resource, albeit one that presents challenges when it comes to financing transmission investments.

Transmission or distribution subsidiaries, with separate financial systems and credit ratings, may find it easier to access commercial loans specifically for grid upgrades than the parent SPC.

Developing Regulatory Frameworks for Renewable Energy Integration

Developing a market for grid services and offering attractive incentive policies, such as a pricing model for wheeling, could help attract private investment in grid infrastructure. Developing such a market as part of a successful energy transition requires regulatory support for market flexibility, ancillary services, and energy storage.

SPCs, including EVN, need robust policies that create conducive conditions for renewable energy integration, enhance grid flexibility, and improve energy storage capabilities. This will help them manage the challenges of intermittent renewable sources like wind and solar.

Expanding Smart Grid and Modernization Efforts

EVN has made significant progress in deploying smart grid technologies, much like other SPCs managing large, complex grids. The implementation of advanced monitoring systems, remote control capabilities, and automation has enhanced efficiency. However, continued investment in both physical grid upgrades and digital infrastructure is necessary to accommodate growing renewable energy capacity and increased availability of information regarding network function.

7.0 PLN's Experience in the Early Retirement of Coal Power Plants in Indonesia

Table 6. Case study summary: PLN

Government ownership	100%
Structure	Vertically integrated utility: controls entire electricity supply chain
Climate targets	Net-zero by 2060 (same as national target)
PLN power station capacity from fossil fuels	90.7% (2023 data)[23]
PLN context for early coal plant retirement	• PLN has significant financial challenges (including debt), and it is reliant on government support. • additional financial strain from paying for an oversupply of electricity (due to government overbuild of independent coal plants with take-or-pay contracts) • Coal for electricity generation has a price cap, creating further lock-in for coal plants. • Ministerial regulations from 2017 helped create a more conducive private sector investment environment in the electricity sector, particularly for renewable energy projects. • Until April 2025, the only legal framework related to early coal plant retirement was a Presidential Regulation from 2022, but it did not cover JET elements for coal supply chain. • Early coal retirement increases the short-term grid investment needs to handle more renewable energy.
Main PLN actions on early coal retirement	• In 2022, PLN announced that a roadmap was being developed to remove 6.7 GW of coal capacity by 2040, including 3.5 GW from early closure, but this has not yet been released. • In 2022, PLN indicated it was looking into finance options for early coal retirement, such as blended finance or IPP refinancing, but by 2025 it seems that PLN requires that the support must be from external entities (foreign or private investment). • One of PLN's coal power plants was designated as a pilot project, shortening operational lifespan by 9 years, to retire in 2037. But until the funding is secured and the full regulatory mechanisms and legal basis are in operation, this pilot is effectively on hold.

Source: Authors.

[23] Based on total installed capacity from PLN (2024b).

7.1 Key Messages for SPCs on Early Coal Retirement

- With government, develop a comprehensive legal framework. Include clear, fair, and transparent mechanisms for a) engagement and planning on just transition, and b) renegotiation of coal plant contracts and all relevant secondary party commitments.
- Provide data transparency on all aspects of coal plant closure as this can accelerate negotiation and decision making.
- SPCs require government to enable financial incentives and support for renewable energy and grid projects, as these are needed to complement the early retirement of coal plants.
- There is a need for expedient, low-cost financing options to complement larger international initiatives like the JETP and Energy Transition Mechanism, but there are no obvious solutions on how to do this: this is an area for SPCs to work on.

7.2 Overview

The government of Indonesia has announced a target of achieving net-zero emissions by 2060 or sooner. In its updated NDC from 2022, the GHG emission reduction target was 32% below the business-as-usual scenario by 2030 or 43% with international support. It does not specifically address the early retirement of CFPPs. However, Climate Action Tracker (2024) has suggested that existing policies are insufficient to meet climate targets.

The country's state-owned vertically integrated electricity utility, PLN also has a goal to achieve net-zero emissions by 2060. PLN has said it is developing a roadmap for the early retirement of CFPPs. The plan[24] aims to retire 6.7 GW of capacity by 2040, made up of 3.2 GW through expiring contracts at older power plants, and 3.5 GW through early retirement of newer coal plants, based on specific conditions (Christian, 2022).

Financially, the company struggles with a heavy debt load and dependence on government subsidies, making the early retirement of CFPPs a risky move, especially without low-cost funding from international financial institutions. Furthermore, the government overestimated the country's previous electricity demand growth, resulting in an excess of coal IPPs. This oversupply, coupled with take-or-pay clauses in the contracts for coal IPPs, results in PLN paying for electricity from these plants regardless of actual demand, creating additional financial strain.

Operationally, PLN faces challenges related to managing stranded assets and ensuring energy security while reducing coal generation. The early retirement of CFPPs must be offset by building new renewable energy plants to meet electricity demand, requiring significant changes in infrastructure and operational practices, as the current grid infrastructure is heavily geared toward thermal plants.

A key aspect of PLN's coal retirement effort is the difference in progress between the early phase-out of privately owned CFPPs compared to state-owned plants. Private IPPs

[24] Unreleased as of April 2025.

(sometimes with foreign investment), are often more agile in adopting renewable energy technologies and have made more progress in closing coal plants or transitioning to renewables. PLN's progress, while commendable, has been slower due to its larger portfolio of coal assets and complex regulatory structures.

Energy Transition in Indonesia

Indonesia's electricity sector is heavily dominated by fossil fuels, with CFPPs accounting for 67% of electricity generation in 2023 (PLN, 2024a). This heavy dependence on coal is primarily due to Indonesia's abundant coal reserves (Julian, 2023). This has been central to the country's energy strategy in building new power plants: the Fast Track Program 1 of 2010 (10 GW of coal and natural gas power plants), Fast Track Program 2 in 2015 (another 10 GW), and a further 35 GW of projects.

Aside from a broader supply–demand mismatch, these three megaprojects suffered from many delays (Kementerian Energy dan Sumber Daya Mineral, 2012) and cost overruns, contributing to PLN's financial strain.

This dominance of coal in power generation also contributes to the challenges transitioning to renewable energy, as there are substantial sunk costs in the already established coal-based infrastructure.

In 2014, Indonesia first declared a target to increase the share of renewables to 23% of the national energy mix by 2025 (Presiden Republik Indonesia, 2014). However, progress has been slow, with renewables accounting for only 13% of the energy mix in 2023 (PLN, 2024a). Instead of devising a strategy to accelerate renewable energy deployment, the Government of Indonesia is planning to revise the renewable energy target downwards in 2025 to around 17%–19% by 2025 (Muliawati, 2024a).

The government, through revisions of two Ministerial Regulations in 2017, has encouraged private sector participation in electricity provision. These regulations aimed to create a more conducive investment climate in the electricity sector, particularly for renewable energy projects (Jullaga & Nurafia, 2017). This was also reflected in PLN's Electricity Supply Business Plan (RUPTL) 2021-2030, and subsequent update for 2025–2034, where IPPs will play a significant role in renewable energy-based power plants (Chaniago, 2025; PLN, 2021).

7.3 PLN's Role in the Electricity System

As a vertically integrated utility, PLN plays a central role in Indonesia's electricity system. **It controls the entire electricity supply chain—generation, transmission, and distribution.** PLN is responsible for about 70% of the nation's electricity generation, and, as of 2024, had 45.1 GW of installed power plant capacity (PLN, 2024b). PLN provides

electricity by operating its own generating plants, IPPs, and rentals:[25] out of the country's total installed capacity, 62% belongs to PLN, 36% to IPPs, and the other 2% is from rental units (PLN, 2024a).

The high dependence on coal is influenced by the ongoing belief that coal is the cheapest source of energy when it comes to electricity generation. However, the seemingly low cost of electricity from coal is partly due to substantial coal subsidies. The Fossil Fuel Subsidy Tracker estimated that coal subsidies in Indonesia were USD 5.58 billion in 2023 (Organisation for Economic Co-operation and Development [OECD] & IISD, 2024). **With over 90% of energy support directed to fossil fuels, renewable energy development faces an uneven playing field,** resulting in slow progress (Christensen et al., 2022). They come in various forms such as the Domestic Market Obligation policy from 2009, which caps the coal price for electricity generation at USD 70/ton, making it lower than international prices. This policy was still in effect in February 2025 (Nangoy, 2025), and while the intention was to keep electricity tariffs low, it contributes to keeping PLN locked into coal and could delay the transition to renewable energy.

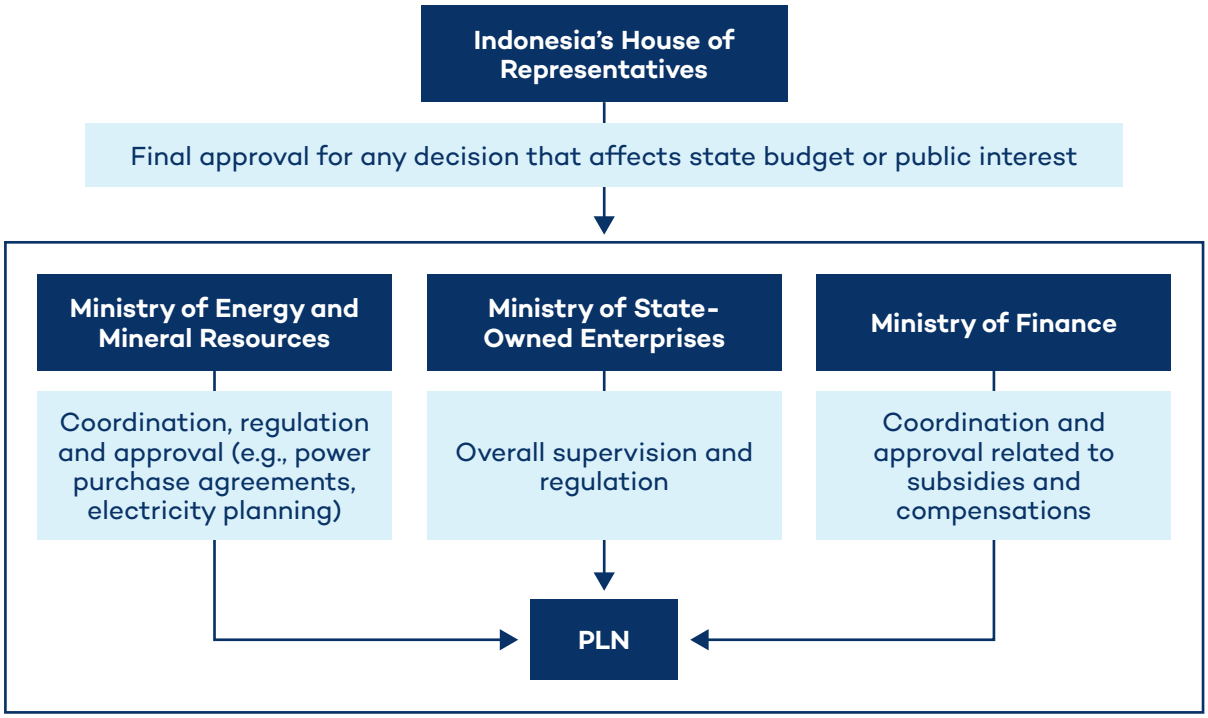
To address the affordability of electricity, some household groups are entitled to a lower tariff. The gap between the basic cost of electricity and these lower tariffs is covered by government subsidies (PLN, 2024a). A concern surrounding early coal retirement is its potential impact on electricity tariffs and associated subsidies. Given the incomplete legal framework (Section 7.3), it remains unclear who should cover these costs, if the electricity price were to increase.

Institutional Structure

PLN has operated under the oversight of three different ministries (Figure 15). This has limited flexibility and autonomy in decision making and introduced governance challenges, including for early coal retirement. However, in February 2025, Indonesia launched a new sovereign wealth fund, Danantara (see Box 4). This is significant development, as the government plans to transfer ownership of several SOEs, including PLN, to Danantara. At the time of writing, it was not clear who will ultimately drive SOE reform, and how the role of the ministries in Figure 15 will shift over time.

[25] Temporary generation facilities, such as diesel or gas engines, leased from third-party providers.

Figure 15. PLN's oversight structure before Danantara



Source: Authors' analysis.

Box 4. Danantara – an important new chapter for PLN

Indonesia's new sovereign wealth fund, Danantara, will initially serve as an investment vehicle and holding company for seven Indonesian SOEs, totalling USD 900 billion in assets under management. This would make it the fourth largest sovereign wealth fund in the world. It aims to accelerate economic growth, attract foreign investment, and strengthen key sectors, including renewable energy (Soeriaatmadja, 2025). As part of the restructuring, PLN transferred IDR 150.5 trillion (~USD 9.49 billion) worth of shares to Danantara, shifting financial oversight of the utility (Fajri, 2025).

Analysts have expressed mixed views on what this change means for PLN. Some argue that Danantara's financial backing and consolidation could help PLN secure investment for its energy transition, while others warn that PLN's strategic decision making and ability to execute energy transition plans could slow because approvals will now involve both Danantara and the Ministry of SOEs (Gunadi et al., 2025). There is also potential for policy misalignment if long-term priorities in PLN's RUPTL do not align with Danantara's investment direction.

Further concerns have been raised about accountability, political influence, and independence, as Danantara is not overseen by the Supreme Audit Agency or the Corruption Eradication Commission, and decisions may involve former presidents and religious organizations (Shabrina, 2025).

The impacts of these new governance developments for PLN remain uncertain, including their influence on early coal retirement plans.

7.4 Challenges of Early Coal Retirement Projects in Indonesia

The discussion on early coal retirement began in 2022, when PLN announced its commitment to achieve net-zero emissions by 2060, matching the national target (Syahputra, 2022). The Ministry of Energy and Mineral Resources announced plans to accelerate the retirement of 13 CFPPs before 2030 as part of Indonesia's coal phase-down strategy, although some plants would naturally retire by 2030 due to age (Setiawan, 2024) Although PLN has stated that it has updated its RUPTL to align with the net-zero goal by 2060, the latest plan was not publicly available as of April 2025.

Lack of a Comprehensive Legal and Regulatory Framework

Prior to April 2025, the only legal framework mandating the early retirement of CFPPs is the Presidential Regulation No. 112/2022 on the Acceleration of Renewable Energy Development for Electricity Generation. This regulation outlines activities aimed at accelerating the retirement of CFPPs and prohibits building new ones while limiting the operation of existing plants until 2050 (Government of Indonesia, 2022). However, the regulation has been criticized by experts for including loopholes, such as exceptions to CFPPs that are already included in the current RUPTL, and CFPPs committed to reducing emissions through CCUS, carbon offsets, and renewable energy investments. This is perceived by some experts as a lack of commitment from the government to reduce dependence on coal.

Furthermore, **the Presidential Regulation is limited in scope to the energy industry and does not account for the economic and societal impacts that might arise.** The regulation only covers contracts between PLN and the IPPs. The regulation does not govern PLN's third-party agreements, such as contracts with local workers who are involved in the plant's operation. It also does not regulate compensation mechanisms for contract workers nor provide for reskilling workers in the coal supply chain that can enable them to pursue alternative livelihoods. According to experts interviewed, to avoid triggering economic and social unrest, there needs to be a clear regulatory framework that covers socio-economic aspects of the resulting transition.

In April 2025, Ministerial Regulation No. 10/2025 on the Road Map to Energy Transition for the Electricity Sector was released. Although this is a step forward, researchers noted that this regulation still lacks several key elements, including a comprehensive list of CFPPs that are slated for retirement, the total capacity to be retired, and a clear deadline for retirement. Additional criteria suggest that early retirement of CFPPs may be conditional (Savitri, 2025). At the time this report was being finalized, it was too early to say how effective this legal change will be.

Institutional Challenges

In some cases, a CFPP slated for early retirement may change ownership from PLN. Experts interviewed for this study suggested that this raises concerns that if the new owners demonstrate higher efficiency and cost-effectiveness in managing the retirement, it will put

PLN's operational practices under scrutiny. This lack of trust, along with the absence of transparent data on operations, financial status, and decision-making processes within PLN, complicates the transition process. Addressing these issues requires a strong commitment from PLN to improve transparency and accountability.

One interviewee noted that while PLN claimed to have conducted its own simulations and calculations for early retirement, it had not disclosed this data as of February 2025. Also, PLN has a history of failing to disclose data on emissions from its major coal plants (Jong, 2024).

Operational Challenges

Early retirement of existing plants could help with oversupply, but in the long term, would need to be combined with building new power plants, preferably from renewable energy, to meet future demand. However, experts interviewed suggested that this transition would require significant changes in PLN's existing infrastructure and operational practices. Each system has different generation configurations, transmission infrastructure, and load characteristics.

> The current grid infrastructure is not capable of handling large amounts of renewable energy unless coupled with storage, due to geographical factors (Indonesia is a collection of many islands) and intermittency issues.

In the long term, a more flexible smart grid will help to properly integrate high levels of renewable energy-based electricity.

Both grid upgrades and storage facilities would require substantial investment, as well as changes to PLN's operations and possibly tariffs. **An electrical grid of approximately 23,648 kilometres must be constructed to support new renewable energy investment of 62 GW by 2040.** This calculation is derived from a study PLN conducted under a scenario of accelerated renewable energy deployment coupled with coal phase-down. The investment needed is about USD 31 billion. As noted by experts interviewed, the construction of this grid would require cheap loans or financing, since grid construction does not have an attractive investment return rate (unclear revenue models, government-controlled tariffs, long payback periods), and regulatory support is also needed to streamline approvals (Wahyudi, 2023).

Box 5. Pilot projects for early coal plant retirement

Two CFPPs have been designated as pilot projects for early retirement: PLTU (Pembangkit Listrik Tenaga Uap) Pelabuhan Ratu operated by PLN and PLTU Cirebon 1, privately operated by PT Cirebon Electric Power.

PLTU Pelabuhan Ratu (1,050 MW) would shorten its operational lifespan from 24 to 15 years, giving it a new retirement year of 2037. Before retirement, the plant ownership would be transferred from PLN to PT Bukit Asam Tbk (PTBA), a coal-mining SOE with a strong financial position and operational efficiency. In November 2023, PTBA was reportedly still waiting for government direction regarding the acquisition of PLTU Pelabuhan Ratu (Noor, 2023). By February 2025, ownership had not yet been transferred. The estimated cost in 2022 for this early retirement was USD 870 million (Institute for Essential Services Reform, 2024). Involving a coal-mining SOE may raise concerns about potential conflicts of interest in the move away from coal.

The process for PLTU Pelabuhan Ratu, which is owned and operated by PLN, is expected to be complicated, especially since PLN itself is showing reluctance to proceed with the early retirement project. This reluctance is due to various factors, including financial concerns, operational apprehensions, institutional challenges, and the lack of legal and regulatory frameworks that are covered in the subsequent sections, according to interviewed experts.

PLTU Cirebon 1 (660 MW) would shorten its operation by 17 years, from an estimated 40 year lifespan, with a new retirement date of 2035 (Setiawan, 2022). The Indonesian government is still refining plans for the early retirement of PLTU Cirebon 1, with an estimated funding requirement of approximately USD 1.3 billion to replace with renewables (Suroyo & Nangoy, 2024).

As of February 2025, PT Cirebon Electric Power is still conducting an in-depth assessment of the early retirement plan to identify impacts to the company, workers, society, and local and national governments, as well as the overall national electrification program (Satriya, 2024). One of our interviewees stated that the early retirement process for PLTU Cirebon 1 is likely to progress faster compared to PLTU Pelabuhan Ratu. Being privately owned, the approach can strictly be on business-to-business basis, while avoiding the institutional and operational difficulties associated with a PLN-owned plant.

In interviews, experts suggested that the government needs to ensure that the national budget won't incur losses following the early retirement of CFPPs, the process is legally sound and is not perceived as detrimental to the state's interest. As of September 2024, Finance Minister Sri Mulyani still could not specify when the funding would be disbursed for PLTU Cirebon 1, as it still a work in progress. (Masitoh, 2024).

The early retirement of PLTU Cirebon 1 will also require a renegotiation of PLN's PPA and other agreements with secondary parties in the production and distribution of electricity, such as coal suppliers, logistics companies, and other related parties, due to the shortened operating period.

Financial Concerns and Opportunities

PLN's financial situation is characterized by significant debt and dependence on government subsidies. Although PLN has managed to reduce its total debt by more than IDR 50,000 billion (~USD 3.1 billion) through government restructuring efforts over the past 4 years, the current debt load of IDR 396,000 billion (~USD 25 billion) is still significant (Muliawati, 2024b).

The utility's financial stability is further strained by paying for an overcapacity of supply that was exacerbated by low demand during the COVID-19 pandemic. As of June 2023, the oversupply in the power grid ranges from 25% to 57%, with a total of 6 GW. It is estimated that PLN will incur a loss of around IDR 3,000 billion (~USD 197 million) per unused GW of electricity, and that PLN's losses could reach up to IDR 18,000 billion (~USD 1.2 billion) for 2023–2024 alone, as the company is obliged to buy power from IPPs (Aulianta, 2024). This financial burden, combined with its debt, makes it challenging for PLN to invest in renewable energy projects.

The CEO of PLN, Darmawan Prasodjo, recently stated that the early retirement of CFPPs is relatively difficult or not feasible to execute (Wahyudi, 2024).

> He stated that without access to additional low-cost funding from international financial institutions, the scheme would represent a risk for the financial sustainability of the company.

Darmawan said that PLN prefers a moderate pathway through the reduction of the capacity factor of coal plants, or coal phase-down rather than phase-out. In line with government rhetoric, he suggested this approach is intended to maintain system reliability and reduce the financial impact on PLN (Wahyudi, 2024).

This recent statement appears to be a rollback on its earlier commitments, since PLN had claimed to have prepared a roadmap for the early retirement of CFPPs in 2022, with a plan for early retirement of 3.5 GW CFPP of capacity by 2040 (Christian, 2022). Moreover, PLN and PTBA had signed a principal framework agreement, committing to cooperate in the early retirement of PLTU Pelabuhan Ratu back in 2022.

One interviewee stated the primary challenge associated with early retirement is the concern over increased additional costs if these plants are retired early. These include decommissioning expenses, worker compensation, system costs related to grid upgrades, and investment in new renewable energy plants to meet future electricity demand. Currently, there is no mechanism or legal basis to determine who should bear these additional costs.

PLN is reported to be considering three options to finance the plants' early retirement: a) writing off the assets from PLN's books, b) spinning off the assets through blended financing, or c) refinancing from IPPs (Christian, 2022); however, further information is not publicly available.

PLN has stated that international funding is crucial for the early retirement of CFPPs, as it is not a commitment that was included in Indonesia's NDC targets (Rahayu, 2023). This is where initiatives such as the Energy Transition Mechanism (ETM), launched in 2021 by the Asian Development Bank, and Indonesia's JETP could become instrumental.

Box 6. International financing options for early coal plant retirement

In November 2022, Indonesia launched the ETM Country Platform at the G20 Leaders' Summit to drive a fair and affordable energy transition. PT Sarana Multi Infrastruktur, an SOE under the MOF, was appointed to manage the platform and develop the financing framework. The platform aims to mobilize USD 4.6 billion to retire 2 GW of CFPPs and replace them with renewable sources (Indonesia Green Growth Program, 2022).

At the same event, the Indonesian JETP was also launched. The agreement pledges to mobilize USD 20 billion over a 3- to 5-year period through public and private finance and aims to help decarbonize Indonesia's energy sector using a mix of grants, concessional loans, market-rate loans, guarantees, and private investment.

Under the JETP, the early retirement of CFPPs is intended to be carried out for 1.7 GW of IPP and PLN capacity by 2040 and will be supported by the ETM (JETP Secretariat, 2023).

By February 2025, the United States had withdrawn from the Indonesian JETP, but other partners, such as France, Germany, the European Union, the United Kingdom, the Netherlands, and Denmark, remain committed. Indonesia's JETP Secretariat head, Paul Butarbutar, noted that while the USD 21.6 billion pledge from private and public donors remains unchanged, the U.S. withdrawal will affect transition studies and grant funding. Despite the uncertainty, no plans exist to withdraw already-allocated funds, and Germany has taken over the U.S. role as a co-leader in the JETP initiative.

Government officials have previously expressed frustration over the lack of clarity on U.S. commitments, with some calling the JETP a failure. The JETP initiative has struggled with financing challenges, leadership changes, and complexities in shutting down power plants. While the U.S. withdrawal introduces more uncertainty, the success of this program will ultimately depend on Indonesia's ability to assert its commitment, especially in the coal retirement program under the new leadership from Germany (Karyza, 2025).

Also in February 2025, Indonesia secured a EUR 14.7 million grant from France and the EU for its energy transition. PLN is set to get about EUR 6.5 million from this new grant. **This grant will go into backing the Indonesia Energy Transition Facility**, a 5-year technical assistance program that will assist the implementation of the JETP and has a component for a capacity capacity-building program for Indonesian SOEs (Shofa, 2025).

7.5 Lessons From PLN's Early Coal Retirement Experience

Given the challenges with early coal retirement, PLN has shifted focus toward accelerating renewable energy development, green hydrogen, and CCUS. However, dropping the early coal retirement scheme could represent a rollback, and PLN might miss out from certain economic benefits. For example, gradual retirement of CFPPs helps decrease PLN's financial costs from the current oversupply and reduces significant maintenance costs of old CFPPs (Wuri, 2024).

Developing a Comprehensive Legal Framework for Early Retirement

For PLN, it is necessary to complete the gaps in existing regulations for coal phase-out. Other SPCs should also have regulations to establish clear compensation mechanisms for all business parties, facilitate renegotiation of PPAs and other contracts with secondary parties, and ensure that the process is fair and transparent. There should also be a legal framework that covers just transition mechanisms for all affected parties, including workers. This could include financial compensation, retraining programs, and job placement services to equip the workforce with the necessary skills to work in alternative livelihoods, such as green sectors.

Improve Evaluations and Data Transparency

To accelerate negotiation and decision-making processes, improve data transparency on all aspects of coal plant closure. Simulations, calculations, and financial information relevant to the early retirement process should be shared and discussed among all related parties to improve the effectiveness of the transition strategy.

Securing Low-Cost Funding and Financing

Although there have been financing commitments in the form of ETM and JETP, there appear to be complications and delays in the disbursement of the funds. PLN should try to find alternative funding sources, including domestic sources, to complement the costs associated with early retirement, such as decommissioning expenses and system upgrades. Addressing internal challenges and increasing transparency could help improve credit scores and attract investors.

Government to Enable Financial Incentives and Support for Renewable Energy

Government should provide incentives and support to facilitate the transition, including subsidies and tax breaks for renewable energy projects. Reallocating funds from fossil fuel subsidies and implementing modest taxes on transport fuels and coal could assist in raising some of the funds needed to reach Indonesia's renewable energy targets and other climate goals. However, these measures are politically sensitive and may trigger public and industry backlash, especially if not accompanied by clear communication and social safeguard measures. To build public and political buy-in, these fiscal reforms should go into funding programs with clear benefits to the people, such as social protection, better public services, and affordable clean energy.

Clear policies and guidelines should also be developed to facilitate investment in renewable energy infrastructure that is required as coal plants retire. These could include a dedicated energy transition fund that comes from savings from subsidy reforms and carbon taxes as well as a national energy plan aligned with PLN's RUPTL that has detailed investment pipelines for renewables.

8.0 Cross-Cutting Findings

Across the four case studies (and for SPCs in EMDEs more broadly), there are some common contextual features that inform the recommendations for three groups of actors: governments, SPCs, and the international community.

1. SPCs can have different but important roles to play in advancing the energy transition.

Each SPC has a unique institutional structure, mandate, and country context. Although most SPCs need to increase climate ambition, narrowly focusing on renewable energy capacity expansion does not fully capture the different ways in which they are facilitating the energy transition in emerging economies. While SPCs have the potential to lead on energy transition, given their traditional dependence on thermal power and fossil fuels, they could hinder the energy transition in the absence of policy frameworks and incentives that encourage their diversification.

2. Financial position and access to finance is a major challenge.

SPCs in EMDEs, including Eskom, PLN, and EVN, are often saddled with large amounts of debt and have difficulties in mobilizing capital. Even those like NTPC that are in a relatively strong position have implemented measures to improve their financial standing. This situation is compounded when the energy transition demands additional SPC expenditure (such as for grid upgrades to support renewable energy) or potential loss of earnings (such as early retirement of coal). There is thus a need to develop pragmatic financial support solutions from the international community for SPCs in EMDEs.

3. SPC may be constrained by the outsized support for fossil fuels in power system.

Despite governments' support for low-carbon changes in their energy systems at a high level, and in international processes like the United Nations Framework Convention on Climate Change global stocktake, there is still widespread political and industry support for fossil fuels beyond their technical requirement in the power system. This is sometimes linked to strong and influential vested interests in the coal sector. In South Africa and Indonesia there is push back on coal plant closures, and even though NTPC is building out renewables, it is still constructing new coal plants.

4. There is an opportunity for SPCs to become leaders in low-carbon action.

SPCs may soon be better placed than ever to lead on energy transition: the declining costs of clean energy and storage should increasingly allow them to invest in low-carbon technologies while still delivering on their core mandate of delivering secure, reliable, and affordable electricity.

9.0 Recommendations

9.1 Governments

1. In conjunction with their SPCs, governments should create the mandate and policy support mechanisms for SPCs to realistically deliver on climate commitments and JET objectives.

This includes, but is not limited to

- enabling strong and visionary SPC leadership;[26]
- mandating SPCs to deliver a specific share of national targets on emissions reductions;
- developing legal and regulatory frameworks for processes related to just transition, including early coal plant closure (plus contract renegotiations) and support for grid strengthening activities;
- instituting electricity sector reforms that fit the local circumstances while encouraging deployment of renewables. This may include removing inefficient fossil fuel subsidies, platforms for ancillary services, competitive electricity markets, demand side management, and potentially SPC restructuring;
- identifying and implementing appropriate financial incentives for a shift to a renewable energy-dominated power system, in areas such as carbon pricing, electricity tariffs (production and consumption), tax credits, and exemptions;
- developing effective oversight structures that work effectively across related energy transition sectors, such as food, water, and transport.

2. Governments should shift public finance support measures and resources from fossil to clean energy.

- develop mechanisms to increase finance, including efforts to shift public financial support to SPC decarbonization activities, thereby crowding in domestic and international capital.

3. Governments should highlight the contribution that SPCs can make in climate change mitigation in their revised NDCs.

- incorporate targets, policies, and measures related to SPCs' contributions to the energy transition into their third-generation NDCs due in 2025.
- this could include the specific share of national emissions reductions targets that SPCs are responsible for, policy support mechanisms designed to help SPCs deliver on those commitments, and legal and regulatory frameworks for processes related to just transition.

[26] In balancing secure, affordable energy provision with decarbonization objectives, senior SPC staff should be given support to break from entrenched business models and deal with pressure from lobby groups. Evidence from our interviews indicates that the chance of acquiring green or climate finance increases significantly when potential lenders trust that the SPC leaders they interact with will honour commitments in a timely manner.

9.2 SPCs

The following recommended actions for SPCs may extend to include their respective boards, line ministries, or national oversight bodies. Most of these actions are interdependent and should happen in parallel, applying just transition principles throughout the process.

Collaboratively Develop SPC Plans for Energy Transition

1. SPC transition plans must be context specific, taking into account their financial position and opportunities, along with their role in the power system (e.g., generation-only vs whole value chain). SPCs must also assess the level of risk they can take on decarbonization, and plan how to minimize this through smart investment choices.
2. SPC plans must align with broader national activities, such as integrated resource planning, sectoral roadmaps, and climate action plans. Therefore, SPCs must have effective mechanisms to work with the relevant entities.
3. For grid integration of renewable energy, as evidenced with EVN, there should be strong coordination between the SPC and line ministries, regulatory bodies, and local implementation agents so that renewables development and grid upgrades are geographically matched. Plans should also consider grid modernization though software and automation.
4. For expansion of renewable energy, the plans should consider when private sector players can be effective partners for project development, and what complementary technologies like energy storage are needed in increase the security of supply from intermittent renewable energy sources. NTPC successfully worked with private sector to catalyze growth of utility-scale solar in India.
5. For early coal retirement, transition plans must deal with financing, and how to secure international assistance for SPCs in EMDEs. In the case of PLN's early coal retirement pilot, it seems the process will stall if without foreign assistance.
6. Transition plans should only include proven and cost-effective decarbonization technologies. CCUS is being explored by Eskom, PLN, and NTPC, but it does not have a proven track record globally as an affordable and technically reliable solution.

To do this planning in a fair and just way,

1. Planning must meaningfully include all relevant stakeholders from the outset.
2. Transition plans should deal with how the SPC can interact with regional actors, in cases where closure of coal plants in linked to broader economic diversification activities.
3. For energy security and the justice components, the timing and sequencing of events (including availability of funding) in the plan is critical. The Komati experience in South Africa reveals some of the negative consequences when this is neglected.

Seek Synergies in Structural Changes That Could Help Financial Position and Renewable Energy Ambitions

NTPC was able to aid its renewable energy expansion and debt by creating a dedicated renewable energy subsidiary and then selling of portion of these shares to external investors.

1. For some SPCs, improving core business operations and efficiency may be essential to deliver on energy transition, particularly to address debt and improve access to finance
2. Other SPCs should look into analogous structural changes and shareholding alternatives and evaluate if they will be effective in the local circumstances. They may require external technical assistance to design and assess such options.

Create a Strategically Situated JET Office Within the SPC

The Eskom JET Office example appears to be a model worth replicating, with adaptations to the specific SPC context. To function optimally, SPCs should consider

1. The office should be located in such a way that it does not have a conflict of interest with the fossil fuel generation divisions. Thus, it will likely be a core strategic function that then works directly with other departments, including generation.
2. It should be provided with sufficient human and financial resources to be effective. Reporting directly to a supportive CEO is one way to help get sufficient support.
3. The JET office can have a lead role in transition planning for the SPC, to ensure that the justice components are included from the outset.
4. For stakeholder engagement with workers and communities, the JET office should contract trained and trusted community engagement professionals, familiar with the local context at individual power stations and associated supply chains.

Complement International Climate Finance Opportunities With Local Solutions

The emissions intensity of the power sector means that national climate change commitments rely heavily on SPCs in EMDEs, where they often provide a high percentage of the national electricity supply. Therefore, power utilities are a priority for climate financiers, and, where appropriate, SPCs can promote alignment of domestic and international processes and prioritizations.

1. Early coal plant retirement can attract foreign climate finance in EMDEs. Conversely, in South Africa, the plans to extend the life of coal plants threatens the JETP and associated funding initiatives.
2. Ramping up the rate of renewable energy expansion, and its integration to the grid, can also be a hook for green finance. Given the delays with the JETPs, this could be done on a bilateral basis.
3. While there is a clear need for climate finance for SPC energy transition in EMDEs, as the early retirement of coal experience of PLN shows, SPCs should not only rely on these avenues. SPCs should also seek complementary finance sources, such as redirected fossil fuel subsidies (direct and indirect), carbon taxes, or private sector investment.

Improve Data Transparency and Access to SPC Energy Transition Information

Access to data around SPC transition activities (e.g., coal plant closure) can facilitate evidence-based decision making, speed up negotiations, and attract a wider set of potential funders.

1. A JET office can monitor that the required information is available for free, in an appropriate language, and at a level that workers and communities can engage with.
2. Regular site visits and media briefings should be allowed.
3. An online dashboard tracking the progress on SPC transition activities, co-administered by an independent body, could help combat false or distorted narratives that have been linked to coal plant closure, retrofitting, or repurposing.

9.3 International Community

Work With SPCs to Design Practical Financial Assistance Mechanisms

Many of the interviewees for this study highlighted the requirement for foreign financial assistance for SPC energy transition activities. However, there is growing concern about whether the JETPs in South Africa, Indonesia, and Viet Nam will deliver adequately and over what time frame. There appears to be a long-standing gap in viable alternatives to the current financial approaches, and in the case of PLN, this has contributed to the stalling of early coal retirement projects.

1. International bodies, such as MDBs and intergovernmental organizations should partner with SPC finance teams to look at new options to deliver fast disbursement of funds in return for demonstrable progress on decarbonization.
2. A stage-gate approach, where each tranche of support is dependent on meeting prior objectives, could be considered as part of the design.
3. Work toward increasing the total amount of international financial support for SPC energy transition efforts, and how to use this to catalyze international private finance, as a complement to domestic finance.

Help Share Lessons on SPC Experiences and Leadership on Energy Transition

1. There is a gap in basic comparable data on SPC ambitions and actions on decarbonization. The closing of this gap by research groups would help SPCs—and governments and SOEs more broadly—identify leading firms and learn from their experiences.
2. International climate policy discussions should give SPCs attention, given their vital position within the global electricity sector. Their scale, emissions, and socio-economic significance in major emerging economies highlight the need for a more detailed analysis of their operations and impacts.
3. International platforms should seek to elevate these experiences and better support the exchange of knowledge on challenges and opportunities between SPCs and line ministries in different countries that could facilitate increased climate ambition.

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