

---

# Decarbonisation in State-Owned Power Companies

---

Briefing from the workshop on 28–29 September 2022

---

Run Zhang-Class  
Philipp Godron  
Lixue Lin-Siedler

297/02-DO-2023/EN  
June 2023

## Acknowledgements

The completion of this briefing report was only possible thanks to the creative input of all the experts who participated in the workshop on 28–29 September 2022. The authors would like to express their sincere appreciation for the frank and constructive discussions.

Special thanks to Jesse Scott, Vincenzo Franza, Yagnyashri Kodaru, Nayeon Kang, Saerok Jeong, and colleagues at Agora Energiewende: Simon Müller, Yin Ming, Naila Saleh, Kwanghee Yeom,

Lidia Wojtal, Fabian Barrera, Emir Çolak, and particularly Kinita Shenoy, Alexandra Steinhardt, Kevin Tu and Markus Steigenberger, for their strong support for this project.

The authors are grateful for the review by the following experts, which greatly benefitted this briefing report: Alex Clark, Ernst Kuneman, Simon Müller, Monika Morawiecka, Lidia Wojtal, Tracy Ledger, Mike Levington, Philippe Benoit, Yin Ming, Sasanka Thilakasiri, Mareike Herrndorff, Federico Lopez, and especially Anders Hove.

Dear reader,

The power sector currently accounts for approximately one-third of the world's carbon emissions. Its rapid transition from fossil fuels to renewables is fundamental to fast-tracking deep emissions reduction across all sectors, as decarbonisation of heating, industry, and transport will primarily be accomplished through electrification.

In the power sector, although state-owned power companies (SPC) own the majority of fossil fuel assets in many of the world's top emitting countries, they also have advantages in investing in renewables and related infrastructure due to more accessible funds and resources. Consequently, engaging SPCs is crucial if we are to decarbonise the power sector and ultimately achieve net zero emissions. However, the nature of SPCs and their corresponding priorities have meant, to a certain extent, that they face more complicated decarbonisation challenges than the private sector, in terms of governance and change management, for example.

Against this background, Agora Energiewende organised a workshop on SPC decarbonisation on 28–29 September 2022. Under the Chatham House Rule, experts who have started tackling these challenges for significant emitters discussed pressing issues relating to SPC governance, financing, just transition, incentives, and tools for decarbonisation.

This briefing report aims to raise awareness of the importance of SPCs for climate advocacy and explore politically feasible solutions for accelerating SPC decarbonisation at the international level. It also highlights potential areas for further research and multilateral collaboration on this topic.

We hope you find the report helpful, and we welcome your feedback.

Sincerely,

Markus Steigenberger  
*Managing Director, Agora Energiewende*

## Key messages

1

**SPCs are crucial to the success of the global energy transition.** SPCs operate substantial fossil fuel assets in many of the world's top emitting countries, and also confront a wide range of critical socioeconomic issues.

2

**A detailed understanding of how SPCs operate and the coordinated support they need is a prerequisite for ensuring the role of SPCs as change agents.** The design of operating mandates, transition targets, and incentives depends on in-depth knowledge of decarbonisation drivers, the complex challenges SPCs face, and the local contexts within which SPCs operate.

3

**Political leadership is crucial for a rapid and smooth transition of SPCs.** To support SPCs in decarbonising, governments should ensure consistent policies and coordinate often conflicting requirements.

4

**International multilateral engagement can play a significant role in promoting SPC decarbonisation through knowledge exchange and financing.** Energy transition progress depends on partnering with SPCs rather than marginalising them. Sharing experience and lessons learned can minimise unnecessary detours and spark new ideas for decarbonisation efforts from all stakeholders.

# Content

---

<b>1</b>	<b>Introduction</b>	<b>5</b>
1.1	Landscape	6
1.2	SPC profiles	7
<b>2</b>	<b>Drivers of SPC decarbonisation</b>	<b>7</b>
2.1	Policy constraints/mandates	7
2.2	Financial market consensus and public awareness on decarbonisation	8
2.3	Profitability	9
<b>3</b>	<b>SPC dilemmas: common challenges</b>	<b>10</b>
3.1	Governance	10
3.2	Finance	11
3.3	Just transition	12
<b>4</b>	<b>Incentives and other tools</b>	<b>13</b>
4.1	A supportive ecosystem	13
4.2	Multisectoral and multilateral engagement	15
<b>5</b>	<b>The outlook for SPC decarbonisation</b>	<b>17</b>
<b>6</b>	<b>Conclusion</b>	<b>19</b>
	<b>References</b>	<b>21</b>

---

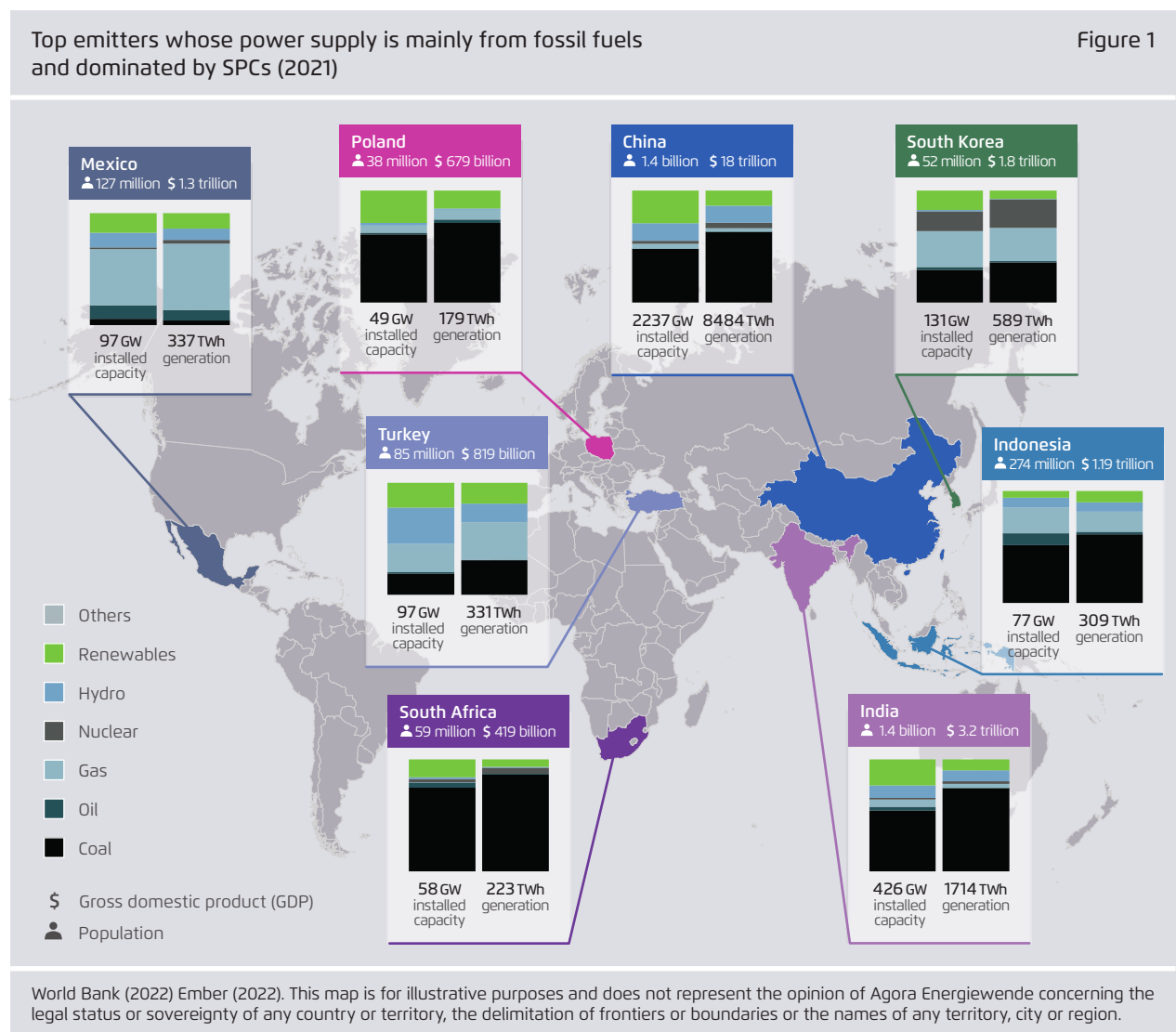
## 1 Introduction

State-owned enterprises (SOEs) play a vital role in politics and economic and social development in some developed countries and many emerging economies. They are also correspondingly significant contributors to emissions at the national and global levels, though the total volume remains to be calculated.<sup>1</sup>

There is no standard definition of a state-owned enterprise. This report takes SOE to mean a legal entity

established or nationalised by a national government with more than 50 percent shareholding to perform business activities on behalf of the government, potentially in competition with private companies and other SOEs.

SOEs, and more specifically in this report state-owned power companies (SPCs), whose core business is power generation and, in some cases, also power transmission and/or distribution, are a worldwide phenomenon.

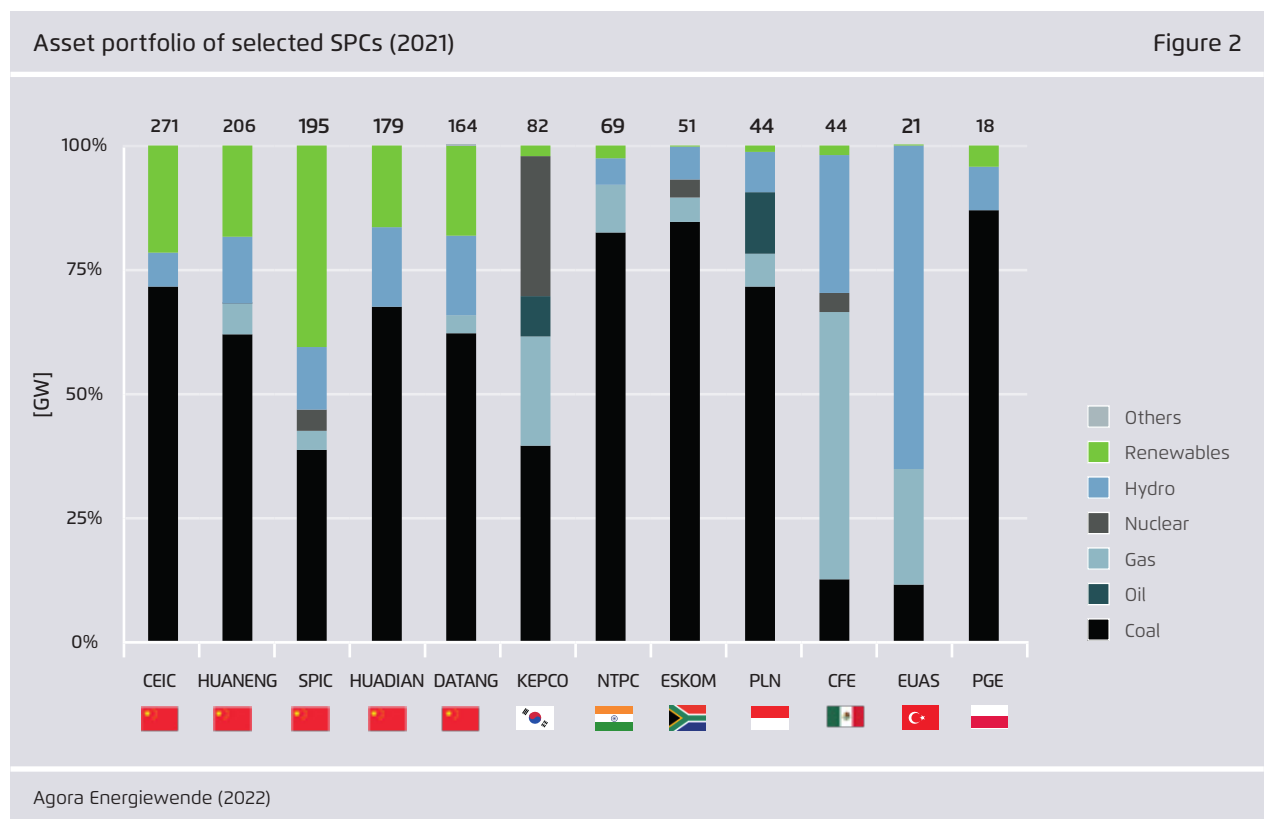


1 Clark & Benoit (2022)

### 1.1 Landscape

Of the world's top emitting countries, whose carbon dioxide (CO<sub>2</sub>) emissions each account for around one percent, or more than one percent of the global total,<sup>2</sup> at least eight have a fossil fuel-dependent power sector in which SPCs play a significant role in terms of power supply. The total emissions from these eight countries account for almost half of the global emissions from energy in 2021.<sup>3</sup>

For many of the selected cases, SPCs and their related industries such as coal production employ large numbers of people, with a corresponding impact on the local economy where they operate. In China, for example, the “Big Five” – the five largest-generating SPCs operating about half of China's fossil fuel generation assets – employed over 770 000 people in 2021.<sup>4</sup> In addition, around 2.6 million are employed in the upstream coal industry in China, though this is down from nearly 6.1 million in 2013.<sup>5</sup> This makes SPC decarbonisation not only a technical, financial, and governance issue, but also a social challenge.



2 Statista (2022)

3 BP (2022)

4 Agora unpublished dataset

5 China5e (2020) NBS (2013). The number of people not directly employed by SPCs/SOEs, i.e., those under different types of service contract, including migrant workers, is unknown due to data scarcity.

## 1.2 SPC profiles

In addition to their large employment base and role in national economies, SPCs usually have other characteristics in common despite their differing national circumstances. For instance, a high proportion of their generation capacity is in fossil fuel assets, their increased emissions from fossil fuel-powered generation require abatement, and their highest priority is ensuring reliable and low-cost energy supplies to businesses and residential customers.

Direct government control of SPCs can both hinder and help their contribution to accelerating their country's energy system transformation. On the one hand, political contestation and lack of consensus on climate policies can inhibit SPC decarbonisation. On the other, SPCs can respond quickly to direct policy changes, and their market dominance can enable them to rapidly adopt and scale up new technologies. The scale of SPCs gives them scope for rapidly shaping the new energy landscape.

## 2 Drivers of SPC decarbonisation

SPCs are often shielded from competitive pressures, as most are either monopolies or oligopolies within the national power sector, particularly those that own generation assets while also remaining deeply involved in transmission and/or distribution. To a large extent, monopolies or oligopolies suffer from performance inefficiencies and reluctance to change. However, decarbonisation seems to offer a different narrative. Due to the multiple priorities SPCs serve, SPCs are sensitive to both external pressure and internal motivation to decarbonise, which can also represent a window of opportunity for the long-standing call for broader SOE reform.

## 2.1 Policy constraints/mandates

Since 2020, the world's largest emitting countries have started to set net zero emission goals. Although in certain countries the private sector is particularly influential in lobbying fossil fuel industries, most states have a firm grip on national decarbonisation programmes through their direct control of SPCs. For example, in South Korea, whenever the government mandates a target, Korea Electric Power Corporation (KEPCO) – the country's largest utility, responsible for generating, transmitting, and distributing electricity – will automatically establish a hierarchical system to follow and carry out the mandate regardless of its financial cost. The government controls KEPCO's decarbonisation activities through its Annual Management Performance Evaluation Scheme. In China, a few months after the President's pledge that the country will peak its carbon emissions before 2030 and achieve carbon neutrality before 2060 ("30–60 targets"), several SPCs set their timelines for peaking carbon emissions, though the carbon neutrality timelines deserve more attention from a long-term planning perspective. The state-owned Assets Supervision and Administration Commission (SASAC) of the State Council, as the main shareholder for Chinese SOEs, has set as a goal that by 2023, all publicly listed (subsidiaries of) SOEs are to file an Environmental, Social and Governance (ESG) annual report; and the total installed renewable (including hydropower) generation capacity of national SOEs should increase from approximately 40 percent in 2020 to over 50 percent by 2025.

On the other hand, SPCs exert great influence on the market and relevant regulation, as their business models are strongly linked to vertically integrated supply chains. This includes centralised power generation assets, and often extends to mining, power transmission and distribution. For example, PLN, which controls over 72.5 percent of Indonesia's generation capacity, sets the national generation plan, which is the basis for Indonesia's power sector outlook for the next ten years. At the same time, re-

structuring of SPCs has been in progress or at least under discussion for some time in some countries in order to strengthen the role of the market and regulatory regime.

## 2.2 Financial market consensus and public awareness on decarbonisation

Public finance from South Korea, Japan, and China accounted for over 95 percent of total foreign financing of coal-fired power plants from 2013 to 2021.<sup>6</sup> In 2021, South Korea announced an immediate halt to state-backed overseas coal project financing, and this was followed by Japan, which vowed to end overseas coal financing by the end of the same year. China also pledged to stop financing new coal-power projects abroad, though ambiguity in the policy is yet to be clarified. Furthermore, 39 countries and institutions signed a declaration at COP26 to end new direct public support for the international unabated fossil fuel energy sector by the end of 2022.<sup>7</sup> The signatories make up a majority of shareholders of several Multilateral Development Banks (MDBs).

The transition away from fossil fuel project financing started earlier. For example, the Asian Development Bank (ADB) has not financed coal-fired power plants since 2013, though its policy officially allows it. In September 2021, ADB issued a revised energy policy document formally withdrawing from funding new coal-fired power and heating plants.<sup>8</sup>

Moreover, a growing number of top insurance companies, largely from the US and Europe, have stopped providing coverage for coal projects.<sup>9</sup> Major reinsurers, which reduce insurance risks by underwriting frontline insurers, have also withdrawn from providing coverage for coal projects.<sup>10</sup>

Meanwhile, greater public awareness of climate change and its impact has also affected fossil fuel projects in differing ways across the world. According to the Environmental Justice Atlas (EJAtlas), which collects stories of global communities struggling for environmental justice, there have been 714 reported fossil fuel and climate justice-related cases, of which 105 reached a successful conclusion for the climate, either when communities won court cases, reclaimed access to the community properties, or successfully got projects cancelled. These consequences – disruption, suspension, or cancellation of the controversial projects, or long-term policy change – exacerbate project risks for fossil fuel projects and help push financiers away from supporting similar projects in the future.

In addition, financiers and SPCs have faced increasing reputational risks as deaths and other public health impacts related to fossil fuel consumption receive more attention. Air pollution from combusting fossil fuels was responsible for about one in five deaths worldwide in 2018.<sup>11</sup> In 2022 in Poland alone,

---

6 Liu et al. (2021)

7 The 26th United Nations Climate Change Conference of the Parties (COP26) was held in Glasgow on 31 October–13 November 2021. The statement on international public support for the clean energy transition was signed on the occasion of the COP26 Climate Summit on 4 November 2021. UKCOP26 (2021)

8 ADB (2021)

9 Colman (2020)

10 Jessop & Cohn (2021)

11 Vohra et al. (2021)



30 people died in mining-related accidents.<sup>12</sup> According to Global Energy Monitor (GEM), at least 28 people have been killed in anti-coal conflicts over the last decade in India and Bangladesh. The corporate image of fossil fuel-dependent SPCs also affects their competitiveness in the talent and capital markets, which applies particularly to the listed subsidiaries of SPCs.

### 2.3 Profitability

In general, as in the private sector, SPCs have a business obligation to pursue profits. In countries like China, SPC profitability is a factor in determining the salaries and bonuses of employees and management. Even Comisión Federal de Electricidad (CFE) – Mexico's dominant power company, whose primary function inside the country is social benefit – has upgraded its corporate mission to be profit-based.<sup>13</sup>

Fossil fuel-dependent SPCs are exposed to fluctuations in fuel costs unless they own sufficient upstream assets like coal mines to hedge against the market prices for fossil fuels. China's Big Five SPCs have experienced ongoing annual losses in fossil fuel power generation, particularly for coal power, which has even eaten up the profits from other business divisions such as renewable generation, technical engineering services, or financial services.

The subsidies to China's Big Five generation SPCs account for 0.4 percent of their total revenue, equivalent to approximately one billion USD in 2020.<sup>14</sup> Although subsidies allow for lower-cost electricity to businesses and residential consumers, they are not sustainable revenue streams for the SPCs. Large

subsidies, particularly for fossil fuels or fossil power generation, disincentivise SPCs to transition. Moreover, state subsidies can be increasingly problematic given tight state budgets, cheaper alternatives, and other circumstances such as European Union's regulations and policies on competition. In the long term, against the background of national decarbonisation pledges, steady cost reduction and diversified revenue streams are essential to maintaining stable growth in SPC operating margins.

Meanwhile, renewable energy generation is increasingly competitive. The global weighted average levelised cost of electricity (LCOE) generation from newly commissioned utility-scale solar photovoltaic (PV), onshore and offshore wind projects has fallen by at least 88 percent, 68 percent, and 60 percent respectively since 2010.<sup>15</sup> This cost decline has become the turning point for the energy transition in many countries, where SPCs can be the largest investors in renewables and related infrastructure. For example, in Poland, Polska Grupa Energetyczna (PGE) – the country's largest power company – has historically been heavily coal-based due to abundant and cheap domestic coal supplies. But PGE is now losing money on its coal assets.<sup>16</sup> In addition to the rapidly growing costs of hard coal and carbon emission allowances, the continuing decline in renewable energy costs incentivises the company to maintain its status as Poland's biggest investor in offshore wind projects and to take further action toward achieving its goal of climate neutrality in 2050. Similarly, in countries like South Africa, where the SPC Eskom covers 90 percent of the country's energy supply via its generation, transmission, and distribution assets, there is an increasing sense by the civil society organisations (CSOs), the company

---

12 It includes copper mining fatality data. Wyższy Urząd Górniczy (2023)

13 SPC decarbonisation workshop discussion (2022)

14 Agora unpublished dataset

15 Taylor et al. (2022)

16 PGE (2022)

itself, and the government that the future is in transition, as the company has been on the verge of financial ruin due to insufficient investment in new generation capacity, a growing skills deficit, and other management issues.<sup>17</sup>

### 3 SPC dilemmas: common challenges

As indicated in Figure 1 and Figure 2, SPCs exist in countries with differing levels of economic development, and within different market mechanisms and energy structures based on differing national resource endowments. Nevertheless, SPCs share similarities in the face of the decarbonisation challenge, where conflicts of interest often arise from the fact that SPCs serve multiple objectives.

#### 3.1 Governance

The responsibility for energy policy is located in different ministries in the selected country cases, with different corresponding priorities. For example, in South Korea responsibility for energy is located in the Ministry of Trade, Industry and Energy, which is likely to mean that the role of energy is to facilitate economic development. In South Africa, energy governance is based in the Department of Mineral Resources and Energy, linking it directly to fossil fuels. In China, the situation is more complicated: after decades of departmental restructuring, energy governance is currently under the National Energy Administration, a subordinate body of the National Development and Reform Commission, the main economic planning agency. In many countries, climate-related work is based in the environment ministry, whose role is yet to be strengthened in the government decision-making of energy and economic policies. Ownership of SPCs in South Korea, South Africa, and China is located in the Ministry of

Strategy and Finance, Department of Public Enterprises, and SASAC, respectively. On the one hand, this multi-organisation governance model allows reciprocal monitoring across different departments; on the other hand, it often creates inefficiency in decarbonisation master planning due to diverging interests, insufficient coordination, and challenges for decision-making in SPCs, which have to respond to conflicting priorities.

The state's influence on SPCs is usually mediated not only through ownership but also through management. Although in some countries SOE corporatisation or reform has already been underway for years, the state still influences the day-to-day business of SPCs. For instance, the head of the National Thermal Power Corporation (NTPC) – India's largest power utility – is almost always a bureaucrat from the civil service. In China, the senior managers of SPCs are still nominated by SASAC, while they can be promoted directly into government ministries at the provincial or national level. In addition to staffing, state influence is also felt in planning and production, though SPCs can be more progressive than the government in some cases. Since salaries and bonuses are linked to profitability, SPCs in China have not been motivated either to add more coal power projects or to generate loss-making coal-fired power in recent years. However, they have been ordered to do so to meet one of China's top priorities – security of energy supply, particularly since the energy crunch in the autumn of 2021. At a critical period, these orders caused safety issues and even casualties – for example, accidents resulting from the waiving of maintenance requirements.<sup>18</sup>

While dealing with the state acting as the manager, SPCs often face issues with inconsistent policies. Governments are currently backtracking on the energy transition in countries like Mexico and South Korea. In November 2022, Mexico's new

---

17 Daily Investor (2022) Brederode (2023)

18 Chen et al. (2021)

government updated its nationally determined contribution (NDC) with a higher emissions level than the targets from 2016, and its recent policies and amendment proposals on legal provisions tend to support fossil fuels.<sup>19</sup> In South Korea, the new administration indicated, by 2030, renewable energy's share in the country's energy mix would be "realistically adjusted to below 30 percent" while promoting pro-nuclear policies, even though recent research recommends a more ambitious target of 50 percent renewables by 2035.<sup>20</sup> In a one-party system like China's, there should be fewer problems related to policy consistency. Nevertheless, policy and market signals sometimes contradict each other.<sup>21</sup>

Inconsistencies also emerge in management appointments. Due to the lack of a decarbonisation roadmap at either the national level or SPC level in most of the selected case countries, the progress of decarbonisation in SPCs is mainly up to the company's leadership. Eskom, for the first time, had a CEO who saw the urgency of the energy transition in South Africa,<sup>22</sup> and the current General Manager of EÜAŞ – Turkey's largest power company, which owns approximately one-fifth of the country's generating capacity – is keen on new technologies to enable decarbonisation. However, if there is no science-based mechanism or pathway set up for an SPC, then its decarbonisation goals, strategies, and implementation will be left mainly at the discretion of the leadership. In such cases, any leadership change will put decarbonisation policy or investment programmes at risk.

### 3.2 Finance

Unlike in the private sector, SPCs pursue several objectives, including but not limited to national energy security, the public interest, and profitability, which often conflict with one another in the current business environment. The financial consequences include high receivables, high debt ratios, low return on assets, or non-performing assets, although not all SPCs share these problems.

On top of the above issues, decarbonisation further increases the short-term operational challenges for SPCs. The experience of companies now at the forefront of low-carbon development that has proved the cost-competitiveness of investing in sustainability shows the importance of successful communication around the economic value of sustainability.

Short-term decarbonisation challenges often result from unfavourable market conditions, such as the absence of a level playing field for renewables and insufficient flexible generation to balance the grid. These factors make it difficult for many countries to accelerate investment in renewables. This brings about a vicious circle for SPCs: under pressure from the increasing demand for power and the need to secure energy supply, most likely accompanied by government demand for economic growth, SPCs often operate fossil fuel assets at a financial loss, while continuing to invest in conventional projects with high operating costs but where they still possess the necessary technical and operational know-how.

Meanwhile, to respond to the decarbonisation requirements, SPCs have expended significant efforts on research, development, and application for

---

19 Climate Action Tracker (2022)

20 Lee & Kim (2022) Park et al. (to be published)

21 Hove et al. (2021)

22 Eskom's former CEO, Andre De Ruyter, resigned shortly after Minerals and Energy Minister Gwede Mantashe criticized Eskom's management, saying, "Eskom, by not attending to load-shedding, is actively agitating for the overthrow of the state." De Ruyter's term ended in February 2023. Stark (2023)

advanced coal-based low-carbon technologies as an alternative solution; these include supercritical (SC) and ultra-supercritical (USC) power plants,<sup>23</sup> and planning carbon capture, utilisation, and storage (CCUS). However, partly due to the absence of proper carbon pricing, the economics of some technologies remain disputed.<sup>24</sup>

SPCs have also invested heavily in renewables.

However, the development of renewables in some countries has run into new problems. For example, China's rapid expansion of renewable capacity was, to a large extent, due to the feed-in tariff (FiT) policy. SPCs were at the forefront of renewables installation. The installed capacity of wind and solar of China's Big Five generation SPCs amounted to at least 220 GW by 2021, almost six times that in 2011.<sup>25</sup> However, by 2021, China's total renewable FiT payment arrears were up to about 400 billion yuan (approximately 63 billion USD), and the settlement process only started in 2021.<sup>26</sup>

In addition to FiT payments, electricity bill payments also represent a crucial revenue stream for SPCs, and delays impact the company's cash flow. Non-payment drives up already high debt ratios, raises borrowing costs, and negatively affects investments in renewables and supporting infrastructure. Eskom's revenue collections have been challenged by residents, due to frequent service interruptions and unaffordability for low-income households, among other problems. Coupled with internal issues such as

corruption, Eskom is facing an unprecedented financial crisis.<sup>27</sup>

In the face of such high receivables, Eskom has threatened residents with further power cuts, which contradicts its clear mandate to provide sustainable and affordable electricity.<sup>28</sup>

### 3.3 Just transition

Electricity access and affordability are widespread issues. Roughly 770 million people, or about 10 percent of the world's population, live without access to electricity, mostly in Asia and Africa.<sup>29</sup> Unaffordable electricity prices in less developed regions can trap countries in a vicious circle of low productivity and lack of industrial competitiveness.

In such circumstances, SPCs face the dilemma of serving society and making a profit at the same time. One study showed that South Africa's utilities had a quasi-fiscal deficit of over 11 billion USD, accounting for 3.4 percent of the country's GDP. Four percent of the hidden costs – components of the quasi-fiscal deficit – came from bill collection losses, and 81 percent from under-pricing.<sup>30</sup> Although organisations such as the World Bank have researched and proposed measures to solve the dilemma of power affordability and financial viability for utilities, in countries such as South Africa, the situation is deteriorating. In terms of electricity access, the proportion of the global population without access to

---

23 Benoit & Clark (2020)

24 Thanganadar et al. (2021) AssessCCUS (n.d.)

25 Agora unpublished dataset (2022)  
Black Hawk Solar (2022)

26 Zhao (2022)

27 Daily Investor (2022)

28 South Africa's Constitutional Court ruled Eskom cannot throttle bulk electricity supply to defaulting municipalities. Cronje (2022)

29 IEA (n.d.)

30 "Quasi-fiscal deficit is the difference between the net revenue of an efficient electricity sector covering operational and capital costs and the net cash collected by the utilities." Kojima & Trimble (2016)

electricity in sub-Saharan Africa rose to 77 percent from 74 percent before the COVID pandemic.<sup>31</sup> The financial status of most fossil fuel-dependent SPCs that do not own any assets in upstream industries such as coal mines is also under increased pressure due to the impact of the COVID pandemic and the ongoing global energy crisis.

SPCs' social mandates extend to employment, where the drive for decarbonisation brings additional challenges.

The IEA's *Roadmap to Net Zero by 2050* indicates that the global energy transition will result in a generally net positive creation of employment. However, the impact on regions, communities and individuals is uneven.<sup>32</sup> The renewable energy sector has created 12.7 million jobs up to 2021, including indirect employment, but two-thirds of these jobs are in Asia, and China alone accounts for 42 percent of the global total.<sup>33</sup> Given their manufacturing capacity and well-established renewable sector-related supply chain, Asian countries, particularly China, may be in a more advantageous position for coping with job losses in fossil fuel-based sectors, assuming they have reliable retraining and repurposing systems. In China, some SPCs cover a broad spectrum of businesses, such as real estate and retail, which can counteract the risk of job losses to a certain extent. This may not apply to all regions in China or other countries: for example, in the South African coal belt province of Mpumalanga, ten entire towns depend on coal mining. When the mines closed, the economy of the towns is deemed to collapse.<sup>34</sup> Such cases of high local economic exposure to fossil fuel industries are common, even in some developed countries, such as the US and Germany.

In addition to its impact on employment in the regions where coal mines and coal-fired power plants are located, the clean energy transition also affects industries along the whole supply chain, such as manufacturing, construction, and coal freight.

Another issue is that the industries mentioned above often rely heavily on temporary workers, which are not necessarily reflected in the employment statistics. Temporary workers are usually from low-income groups, and are typically uninsured and lack rights to unemployment compensation.

## 4 Incentives and other tools

Incentives for decarbonising SPCs have taken the form of both sticks and carrots. Sticks – such as external pressure from government, the financial sector, and civil society – have had demonstrable positive effects on SPCs in some countries' decarbonisation programmes. Carrots – including benefits from a transition-friendly ecosystem, cross-sector synergies, and multilateral collaboration – will be equally important in sustaining the transition.

### 4.1 A supportive ecosystem

Although profitability is typically not the highest priority for SPCs in driving corporate behaviour, the possibility of increasing the operating margin, or at least cash flow, is still widely perceived as a key performance indicator (KPI), and this is unlikely to change under decarbonisation. Thus, it is crucial that SPCs shape and implement a sustainable development strategy based on their strengths and weaknesses. For example, it is relatively easy for SPCs to access

---

31 IEA (n.d.)

32 Cozzi (2021)

33 Renner et al. (2022)

34 Mantashe (2022)

financing and resources such as land to deploy capital-intensive and large-scale renewable projects. By prioritising their social mandate, however, SPCs may earn lower electricity revenues, which will impact their cash flow and financing capacity.

To strengthen SPCs' weaknesses, such as revenue generation, favourable market conditions may need to be enhanced. For example, South Korea launched its Emissions Trading Scheme (ETS) in 2015 and entered its third operation phase in 2021. Due to the high proportion of free allocations (currently up to 90 percent) and its poor coordination with the power market, South Korea's ETS has had little effect on decarbonisation and KEPCO's green growth.<sup>35</sup>

In addition to customised national market mechanisms, financial instruments can act as effective stimuli for SPC decarbonisation. Here are two examples:

→ Pension funds: An ageing society is a phenomenon common to most advanced economies and also to some developing countries. Pressure on pensions has become a widespread concern, along with inflation caused by a combination of the COVID pandemic and the recent energy crisis. Thus it makes sense to increase the scale of investment and improve investment returns. The state, and in some cases companies, as pension providers, have the option to make pensions climate friendly. In Japan, public pension funds are managed by the Government Pension Investment Fund (GPIF). Since Japan signed the Principles for Responsible Investment (PRI) in 2015, ESG factors have been integrated into the investment strategy of GPIFs to improve corporate ESG disclosure and thereby stabilise long-term corporate value and investment returns.<sup>36</sup>

→ Transition bonds: These may be useful in countries with limited fiscal space and provide SPCs with an alternative source of funding for new or existing transition projects when the projects or the financing are not classified as "green". For instance, SPCs may issue transition bonds to pay for retrofitting coal-fired power plants with biomass co-combustion. It is important that the transition bonds incentivise "brown" companies to take the first transition step. However, this may encourage companies to sink more capital into carbon-intensive projects and reduce potential financing opportunities for zero-carbon ones. Furthermore, just as green bonds can lead to "greenwashing", transition bonds also face the possible accusation of "transition-washing".<sup>37</sup> Science-based guidelines for transition finance are therefore essential to avoid the unnecessary lock-in of inefficient decarbonisation assets, and effective regulation is crucial to ensure that transition bonds serve their purpose.

In addition to creating feasible mechanisms and tools, in order to establish and sustain a healthy ecosystem to motivate low-carbon development, the government must eliminate obstacles such as corruption related to project permitting, project outsourcing, asset mergers and acquisitions, transfers of interest, and so on.

---

35 Kuneman et al. (2021)

37 Quinson (2021)

36 Song (2022)

Table 1: Corruption Perception Index (CPI, 2022)

Country*	CPI (total 100)	Rank (total 180)	Fossil fuel-fired power generation
China	45	65	66%
South Africa	43	72	87%
Vietnam	42	77	64%
India	40	85	78%
Turkey	36	101	65%
Indonesia	34	110	82%
Mexico	31	126	73%
Pakistan	27	140	60%

Transparency International (2022). Lower CPI means a higher level of corruption. Our World in Data (n.d.)

\* Vietnam and Pakistan were also discussed at the workshop

Despite the active fight against corruption within Eskom, particularly in terms of alleviating the company's debt load, the company's decline is still evident.<sup>38</sup> Institutionalised corruption has been one of the main reasons for this, a result of a combination of a lack of individual motivation and vulnerabilities in the energy sector's institutional structure – problems that likely require changes beyond the corporate level.

According to the Corruption Perception Index, many countries where fossil fuel-dependent SPCs dominate may be in an even worse situation than South Africa.

A proven anti-corruption regime can help attract more financing sources both domestically and internationally and ensure the effective use of climate funding. Furthermore, a less corrupt and more rule-based market can also help regain the confidence of investors.

## 4.2 Multisectoral and multilateral engagement

In addition to financing, resources such as land, access to end users, and data will play a critical role in ramping up the low-carbon development of SPCs. These resources can be concentrated in sectors that do not necessarily collaborate. Counteracting sector fragmentation can benefit multiple industries, in terms of both decarbonisation and growth.

Oil and gas companies are also facing pressure to decarbonise. Compared with their peers in the power sector, which have gained expertise in renewable technology development and deployment, oil and gas companies' main strengths are in managing the development rights of land and sea areas, as well as in driving cash flow from these assets. Oil and gas fields can be used for both utility-scale and distributed renewable projects, and the exploration and development of these fields require huge energy inputs, which are usually supplied by fossil fuels and can be upgraded to renewable generation. Oil and gas companies' favourable cash flows can also mitigate the debt issue faced by some SPCs seeking project co-financing, particularly those with a debt ratio above 70 percent. Furthermore, their extensive national networks of gas stations should not be overlooked, as they offer access points for distributed renewable energy development and demand-side management (DSM) with electric vehicle charging, storage, and energy management system deployed.<sup>39</sup> Climate advocates might prefer alternatives, such as a total and rapid phase-out of oil and gas production, rather than retrofitting the fields with renewable electricity, but investment in existing and new oil and gas projects is still necessary even in rapid clean energy

38 Stark (2023) Kessides (2020)

39 Trinasolar (2021)

transitions.<sup>40</sup> Therefore, it is reasonable to engage the oil and gas sector in SPCs' energy transition while decarbonising their operations.

In the booming digital economy, data has become the new oil. Digital assets are thus crucial for economic competitiveness, and it is important for SPCs to have a digital mindset to realise innovative development. Meanwhile, tech giants dominate the market for many data service sector offerings and business models. By collaborating with the technology sector, SPCs could fast-track their digitalisation process, ultimately generating new business growth opportunities and benefiting their clients and other key players in the energy sector.

In addition to multisectoral interaction, effective multilateral engagement, both domestic and international, is expected to considerably speed up SPC decarbonisation.

At COP26, various philanthropies and non-governmental organisations introduced the Coal Asset Transition Accelerator (CATA). This collaborative initiative aims to create an independent platform which can empower all key actors in the coal just transition worldwide by enabling governments, power companies, the financial sector and CSOs to request and implement the latest resources and best practices.<sup>41</sup>

Based on a country-level transition readiness assessment from the energy system, policy, socioeconomic, market, and financial perspectives, CATA shares its expertise via data analysis, publications, and a technical assistance facility. CATA also enables stakeholder exchange via its Knowledge Hub,

helping identify high-impact opportunities and crucial challenges to address in target countries and providing technical support to key stakeholders for expediting the transition and developing pilot coal transition mechanisms.

In terms of multilateral efforts, MDBs have supported SOEs for decades by providing financial and technical support for engagement, reform, and clean energy transition projects. 2021 saw a record 82 billion USD from joint MDB climate financing, with 62 percent of this sum dedicated to addressing climate change mitigation and adaptation in low- and middle-income countries. The World Bank contribution represents 55 percent of the total funding to low- and middle-income nations,<sup>42</sup> where SOEs often have a dominant role in the economy. This financing is notable given concerns about SOE efficiency and ESG compliance that the World Bank and other MDBs have repeatedly expressed. Pressure from MDBs can motivate SOEs towards compliance with MDBs' financing principles and with other codes of conduct used in international markets.

Partnerships between countries can also support the SPC transition. In 2021, France, Germany, the UK, the US and the EU launched a ground-breaking International Just Energy Transition Partnership (IJETP) with South Africa, aiming to accelerate the decarbonisation of South Africa's economy, with a focus on its power system. The fund has an initial commitment of 8.5 billion USD for the first phase of financing through various mechanisms, including grants, concessional loans, investments, and risk-sharing instruments.<sup>43</sup> The South African government has shown that it is determined to manage

---

40 IEA (2020)

41 CATA (2021)

42 AfDB et al. (2022). The transparency of MDBs' climate finance accounting is questionable. For instance, Oxfam audited the World Bank's reported \$17.2 billion climate

finance FY2020 portfolio to discover possible deviations of up to \$7 billion. Farr et al. (2022)

43 Risk-sharing instruments are designed for projects that, by nature, are riskier and harder to assess than traditional investments and, therefore, often face difficulties accessing finance.



Eskom's debt, which will hopefully enable investment in long-needed renewable and grid capacity.<sup>44</sup> A new JETP was announced at the G20 Summit 2022 to fast-track Indonesia's clean energy transition, with an endowment of 20 billion USD.<sup>45</sup> A month later, another JETP was announced to mobilise an initial 15.5 billion USD over the next three to five years to support the green transition in Vietnam.<sup>46</sup> In addition to financing from the public and private sectors, the donor community will support relevant policy reforms and efforts to improve local framework conditions, which can directly affect SPCs' investment and operations and mitigate the impact decarbonisation might have on the local economy.

## 5 The outlook for SPC decarbonisation

In the selected country cases (Figure 1 and Figure 2), a few SPCs have made net zero commitments, while many have not. The government's climate pledge is

Country	Net zero pledge	SPC	Net zero pledge
S. Korea	By 2050	KEPCO	By 2050
China	Before 2060	Big Five gencos	–
India	By 2070	NTPC	–
Indonesia	By 2060	PLN	By 2060
Turkey	By 2053	EÜAŞ	–
Poland	EU target by 2050	PGE	By 2050
S. Africa	By 2050	Eskom	–
Mexico	–	CFE	–

Agora unpublished dataset (2022)

often the benchmark for SPCs. To promote decarbonisation at SPCs, it is crucial for the climate community to pressure the government to set more progressive and concrete science-based goals.

As the cases of Mexico and South Korea illustrate, backward steps are sometimes prompted by a change of government that discourage SPCs to decarbonise. Climate legislation to bolster decarbonisation policy in the face of political swings can be an important step for two-party or multi-party states. Stakeholders in Mexico had long called for such legislation, with some success prior to the change to an administration more hostile to decarbonisation in 2018. On the other hand, in autocracies or electoral autocracies, climate targets and measures taken with insufficient public consultation or discussion may also negatively impact SPCs, particularly measures which are ambiguous and open to interpretation.

Long-term decarbonisation requires political will and public consensus. However, sometimes political will is only sufficient for high-level statements, and countries lack the critical foundation of targets and implementation strategies. Stakeholders should coordinate decarbonisation plans to present to the government and consider the following aspects at a minimum concerning decarbonisation and growth while SPCs pursue their multiple mandates.

→ **Increase SPC investment in renewables, including distributed energy:** Compared with the private sector, where small and medium-sized enterprises face greater financing challenges, SPCs tend to have an advantage in capital-intensive or large-scale project investment. From the perspective of broader socioeconomic outcomes, it is also easier for SPCs to soak up the unemployment resulting from the closure of coal mines

44 European Commission (2021)

45 WRI (2022)

46 BMZ (2022)

or coal-fired power plants and sustain local economies via large new projects. However, it may be preferable to shift some resources to smaller projects such as distributed renewables or island systems. In Mexico, CFE created an entire division to analyse possible partnerships with the private sector and non-profit organisations to carry out small projects, for example, small hydropower, small nuclear power, and floating solar PV. China's Big Five generation SPCs have vigorously developed distributed solar PV. Compared with utility-scale renewable projects, distributed renewables can be more flexible, suitable for more application scenarios, and have more potential for sector coupling. On the other hand, distributed generation can be less cost-effective due to economies of scale, particularly in locations with grid integration costs; application scenarios should take these variables into consideration.

→ **Incorporate plans to deal with secondary economic impacts of decarbonisation:** Decarbonisation of SPCs isn't confined to their business operations alone. Their fossil fuel-dependent business is a significant revenue stream for other actors and sectors in the supply chain. It also heavily contributes to the social and economic standing of the areas where the main facilities are located. For example, NTPC's coal transition will impact Coal India, whose operations account for 40 percent of India's rail company revenue. Coal India is also one of the largest social providers for schools, hospitals, and so on, and the states are dependent on the local economy built by Coal India. In Poland, PGE's Belchatow lignite complex employs over 13 percent of the Belchatow residents across the two opencast lignite mines and the largest operational coal power plants in the EU (by capacity, as of 2021), which has benefitted the local economy and nearby municipalities for

over three decades.<sup>47</sup> SPCs should seek to design their clean energy transition pathways and technical details in a way that minimises the socioeconomic impact and may even create benefits for local communities exposed to connected industries along the entire value chain.

→ **Form alliances to alleviate technology and business risk:** Countries often obligate SPCs to be the first movers in the power sector decarbonisation process. In addition to their favourable financing and state resources such as land, this inherent first-mover advantage can make SPCs, especially those in a medium- and high-competition market, a clean energy market leader in the fields of technology and business model research and development, industry standard setting, premium contracts in the supply chain and employment. Their established brand recognition and customer loyalty can also help SPCs extend their business in other relevant sectors for strategic growth. On the other hand, first movers have disadvantages, such as bearing the costs of educating market participants, their lack of experience, and the possibility of remaining entrenched in outdated businesses and technologies, such as those connected to their existing asset base. Late movers may be better able to adopt newer and more efficient processes and technologies. To mitigate these disadvantages, SPCs can form alliances, between SPCs as the first movers in the power sector and other industries. Ideally, alliances should also include SPCs operating in countries with different ideologies or experiences.<sup>48</sup>

Regarding experience and lessons learned, in addition to the first-mover alliances as an example, domestic and international exchange between SPCs

---

47 Aminoff et al. (2022)

48 World Economic Forum (n.d.)

and with CSOs can play a significant role, whether via CATA or other multilateral dialogue platforms.

Beneficial international influence can also be gained via climate policy and trade. Because of the substantial rise in Europe's carbon price since late 2020, Polish industry is calling for more investment in renewables, given that high carbon footprints and corresponding costs can weaken the competitiveness of its products in the international market. Turkey, South Africa, and other export-oriented non-EU countries are facing the same risks as the EU will launch the carbon border adjustment mechanism (CBAM) on 1 October 2023 with a three-year transition period.<sup>49</sup>

## 6 Conclusion

The total greenhouse gas (GHG) emissions inventory of SPCs worldwide remains unclear due to data scarcity, notwithstanding some preliminary estimates.<sup>50</sup> Nevertheless, the monopoly or oligopoly status of SPCs in those countries with the largest emissions indicates SPCs are responsible for a substantial share of world GHG emissions. SPCs' strengths – including an integrated understanding of energy and power, experience in large-scale project planning and execution, and access to low-cost finance – can be harnessed to accelerate the low-carbon transition. SPCs are therefore key to the success or failure of global decarbonisation.

In terms of SPC decarbonisation, it is critical to first address the inertia of the current growth path, which results from the size and traditional dependence of most SPCs on large-scale fossil power generation. These factors create both bias and path dependency.

Meanwhile, external challenges have added uncertainty to SPCs' clean energy transition, with mixed

signals from different parts of government pursuing different interests when influencing strategic decisions of SPCs. Such interests include preserving state assets, profit-making, fulfilling social responsibilities, and most importantly securing energy supplies. Improving the balance among SPCs' various policy and economic priorities should be on the agenda for future stakeholder discussions. To balance multiple priorities during the transition, SPCs need clear and consistent political guidance, incentives, and support for their decarbonisation programmes.

In addition to domestic policies and incentives for SPC decarbonisation, international engagement is vital. In the past, financiers and other international stakeholders have focused on market liberalisation, in the hopes of marginalising SPCs and thereby counteracting their conservative focus on fossil fuels. However, many countries have not prioritised market liberalisation, and elsewhere market reforms are potentially in retreat. The speed and success of decarbonisation will depend on partnering with SPCs rather than on marginalising them.

Engaging with SPCs is critical to understanding both the drivers and challenges of SPC decarbonisation, as well as to understanding the wider national context. International stakeholders, including researchers, think tanks and activists, will need to work out the most effective approaches for addressing SPCs' concerns and challenges – which SPC officials are naturally cautious about revealing. In this regard, knowledge sharing is crucial, especially among CSOs, in order to generate insights for discussion and policy advice.

Sharing experience and lessons learned with the wider stakeholder community, particularly among SOEs and policymakers, is equally important. Multilateral collaborating platforms for such purposes are

---

49 Magacho et al. (2022) European Parliament (2022)

50 Clark & Benoit (2022)

emerging, and they are expected to counteract sectoral fragmentation and achieve resource integration among SPCs and with other sectors for decarbonisation. Collaboration platforms and knowledge hubs are ideal vehicles for the design and development of incentives and policies to encourage SPC decarbonisation. As a part of this effort, policymakers and financiers should support a comprehensive range of qualitative and quantitative studies on the effectiveness of incentives and policies for SPC decarbonisation.

## References

- African Development Bank Group et al. (AfDB et al., 2022):** 2021 Joint report on multilateral development banks' climate finance. October 2022  
[https://www.eib.org/attachments/lucalli/mdbs\\_joint\\_report\\_2021\\_en.pdf](https://www.eib.org/attachments/lucalli/mdbs_joint_report_2021_en.pdf)
- Aminoff, F., Champion, E., Sanghera, S., Jean-Michel, C., Bhashyam, A., Vasdev, A., Toora, A., Gawlikowska-Fyk, A., Pandera, J. M. & Dusilo, M. (2022):** Energy in Belchatow After Lignite – Future-proofing energy generation in Belchatow, Poland. 20 October 2022  
[https://assets.bbhub.io/professional/sites/24/BNEF-Energy-in-Belchatow-After-Lignite\\_FINAL\\_English.pdf](https://assets.bbhub.io/professional/sites/24/BNEF-Energy-in-Belchatow-After-Lignite_FINAL_English.pdf)
- Asian Development Bank (ADB, 2021):** Energy Policy – Supporting Low-Carbon Transition in Asia and the Pacific. September 2021  
<https://www.adb.org/sites/default/files/institutional-document/737086/energy-policy-r-paper.pdf>
- AssessCCUS (n.d.):** Techno-Economic and Life Cycle Assessment for Carbon Capture, Utilization, and Storage. (Accessed 4 February 2023)  
<https://assessccus.globalco2initiative.org/ccus-overview/>
- Benoit, P. & Clark, A. (2020):** Engaging State-Owned Enterprises in Climate Action: Workshop Report. 9 November 2020  
<https://www.energypolicy.columbia.edu/publications/engaging-state-owned-enterprises-climate-action>
- Black Hawk Solar (2022):** 五大四小发电集团十年全方位PK (Key indicator comparison of "Big Five" and "Small Four" in ten years) 2 March 2022  
<https://www.jiemian.com/article/7161797.html>
- Brederode, W. (2023):** Former chairman reveals reasons for Eskom's decline. 2 March 2023  
<https://dailyinvestor.com/south-africa/10238/former-eskom-chairman-reveals-real-reasons-for-load-shedding/>
- BP (2022):** bp Statistical Review of World Energy 2022. June 2022  
<https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2022-full-report.pdf>
- Chen, X., Zhao, X., Bai, Y. & Luo, G. (2021):** 电荒何解 (How to solve the power shortage) 11 October 2021  
<https://weekly.caixin.com/2021-10-08/101784198.html>
- China5e (2020):** 煤电和煤炭转型的就业影响 (Employment Impacts of Coal Power and Coal Transition) 9 August 2020  
<http://www.zgmt.com.cn/news/item.do?id=f4f23bded9274192a20c988bebbcc6ce>
- Clark, A. & Benoit, P. (2022):** Greenhouse Gas Emissions from State-Owned Enterprises: A Preliminary Inventory. 3 February 2022  
<https://www.energypolicy.columbia.edu/publications/greenhouse-gas-emissions-state-owned-enterprises-preliminary-inventory/>
- Climate Action Tracker (2022):** Mexico Country Summary. (Accessed 1 February 2023)  
<https://climateactiontracker.org/countries/mexico/>
- Coal Asset Transition Accelerator (CATA, 2021):** Opening a dialogue on the global power sector transition. October 2021  
<https://europeanclimate.org/wp-content/uploads/2021/11/cata-inception-phase-overview-cop26.pdf>

**Colman, Z. (2020):** Climate groups turn up the heat on big banks, insurers. 13 January 2020  
<https://www.politico.com/news/2020/01/13/climate-groups-protest-098251>

**Cozze, L. & Motherway, B. (2021):** The importance of focusing on jobs and fairness in clean energy transitions. 6 July 2021  
<https://www.iea.org/commentaries/the-importance-of-focusing-on-jobs-and-fairness-in-clean-energy-transitions>

**Cronje, J. (2022):** ConCourt rules Eskom cannot throttle power to two serial defaulting municipalities. 23 December 2022  
<https://www.news24.com/fin24/economy/con-court-rules-eskom-cannot-throttle-power-to-two-serial-defaulting-municipalities-20221223>

**Daily Investor (2022):** Eskom's financial crisis – these graphs show how deep the troubles go. 21 October 2022  
<https://businesstech.co.za/news/finance/636793/eskoms-financial-crisis-these-graphs-show-how-deep-the-troubles-go/>

**European Parliament (2022):** Carbon border adjustment mechanism as part of the European green deal. (Accessed 9 February 2023)  
<https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-carbon-border-adjustment-mechanism>

**European Commission (2021):** France, Germany, UK, US and EU launch ground-breaking International Just Energy Transition Partnership with South Africa. 2 November 2021  
[https://ec.europa.eu/commission/presscorner/detail/en/IP\\_21\\_5768](https://ec.europa.eu/commission/presscorner/detail/en/IP_21_5768)

**Federal Ministry for Economic Cooperation and Development (BMZ, 2022):** Just Energy Transition Partnership (JETP) with Viet Nam. 14 December 2022  
<https://www.bmz.de/en/news/press-releases/just-energy-transition-partnership-jetp-with-vietnam-135514>

**Global Atlas of Environmental Justice (EJAtlas)** (Accessed 31 January 2023)  
<https://ejatlas.org/>

**Global Energy Monitor (GEM):** Fatalities at anti-coal protests. (Page last edited on April 30, 2021, assessed 2 November 2022)  
[https://www.gem.wiki/Fatalities\\_at\\_anti-coal\\_protests](https://www.gem.wiki/Fatalities_at_anti-coal_protests)

**Hove, A., Meidan, M. & Andrews-Speed, P. (2021):** Software versus hardware: how China's institutional setting helps and hinders the clean energy transition. 10 December 2021  
<https://www.oxfordenergy.org/publications/software-versus-hardware-how-chinas-institutional-setting-helps-and-hinders-the-clean-energy-transition/>

**IEA (n.d.):** Access to electricity (Accessed 13 November 2022)  
<https://www.iea.org/reports/sdg7-data-and-projections/access-to-electricity>

**IEA (2020):** The Oil and Gas Industry in Energy Transitions. January 2020.  
<https://www.iea.org/reports/the-oil-and-gas-in-industry-in-energy-transitions>

**International Transparency (2023):** 2022 Corruption Perceptions Index (Accessed 16 March 2023)  
<https://www.transparency.org/en/cpi/2022>

**Jessop, S. & Cohn, C. (2021):** Reinsurers look at dumping coal from bulk-buy policies in green gambit. 17 June 2021

<https://www.reuters.com/business/sustainable-business/reinsurers-look-dumping-coal-bulk-buy-policies-green-gambit-2021-06-17/>

**Kessides, N. I. (2020):** The Decline and Fall of Eskom: A South African Tragedy. 2020

<https://www.thegwpf.org/content/uploads/2020/06/Decline-Fall-Eskom.pdf>

**Kojima, M. & Trimble, C. (2016):** World Bank report: making power affordable for Africa and viable for its utilities. October 2016

<https://openknowledge.worldbank.org/bitstream/handle/10986/25091/108555.pdf>

**Kuneman, E., Acworth, W. & Bernstein, T. (2021):** The Korea Emissions Trading System and electricity market. May 2021

[https://www.umweltbundesamt.de/sites/default/files/medien/5750/publikationen/2021-05-19\\_cc\\_36-2021\\_case\\_study\\_korea.pdf](https://www.umweltbundesamt.de/sites/default/files/medien/5750/publikationen/2021-05-19_cc_36-2021_case_study_korea.pdf)

**Lee, J. & Kim, B. (2022):** S. Korea to lift nuclear share of energy mix to 30% by 2030 from 27% last year. 5 June 2022

<https://www.reuters.com/business/energy/skorea-lift-nuclear-powers-share-energy-mix-30-by-2030-2022-07-05/>

**Liu, S., Wang, Y., & Wang Y. (2021):** South Korea and Japan Will End Overseas Coal Financing. Will China Catch Up? 14 June 2021

<https://www.wri.org/insights/south-korea-and-japan-will-end-overseas-coal-financing-will-china-catch>

**Magacho, G., Espagne, E. & Godin, A. (2022):** Impacts of CBAM on EU trade partners: consequences for developing countries. March 2022

<https://www.afd.fr/en/ressources/impacts-cbam-eu-trade-partners-consequences-developing-countries>

**Mantashe, G. (2022):** South African Minister of Mineral Resources and Energy Gwede Mantashe claimed during the ministerial symposium at the African Oil Week and Green Energy Africa Conference. 3 October 2022

<https://www.dailymaverick.co.za/article/2022-10-05-how-do-you-instantly-create-10-ghost-towns-stop-using-coal-gwede-mantashe-warns/>

**National Bureau of Statistics (NBS, 2013):** China Economic Census Yearbook 2013. August 2015  
[http://www.stats.gov.cn/zs/tjwh/tjkw/tjzl/202302/t20230215\\_1907829.html](http://www.stats.gov.cn/zs/tjwh/tjkw/tjzl/202302/t20230215_1907829.html)

**Our World in Data (n.d.):** Share of electricity production from fossil fuels, 2021. (Accessed 9 February 2023)

<https://ourworldindata.org/grapher/share-electricity-fossil-fuels>

**Farr, J., Morrissey, J. & Donaldson, C. (2022):** Unaccountable Accounting – The World Bank’s unreliable climate finance reporting. October 2022

<https://oxfamilibrary.openrepository.com/bitstream/handle/10546/621424/bp-world-bank-unreliable-climate-finance-reporting-031022-en.pdf>

**PGE (2022):** PGE publikuje wyniki finansowe i operacyjne za III kwartał 2022 r. (PGE publishes financial and operating results for the third quarter of 2022). 22 November 2022

<https://www.gkpge.pl/grupa-pge/dla-mediow/komunikaty-prasowe/korporacyjne/pge-publikuje-wyniki-finansowe-i-operacyjne-za-iii-kwartał-2022-r>

**Quinson, T. (2021):** ‘Transition Washing’ Is the Newest Sustainability Dodge. 12 May 2021

<https://www.bloomberg.com/news/articles/2021-05-12/-transition-washing-is-the-new-green-bond-dodge-green-insight>

**Renner, M., García-Baños, C. & Khalid, A. (2022):** Renewable Energy and Jobs - Annual Review 2022. September 2022  
<https://www.irena.org/publications/2022/Sep/Renewable-Energy-and-Jobs-Annual-Review-2022>

**Song, P. (2022)** 老龄化、疫情时代背景下我国养老保险基金与 ESG 投资研究 (Research on China's pension fund and ESG investment in the context of aging and epidemic era) [J]. *应用数学进展* Advances in Applied Mathematics, 2022, 11(7). 4829-4836. 25 July 2022  
[https://pdf.hanspub.org/AAM20220700000\\_34250273.pdf](https://pdf.hanspub.org/AAM20220700000_34250273.pdf)

**Stark, V. (2023):** CEO of South Africa's State-Owned Power Company Eskom Allegedly Poisoned. 9 January 2023  
<https://www.voanews.com/a/ceo-of-south-africa-s-state-owned-power-company-eskom-allegedly-poisoned-/6910764.html>

**Statista (2023):** Largest global emitters of carbon dioxide 2021, by country. 23 November 2022  
<https://www.statista.com/statistics/271748/the-largest-emitters-of-co2-in-the-world/>

**Takatsuki, Y.:** Financing brown to green: Guidelines for Transition Bonds. 3 July 2021  
<https://www.axa-im.com/financing-brown-green-guidelines-transition-bonds>

**Taylor, M., Ralon, P., Al-Zoghoul, S. & Jochum, M. (2022),** Renewable Power Generation Costs in 2021. July 2022  
<https://www.irena.org/publications/2022/Jul/Renewable-Power-Generation-Costs-in-2021>

**Thanganadar, D., Asfand, F., Patchigolla, K. & Turner, P. (2021):** Techno-economic analysis of supercritical carbon dioxide cycle integrated with coal-fired power plant. 15 August 2021  
<https://www.sciencedirect.com/science/article/pii/S0196890421004702>

**Trinasolar (2021):** 天合光能分布式案例 | 我国首座碳中和「光伏 + 加油站」 (Trinasolar distributed renewables case study | China's first carbon neutral PV + gas station). 8 September 2021  
<https://www.trinasolar.com/cn/resources/news-room/wed-09082021-1536-0>

**UKCOP26 (2021):** Statement on international public support for the clean energy transition. 4 November 2021  
<https://ukcop26.org/statement-on-international-public-support-for-the-clean-energy-transition/>

**Vohra, K., Vodonos, A., Schwartz, J., Marais, E. A., Sulprizio, M. P., & Mickley, L. J. (2021):** Global mortality from outdoor fine particle pollution generated by fossil fuel combustion: Results from GEOS-Chem. 5 April 2021  
<https://www.sciencedirect.com/science/article/abs/pii/S0013935121000487>

**World Economic Forum (n.d.):** First Movers Coalition. (Accessed 9 February 2023)  
<https://www.weforum.org/first-movers-coalition>

**World Resources Institute (WRI, 2022):** G20 Summit Sends Positive Signal for COP27; Countries Announce Major Funding Package for Indonesia's Energy Transition. 16 November 2022  
<https://www.wri.org/news/statement-g20-summit-sends-positive-signal-cop27-countries-announce-major-funding-package>

**Wyższy Urząd Górniczy (Polish Higher Mining Authority, 2023):** Wypadki śmiertelne 2022 (Fatal accidents 2022). Assessed 27 January 2023  
[https://www.wug.gov.pl/bhp/wyp\\_sm\\_2022](https://www.wug.gov.pl/bhp/wyp_sm_2022)

**Zhao, X. (2022):** 首批可再生能源补贴核查落地 已有企业退回数亿补贴 (The first batch of renewable subsidies verification completed – enterprises received hundreds of millions of yuan of historical subsidies) 31 October 2022  
<https://www.caixin.com/2022-10-31/101958202.html>



Agora Energiewende  
Anna-Louisa-Karsch-Strasse 2 | 10178 Berlin  
P +49 (0) 30 700 14 35-000  
F +49 (0) 30 700 14 35-129  
[www.agora-energiewende.de](http://www.agora-energiewende.de)  
[info@agora-energiewende.de](mailto:info@agora-energiewende.de)