

Early Phase-Down of Coal Plants

The Role of Development Finance Institutions

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ABBREVIATIONS

ACT	Accelerating Coal Transition
ADB	Asian Development Bank
AMCs	Asset Management Companies
CBA	Cost-Benefit Analysis
CCEFCF	Canadian Clean Energy and Forest Climate Facility
CCS	Carbon capture and storage
CDB	China Development Bank
CHEXIM	Export-Import Bank of China
CIF	Climate Investment Funds
COP28	28th UN Climate Change Conference
CSAs	Coal Supply Agreements
DFI	Development finance institution
EDP	Energias de Portugal
EJETP	Eskom Just Energy Transition Project
ESMAP	Energy Sector Management Assistance Program
ETA	Energy Transition Accelerator
ETM	Energy Transition Mechanism
FAS	Futuro Ativo Sines
GW	Gigawatts
GFANZ	Glasgow Financial Alliance for Net Zero
IDB	Inter-American Development Bank
IPP	Independent Power Producer
ISDS	Investor-state dispute settlement
JET-Ps	Just Energy Transition Partnerships
JTT	Just Transition Transaction
MDB	Multilateral Development Bank
MTV	Managed Transition Vehicle
PLN	Perusahaan Listrik Negara (State Electricity Company, Indonesia)
PPAs	Power Purchase Agreements
SOEs	State-Owned Enterprises
WOLCOT	Women-Led Coal Transitions

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Colombia. Photo by Faber Leonardo via Unsplash

EXECUTIVE SUMMARY

Electrification is an essential ingredient of development and economic growth. Coal-based electricity has been a source of energy access and industrialization for centuries, spurring the Industrial Revolution. However, the social costs of coal-fired power plants—in terms of air pollution, public health and climate change—now outweigh the benefits, with many alternative energy sources that are cleaner and capable of generating the same or more social and economic gains. In addition, it is widely understood that coal consumption for electricity generation must rapidly decrease to remain below the temperature limits set by the Paris Agreement on climate change and avoid catastrophic human impacts and enormous economic costs.

Consequently, many governments have committed to stop building new coal-fired power plants both domestically and abroad. However, researchers and policymakers have underscored the importance of addressing greenhouse gas emissions from existing coal-fired power plants. This is in line with the agreement at 2023 United Nations Climate Change Conference in Dubai (COP28) to phase down unabated coal power and transition away from fossil fuels in a just, orderly and equitable manner. Options for coal power phase-down include retrofitting coal plants, mothballing them or operating them at lower capacity rates. The greatest emissions reductions would be achieved through the early and permanent retirement of coal units.

While many development finance institutions (DFIs) have pledged to halt public finance into new coal-based electricity generation, decarbonization of existing coal plants is yet to receive sufficient attention. DFIs are uniquely poised to play a key role in endeavors such as early phase-down of coal plants given their distinct mandate to prioritize development and provide public goods. Furthermore, the ability of DFIs to supply concessional finance and tolerate high levels of risk makes them well equipped to play a role in phasing down coal-based power generation. This is particularly applicable to multilateral development banks (MDBs) and national development banks (NDBs), which, alongside climate funds, will be the focus of this report.

Innovative examples of financing coal plant decarbonization already exist, almost exclusively targeting the early retirement of units. Within DFIs, the Climate Investment Funds (CIF) has established the Accelerating Coal Transition (ACT) program to support MDBs, the Asian Development Bank (ADB) is piloting the Energy Transition Mechanism (ETM), the private sector arm of the Inter-American Development Bank (IDB) Group, IDB invest, enabled coal plant closures in Chile and the World Bank funds coal plant repurposing in South Africa. The Just Energy Transition Partnerships (JET-Ps) are another example of international effort aimed at accelerating renewables while reducing coal power use.

Apart from these pilot initiatives, the direct engagement of DFIs with the decarbonization of coal plants has been limited. This limitation is shaped by various factors, such as the availability of resources like concessional finance, the institutional capacity and expertise within DFIs and the willingness (or lack thereof) of governments and operators to initiate the phase-down of coal plants and consequently seek DFI support. More broadly, there is also a need to foster greater understanding about how DFIs can support holistic and financing options for coal plant phase-down in a manner that proactively supports development goals, enables investments and unlocks employment and growth opportunities.

To confront these knowledge gaps, the Boston University Global Development Policy Center (GDP Center) hosted a workshop in November 2023 for practitioners and researchers to discuss options to decarbonize coal plants, in particular premature coal plant closure. The workshop objective was to identify scalable methods and tools that DFIs can employ to assist countries in endeavors to transition away from coal-based power generation and to draft tangible policy recommendations

for DFIs and governments to retire coal plants effectively and efficiently while ensuring a just energy transition and economic development. This report synthesizes the workshop discussion and outlines the key findings.

The first part of the workshop delved into DFIs' experiences with early coal plant phase-down up to this point and the lessons learned. Participants assessed various policy options that have been advanced in recent years and discussed their scalability and replicability in similar and different contexts. The second part centered on available models and tools that DFIs have at their disposal and how these can contribute to a just energy transition. The discussion focused on frameworks to prioritize coal plants for decarbonization, methods to evaluate the costs and benefits of DFIs' involvement and financing mechanisms. These frameworks, models and tools have the potential to support a just transition for all.

Key findings:

- Early phase-down of coal plants can take several forms, such as mothballing, retirement and repurposing a plant with renewable capacity.
- A one-size-fits-all approach is not appropriate. Solutions need to be tailor-made to tackle context-specific barriers that exist in phasing down coal plants, with some of the most crucial ones being energy security concerns, foregone profits, as well as political feasibility.
- Scalability is a crucial for coal plant phase-down initiatives to have meaningful impact.
- DFIs possess a unique role in fostering an enabling environment to cease operation of coal units, involving activities such as capacity building, long-term planning and policy formulation.
- DFIs can be instrumental in financing the early phase-down of coal units as first-movers and have a diverse set of promising tools at their disposal.
- Several considerations and prerequisites are key, including the need for more concessional finance, the imperative for transparency and just transition frameworks.

Based on the main findings, we formulated three key policy recommendations for DFIs to support governments in their low-carbon and climate-resilient development, in particular by decarbonizing coal plants.

Key policy recommendations:

- A just, orderly and equitable phase-down of existing coal infrastructure should form a centerpiece of DFIs' climate strategies, supporting governments in accelerating renewable energy generation and economic diversification.
- DFIs should support an enabling environment for coal plant phase-down and shape the market for other financial institutions to engage in coal plant decarbonization.
- Strategies for the phase-down of coal plants should be scalable and built around concessional and grant financing mechanisms.

In line with these recommendations, DFIs can make use of their expertise and experience to assist countries in their low-carbon transition endeavors while ensuring economic development, in particular through support in the early phase-down of coal units.

INTRODUCTION

Climate change has adverse effects on humanity and calls for significant emission reduction in the near future, particularly within the energy sector. The average global surface temperature increased by around 1.1°C compared to pre-industrial times, with further increases anticipated (IPCC 2021a). The main driving force of global warming are greenhouse gas (GHG) emissions, in particular from energy use, such as from coal plants. To adhere to the temperature limits set by the Paris Agreement, coal demand must hence drastically decrease—approximately 95 percent by 2050 compared to 2019 (IPCC 2022). Consequently, preserving 90 percent of coal reserves is imperative to remain below the 1.5°C warming threshold (Welsby et al. 2021; McGlade and Ekins 2015). The current progress on climate action was assessed at the 2023 United Nations Climate Change Conference in Dubai (COP28) through the Global Stocktake (UNFCCC 2023). It underscored the need to drastically scale up climate action to achieve emissions reductions consistent with the Paris Agreement goals. Intensifying climate impacts, including more frequent heatwaves, droughts and heavy precipitation events, resulting in food and water insecurity, displacement and damages to the economy and infrastructure further highlight the importance of immediate action (IPCC 2021b; Hoegh-Guldberg et al. 2018). Given this context, at COP28, countries agreed to double the global average annual rate of energy efficiency improvements and to triple renewable energy capacity by 2030 alongside accelerating efforts towards the phase-down of unabated coal power (UNFCCC 2023).

Despite this urgency, low- and middle-income countries face severe challenges in transitioning their domestic energy systems. The transition requires immediate and substantial reductions in the carbon intensity of the energy system, achieved by phasing out high-carbon energy sources and simultaneously expanding low-carbon electricity production. Both can present significant challenges for countries that are often locked in with fossil fuels, such as coal (Edianto et al. 2023). The roll-out of renewables—which requires a higher upfront cost as compared to fossil fuels (Hirth and Steckel 2016)—tends to be hindered by high costs of capital stemming from high interest rates. Electricity markets in most low- and middle-income countries are also perceived to be risky by credit rating agencies and financial market participants, which increases the cost of capital for those countries. This financial hurdle, coupled with tight state budgets, escalating debt levels and limited access to capital markets, impedes the adoption of cleaner energy alternatives, despite renewables being increasingly cost competitive to coal-based power generation. As a result, many low- and middle-income countries find themselves excluded from economically viable clean energy options while being constrained to higher-cost fossil fuels, such as coal (World Bank 2023c). Consequently, emerging markets and developing economies other than China require financing of climate action and related development goals of around \$1 trillion per year by 2030 from external sources (Songwe, Stern and Bhattacharya 2022).

For low- and middle-income countries, there are several climate and non-climate rationales for decarbonizing their coal plant fleet such as through early retirement. A crucial reason is to remain below the temperature limits agreed upon in the Paris Agreement. While the annual and cumulative emissions of many low- and middle-income countries may be minor, *all* countries must play their part to reach net zero energy sector carbon dioxide (CO₂) emissions by 2050 to limit warming to 1.5°C (International Energy Agency 2023). In addition, initiating a low-carbon development trajectory sooner rather than later yields positive outcomes for low- and middle-income countries, such as reducing risk of carbon lock-in, international recognition and enhanced competitiveness in the face of carbon border adjustments (He, Zhai and Ma 2022; Unruh 2002). Non-climate rationales include avoiding negative impacts of localized air and water pollution on human health and the environment. Overall, replacing coal with renewables presents an opportunity for low- and middle-income countries in terms of social, environmental and economic considerations—particularly when aided by development finance institutions (DFIs).

DFIs are well positioned to assist countries in capitalizing on the benefits from scaling up renewable energies and reducing the usage of coal plants. A large portion of the coal plants that will have to be phased down are in countries in South and Southeast Asia, which face high perceived investment risks, limited access to capital markets and high governmental influence in the energy sector through state-owned enterprises (SOEs). In this context, public finance institutions like DFIs possess competitive advantages over private banks. With their ability to offer low-cost, long-term loans and experience and expertise working in the energy sector, DFIs can play a vital role. Moreover, supporting energy transitions falls within DFIs' mandate to enable economic development and improve livelihoods in low- and middle-income countries (Gallagher et al. 2023). By providing support for the decarbonization of coal plants as part of broader just transition plans, DFIs can fulfill their responsibility to promote sustainable development while demonstrating climate leadership.

This report outlines DFIs' support for sustainable energy transitions more broadly in the second section before explaining the imperative of coal plant phase-down in particular in the third section. The fourth section details existing initiatives to decarbonize plants and potential future actions for DFIs. Crucial considerations and governance principles are addressed in the fifth section, while the concluding section shares policy recommendations for DFIs.

DFIS' SUPPORT FOR ENERGY TRANSITIONS

DFIs, such as bilateral and multilateral development banks (MDBs) and national development banks (NDBs), have initiated support for countries in their low-carbon transition efforts. However, the current situation necessitates increased engagement and holistic approaches, as outlined in this section.

Progress Thus Far

DFIs play a pivotal role in the economic development of low- and middle-income countries, notably through funding energy projects. Recently, the focus has shifted from fossil fuels to renewable power projects.

In contrast to other financial institutions, DFIs are legally independent, follow public policy objectives and are supported by governments. They provide a range of financing options, including investment finance, development policy loans, guarantees and more. Their mandate revolves around poverty alleviation and economic growth promotion by incubating markets, bridging financing gaps, addressing market failures, such as externalities, and facilitating structural transformation (Xu, Ren and Wu 2019).

Given the close association between development and energy use and access, DFIs have financed substantial portions of new electricity capacity in low- and middle-income countries. Research indicates that MDBs facilitated capacity additions of 120 gigawatts (GW) in the 21st century, with an additional 120 GW in the pipeline as of 2021 (Steffen and Schmidt 2019; Sauer et al. 2022). In the last decade, Chinese DFIs, especially the China Development Bank (CDB) and the Export-Import Bank of China (CHEXIM), significantly increased energy financing, with more than 60 GW enabled and another 90 GW in the pipeline. Recent years have seen a shift of development finance from fossil fuel sources to renewable energies, both from MDBs and Chinese DFIs (Sauer et al. 2022).

Over the last decade, the aspect of *sustainable* development has gained growing importance. Under the auspices of the UN, governments formulated the 2030 Agenda, consisting of 17 Sustainable Development Goals (SDGs). SDG 17 explicitly recognizes the key role of DFIs to achieve the other

goals (United Nations 2015). In parallel, climate change has been elevated in the work of MDBs, which regularly issue joint statements on their climate-related work. In 2022, the World Bank embarked upon a reform process based on the “Evolution Roadmap” that involved expanding its vision and the mandate to include global policy challenges like climate change (Yellen 2022). This stage of the World Bank reform process opens up an important opportunity not just to switch the focus to decarbonizing energy systems through the phase-down of coal plants, but also for the World Bank and other MDBs to actively support economic transformation pathways that are low-carbon and climate-resilient.

In their efforts to support climate action in client governments, DFIs have adopted a two-pronged strategy. First, MDBs have adopted a commitment to align financial flows with the objectives of the Paris Agreement and to scale up climate finance. In 2019, MDBs pledged to mobilize \$50 billion in climate finance by 2025. The MDBs reached this figure in 2021 mobilizing an estimated \$51 billion, which increased to \$61 billion of climate finance for low- and middle-income economies in 2022 (International Finance Corporation 2023). This commitment primarily focuses on scaling up renewable energy finance and climate adaptation. Second, many MDBs have committed to avoid supporting new financing towards coal-based power generation, and have added coal-based power generation and other fossil fuels to exclusion lists. An overview of the climate commitments and the exclusion lists of seven MDBs and three NDBs can be found in the Appendix.

Discontinuing MDB support for new coal plants aligns with recent announcements made by the Group of 20 (G20) and individual countries, such as China, Japan and South Korea, to curb support for coal plants in foreign countries. Therefore, DFIs from these nations, including CDB and CHEXIM, are expected to cease funding overseas coal. However, the pledges will likely not cover plants that have already reached financial closure. In terms of renewables, both the CDB and CHEXIM have pledged to boost financing for low-carbon energy projects, for example, through the newly announced Green Investment and Finance Partnership (GIFP) (Zhang and Gallagher 2023). However, as of now, there is no established policy or program in place to implement the commitment.

Forging Ahead: A holistic transition approach

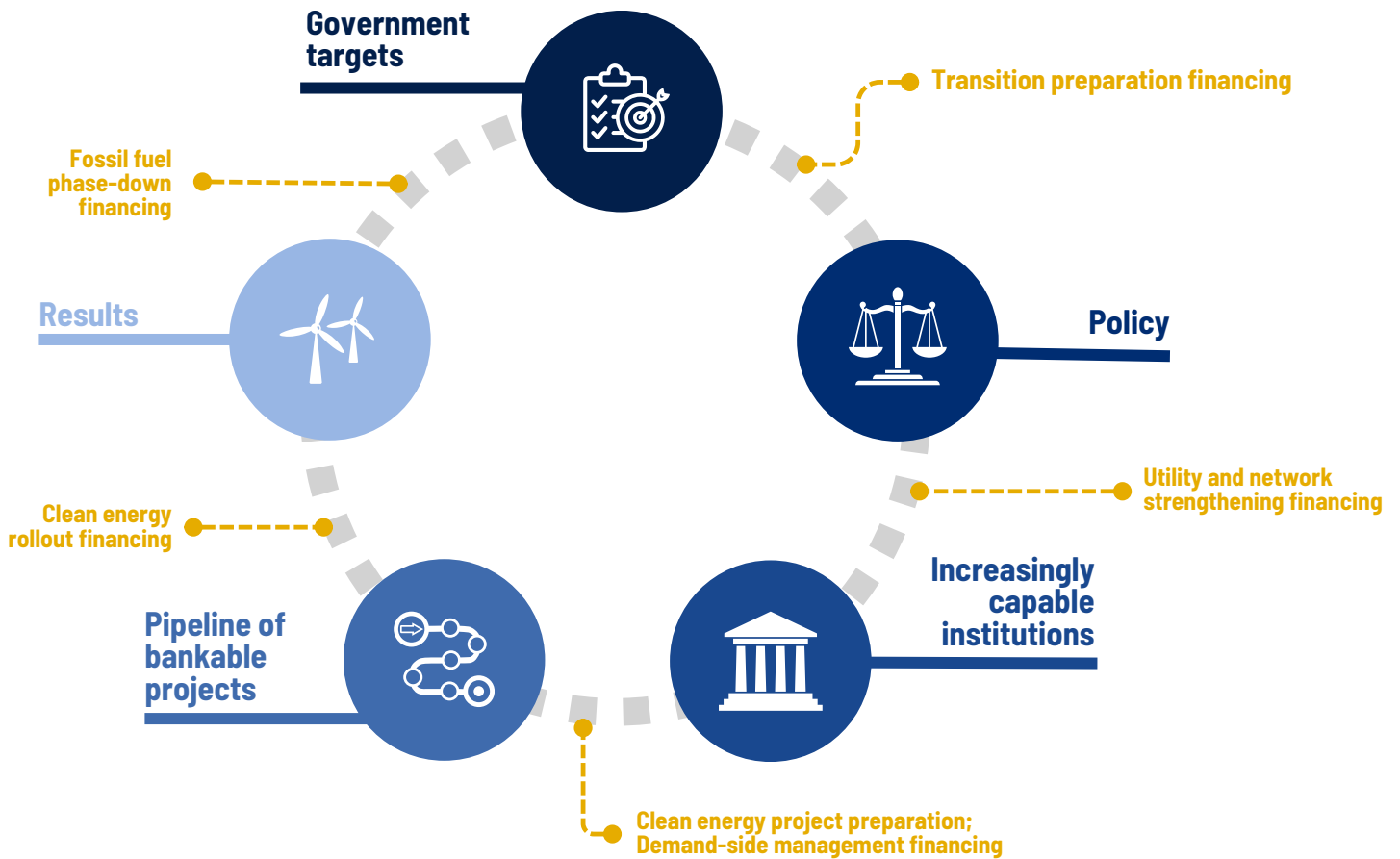
While financing renewable energy projects and halting the support for fossil fuels is a promising first step, it does not sufficiently address the complexity and urgency of energy transitions. DFI support should be holistic in nature to facilitate the energy transition of low- and middle-income countries.

To effectively assist countries in their transition efforts, DFIs need a holistic support plan. The World Bank’s 2023 report “Scaling Up to Phase Down” (World Bank 2023c) introduces a virtuous cycle of policies and institutions, shown in a slightly adjusted version in Figure 1. This cycle can guide DFIs in their decision-making and planning process. It provides an approach to accelerate low-carbon transitions in low- and middle-income countries.

In this cycle, governments are responsible for laying out roadmaps to low-carbon electricity systems, introducing long-term action plans linked to regulatory frameworks and strengthening power markets and required institutions. Power sector reforms alongside de-risking of renewable investments aim at ensuring a pipeline of bankable projects to incentivize private sector participation and the roll-out of renewables (World Bank 2023c).

DFIs can support governments at each stage of the cycle, as highlighted in yellow in Figure 1. Concessional finance is especially promising for assisting governments in realizing their aforementioned responsibilities by overcoming barriers. Barriers may result from various shortcomings, such as governance issues, poorly targeted subsidies and inadequate power sector planning.

Figure 1: A virtuous cycle to accelerate transition of the power sector and avenues for DFIs' support



Source: Reproduction based on the report “Scaling up to Phase Down” (World Bank 2023c).

Specifically, as outlined in the World Bank report (World Bank 2023c), DFIs can provide funding for the following:

- Increasing technical assistance to governments to strengthen their capacity for the transition, including activities such as energy sector planning, formulating transition strategies and clarification of policy goals;
- Strengthening utilities, with a particular emphasis on expanding their capacity to invest in renewable energies;
- Enhancing electricity networks by enabling investments in transmission, especially to develop flexible grids capable of accommodating volatile low-carbon energy sources;
- Implementing demand-side management, such as energy efficiency programs, to enhance energy security and reduce cost increases;
- Ensuring a pipeline of renewable projects through measures such as funding pre-feasibility studies to support renewable energy projects at an early stage (Manych and Ratan 2023);
- Mitigating risk associated with clean energy to attract public and private investment;
- Facilitating the rollout of renewable energy by improving cost competitiveness and increasing technology reliability; and
- Enabling the phase-down of fossil fuels, in particular, coal.

While a significant portion of these financing opportunities is geared towards scaling up renewables, a pivotal aspect of energy transitions, it is imperative to underscore that financing the phase-down of fossil fuels should constitute an essential component of DFI's transition support plans. The subsequent section delves into the subject of coal plant decarbonization and early coal plant retirement, one of the most effective means to mitigate emissions.

THE CASE FOR EARLY COAL PLANT PHASE-DOWN

An integral aspect of a holistic approach to sustainable transitions involves the phase-down of high-carbon technology, particularly coal. This section elaborates on coal plant decarbonization measures including early retirements of coal plants, elucidating why they are necessary and identifying existing hurdles.

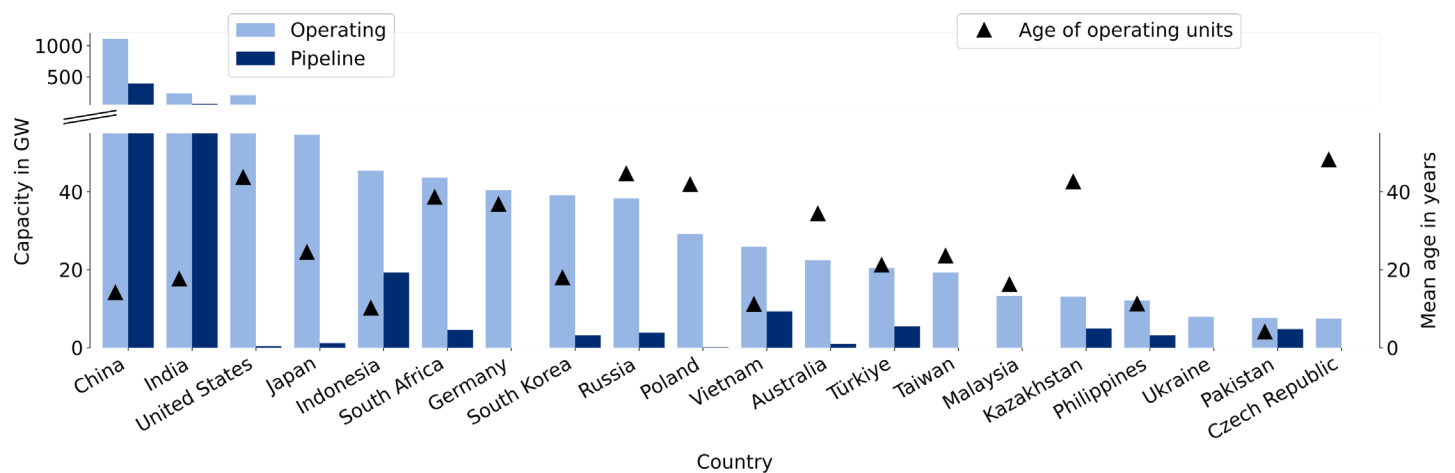
Rationale and Benefits

Of the fossil fuels, coal consumption needs to see the most drastic reductions if the temperature limits set in the Paris Agreement are to be adhered to (IPCC 2022), necessitating the cessation of the operation of coal-fired power plants. However, the needed reductions in coal consumption stand in stark contrast to countries' current reliance on coal. Figure 2 shows the coal-fired power plant capacity per select countries and the average age of the operating coal units. The capacity is disaggregated into plants that were operating as of July 2023 and those in the pipeline, i.e., under construction or in the planning stage.

Notably, many countries, foremost in South and Southeast Asia, are in the process of building new coal plants, while already possessing a relatively young operating plant fleet with mean ages ranging from 10 to 18 years. Examples of such countries are China, India, Indonesia, Vietnam and the Philippines. Industrialized countries, such as Germany, Japan and the United States, have significant coal power capacity and very few new plants in the pipeline. In light of the required reductions in coal consumption in the near future, a significant portion of the coal capacity depicted in Figure 2 will inevitably need to be retired.

Beyond the reduction of GHG emissions, phasing out coal offers local and national environmental, social and economic advantages (Rauner et al. 2020; Hänsel et al. 2021). From a health perspective,

Figure 2: Coal plant capacity per country and the mean age of the operating units, as of July 2023



Source: Own graph using data from Global Energy Monitor 2023.

reducing the usage of coal plants would decrease the number of premature deaths due to bone deformities, kidney dysfunction or respiratory diseases (Koplitz et al. 2017; Casey et al. 2020; Mun-awer 2018). In economic terms, replacing uncompetitive coal plants with cheaper renewable alternatives could save electricity consumers billions of dollars, as coal power is often heavily subsidized. This is due to much of the existing operating coal capacity being uncompetitive compared to building and operating renewables, such as solar and wind, with storage systems (Bodnar et al. 2020). The proportion of uncompetitive coal plants is continuously increasing given the sharp decline in costs for solar and wind.

In addition, reducing the emissions from coal plants by halting operation could reduce fiscal stress for governments. In many countries, SOEs operate and / or own coal-fired electricity units. At present, many of these plants are heavily subsidized, placing a burden on public finances (Calhoun et al. 2021). Retirement of coal assets in an orderly fashion could reduce the fiscal risk in the host countries, i.e., the country where the coal plant is located, and additionally in banks' and investors' countries (R. Cui et al. 2023). The continuous construction of coal units on the other hand bears the risk of stranded assets for companies and governments, which is often not yet accurately taken into account in host countries (Caldecott et al. 2021; Chiyemura, Shen and Chen 2021). Furthermore, countries reliant on coal-based power generation are also vulnerable to carbon border adjustment measures (Task Force on Climate, Development and the IMF 2022). Considering relevant costs and benefits, overall, retiring coal plants in Indonesia in line with 1.5°C and net-zero by 2050 would have net benefits (R. Cui et al. 2022). For private investors, the retirement of high-carbon assets can be linked to investments in low-carbon technologies, replacing their dirty returns with clean ones and hence reaping long-term benefits (Bodnar et al. 2020).

Definition and Overview

The aforementioned advantages serve as incentives for the early phase-down of coal-fired power plants. What does 'early' mean precisely and what are the available measures to reduce emissions from operating coal plants?

The term 'early' lacks a universal definition in this context, but is often tied to a unit's age and related factors. Historically, coal units globally operated for an average of 40-50 years (Global Energy Monitor 2023). However, considerable variations exist between countries. In China, coal units were retired after approximately 22 years on average, while in Germany, Canada and India, the average was around 40 years. In Russia and the United States, the average lifetime exceeded 50 years, and reached 60 years in South Africa. Thus, early phase-down cannot be universally defined by a specific age; instead, it implies premature retirement or mothballing—before reaching the envisaged lifespan without intervention. This consideration involves not only historical retirement ages per country, but also factors such as power sector plans, amortization of loans and equity, power purchase agreements (PPAs) and coal supply agreements (CSA). This is crucial in the context of additional emission mitigation.

There are several options to reduce emissions from coal plants, as highlighted in Table 1. Note that the table is based on a review of available literature and does not claim to be exhaustive. In addition, due to constraints in length, this report does not extensively elaborate on the various options, emission saving potentials and individual hurdles, but rather provides a brief overview of the options.

Four measures allow for the continuous operation of the respective plants. The first approach involves co-firing the unit with biomass or power-to-X (PtX) fuels, including ammonia or hydrogen.

Table 1: Measures to reduce emissions from coal-fired power plants

Continue operation				Cease operation					
				Keep intact			Dismantle (retire)		
Co-firing (biomass, ammonia, hydrogen)	Retrofit with improved technology	Carbon capture and storage	Run at lower capacity factors	Temporary breaks in operation	Keep as reserve capacity	Mothballing	Sole retirement	Replace with REs at different site	Repurpose site and equipment

Source: Climate Investment Funds 2023b; Outlaw, Kachi and Bendahou forthcoming; Chattopadhyay et al. 2021; Jindal and Shrimali 2022.

The second option is retrofitting the coal unit with cleaner and more efficient technology, such as new turbines and generators, aiming to reduce emissions while allowing for prolonged operation. The third measure utilizes carbon capture and storage (CCS) technology, storing carbon instead of releasing it into the atmosphere. The fourth option involves running the coal units at lower capacity factors, thereby reducing the amount of coal burned in the respective unit and mitigating emissions. This measure might require investments and technology updates, as the efficiency of coal units reduces with lower capacity factors, raising concerns about sustainability and profitability. Moreover, all of these measures are deemed problematic, as they incentivize the prolonged operation of plants, diverting attention from ceasing operation of coal units.

The measures that necessitate ceasing the operation of coal units can be categorized into either keeping the plant intact and connected to the grid or dismantling it. Those measures that keep the plant functional include a temporary break of operation, where utilities agree to suspend operation for a certain time to curb emissions. Another option is to keep coal plants as reserve capacity to ensure energy security. Lastly, plants can be deactivated but not retired, a practice known as ‘mothballing.’

In contrast, other measures imply the retirement of plants, i.e., the permanent decommissioning, promising the greatest emission savings. These approaches to retire coal plants can be categorized into three groups. The first group involves the sole retirement of the coal plant. In this case, financial mechanisms facilitate the accelerated closure of the coal plant. The second group entails replacing high-carbon power generation capacity with low-carbon alternatives at a different site. Consequently, next to supporting the closure of the coal plant, DFIs can fund renewables. The third group encompasses repurposing the existing coal plant site or the equipment for various end uses, such as solar or wind plants, battery storages and synchronous condensers.

Barriers and Challenges

While the benefits of coal plant phase-down are evident, various challenges, as outlined in Table 2, warrant careful consideration, in particular for the retirement of units. The barriers are financial, legal, socio-economic, political and include the internal policies of DFIs. Financial barriers encompass the costs for the owner of a plant and potential cross-border repercussions. Legal barriers pertain to contractual agreements and risks that could follow coal asset closure, such as complaints by investors. Socio-economic barriers include negative impacts on workers and communities, posing risks to local, regional and national economic development. Political barriers arise from the political economy in place, which translates into vested interests of powerful actors that can resist coal transitions.

Table 2: Barriers to coal plant decarbonization, particularly to retirement

Category	Barriers	
Internal DFI policies	<ul style="list-style-type: none"> Emission accounting schemes Coal exclusion policies may restrict retirement options Financial feasibility questioned 	<ul style="list-style-type: none"> Overexposure to utilities Limited availability of grants and concessional finance Reputational concerns
Financial	<ul style="list-style-type: none"> Foregone profits Repercussions for investors and banks in other countries 	<ul style="list-style-type: none"> Defaulted loans and outstanding debt High interest rates Indebted governments and companies
Legal	<ul style="list-style-type: none"> Contractual obligations from power purchase agreements (PPAs) or coal supply agreements (CSAs) 	<ul style="list-style-type: none"> Fair and equitable treatment complaints by investors Investor-state dispute settlements (ISDS)
Socio-economic	<ul style="list-style-type: none"> Layoffs Increase in consumer electricity prices Energy insecurity Replacement of coal with gas 	<ul style="list-style-type: none"> Just transition aspects, such as overburdening disadvantaged groups Local, regional and national economic development
Political	<ul style="list-style-type: none"> Political will Political Economy in place, such as interests of powerful actors 	<ul style="list-style-type: none"> State-owned enterprises' (SOEs) reliance on coal Policies supportive of coal-based generation

Source: Authors' compilation based on the discussions at the November 2023 workshop.

The workshop identified certain barriers as particularly crucial to overcome, discussed hereafter in their respective categories.

DFIS' INTERNAL POLICIES

In terms of internal challenges faced by DFIs, the coal exclusion list and emission accounting schemes emerge as potential hurdles. Coal exclusion lists can be considered a milestone in DFIs' path to sustainability and are essential to guarantee that no funding is allocated to the construction of new coal units. However, these policies may impede banks from funding the full range of coal plant retirement options. Where coal retirement is already included in a DFI's strategy, the institution should actively support early retirement. Similarly, emission accounting can render support unfeasible, as it necessitates banks to measure and disclose emissions associated with lending or investment activities. Emissions from financial activities are added to the portfolio of emissions that financial institutions are striving to reduce. Supporting high carbon infrastructure, such as coal plants, would increase banks' portfolio emissions, potentially contradicting emission reduction targets.

FINANCIAL

Given the young nature of coal fleets in many low- and middle-income countries, a phase-down will involve shortening the productive lifespan of a coal plant, which reduces the returns received by the plant owners and investors. Furthermore, a significant financial obstacle lies in the confluence of high interest rates with heavily indebted governments and companies. High interest rates reduce incentives for investments, both in the scale up of renewable energies and in the phase-down of fossil sources. Concomitantly, low- and middle-income countries and their domestic companies, in

particular SOEs, grapple with escalating debt levels (Ray 2024). Taking on additional debt for the decarbonization of coal units, especially with high interest rates, might prove impractical. Companies such as utilities and operators of coal plants likely have outstanding loans and equity that has not yet been amortized. Consequently, they may lack the financial capacity to secure new loans to cease operation of coal units. This challenge is exacerbated by the limited availability of commercial finance and grants.

LEGAL

Legal commitments tied to the supply of electricity or coal present major challenges. Host governments may face legal barriers when attempting to halt operation of coal plants, in particular if they have issued guarantees for power purchase from coal plants through so-called power purchase agreements (PPAs). The vast majority of coal plants globally are operated under PPAs or government mandates to SOEs. If a plant is phased down prematurely, and government action was the proximate cause, guarantees will not be fulfilled, resulting in legal liabilities for the governments. Similarly, coal supply agreements (CSAs) involve a long-term contractual obligation to purchase coal. The renegotiation of both PPAs and CSAs is essential to facilitate any form of premature phase-down such as plant retirement. However, as bilateral contractual agreements, they are often confidential, which impedes transparency and analysis.

SOCIO-ECONOMIC

In addressing social and economic challenges, the workshop identified economic development and energy security as crucial considerations for coal transitions. Over the last decades, both total energy consumption and consumption per capita have been growing significantly, in particular in low- and middle-income countries (World Bank 2023a). In light of this trajectory, the reduction in overall power capacity resulting from the phase-down of coal units raises substantial concerns about energy security, potentially affecting households and economic activities. Hence, it becomes imperative to ensure that there is no net loss in overall energy availability. An essential aspect of this equation is economic development, historically driven by access to and the availability of energy. Coal played an exceptional role, with macroeconomic dynamics, such as positive spillover, to industrial development (Montrone, Steckel and Kalkuhl 2022). It is crucial to ensure that the phase-down of plants, many of which will occur in low- and middle-income countries, will not put the economic development of countries at risk or increase global and domestic inequalities.

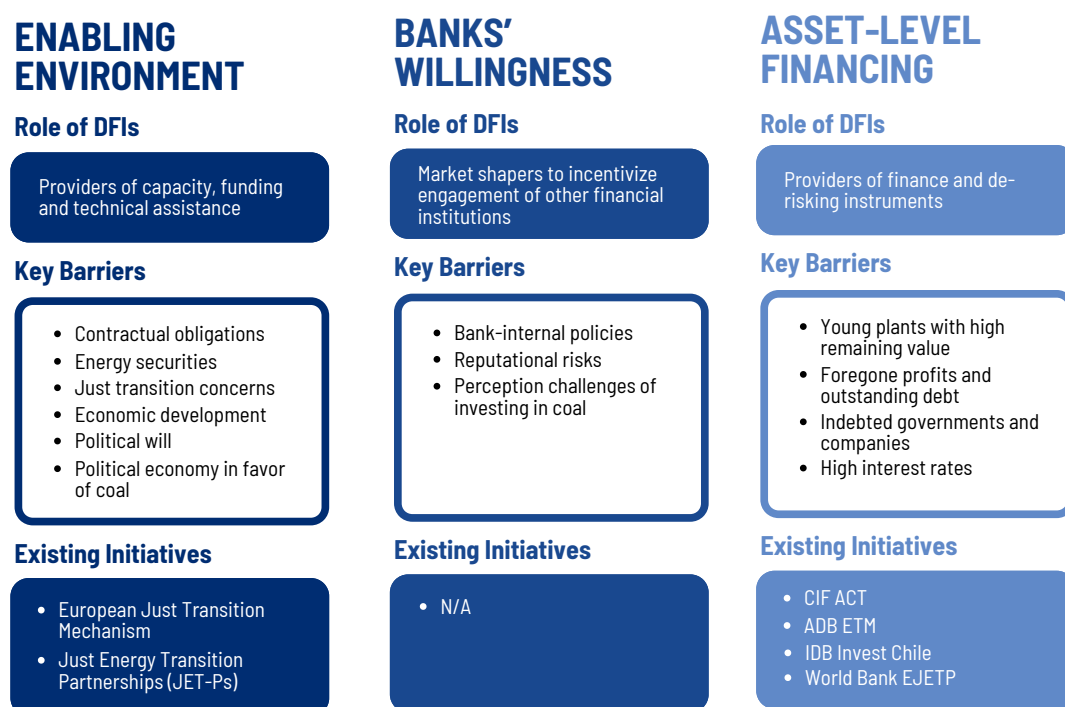
POLITICAL

Even when the aforementioned challenges are taken into account, sustainable transition plans might be impeded by a lack of political will. Phasing out coal is frequently obstructed by political economy factors within the host country, such as the vested interests of powerful domestic actors (Jakob and Steckel 2022; Clark et al. 2023). Large companies often possess strong economic incentives to build and operate coal plants, and enjoy close ties with the government, as observed in India and the Philippines (Montrone, Ohlendorf and Chandra 2021; Manych and Jakob 2021). In countries like Vietnam and South Africa, SOEs centered on coal have paved the way for economic growth in line with government goals and are held in high esteem (Dorband, Jakob and Steckel 2020; Hanto et al. 2022). Meanwhile, in Indonesia, SOEs support coal due to its contribution to governmental revenues along the coal value chain (Ordonez et al. 2021). The process of phasing out coal in these countries must, therefore, carefully navigate the interests of influential actors from both the private sector and the government.

DFIS' SUPPORT FOR COAL PLANT PHASE-DOWN

The premature phase-down of coal plants constitutes a vital element in the holistic plans of DFIs to assist countries in their low-carbon transitions. In the face of the aforementioned challenges, DFIs can assume various roles to support host countries in their efforts to curb emissions from coal plants, in particular for the early retirement of coal plants facing substantial challenges. Figure 3 illustrates that they can facilitate an enabling environment for the cessation of coal plants, act as market shapers and serve as providers of asset-level finance and de-risking instruments, allowing DFIs to overcome key barriers hindering the premature phase-down of coal plants.

Figure 3: DFIs' roles derived from key challenges to early retirement



Source: Based on a presentation from the Rocky Mountain Institute (RMI) at the workshop in November 2023.

Note: The abbreviations used for the initiatives are explained hereafter: Climate Investment Funds (CIF) Accelerating Coal Transition (ACT); Asian Development Bank (ADB) Energy Transition Mechanism (ETM); IDB invest, the private sector arm of the Inter-American Development Bank (IDB) Group; World Bank Eskom Just Energy Transition Project (EJETP). While those initiatives that provide funding for the phase-down of coal plants can positively affect the willingness of other banks to follow suit, none of the initiatives consider their role as market shapers as the main component.

This section describes existing approaches to phase-down, foremost focusing on retirement, from both the private and the public sector. Subsequently, it details three sets of policy options available to DFIs to fulfill the three roles illustrated in Figure 3. The first set of options centers on supporting enabling environments in host countries (DFIs as capacity building providers), the second on banks' willingness to support coal plant phase-down endeavors (DFIs as market shapers) and the third set of policy options focuses on the direct funding of phase-down projects (DFIs as financiers).

Existing Initiatives and Lessons Learned

It is evident that DFIs not only possess the mandate but also the resources and expertise to provide both technical and financial assistance for coal plant decarbonization. In light of these capabilities,

several DFIs have already embarked on initiatives to support coal plant phase-down, particularly retirements, and have gained valuable experience.

Some programs foster coal transitions more broadly, without explicitly targeting coal plant decarbonization. One such initiative is the European Just Transition Mechanism (European Investment Bank 2020), which provides support for coal transitions in Europe by helping the most affected regions, industries and workers to achieve a just transition to a low-carbon economy. The €55 billion in funding includes grants from the European Union (EU) budget, loans from the European Investment Bank and private investment. Another such program is the Just Transition Transaction (JTT), a proposed scheme to set South Africa on track for a low-carbon future (Steyn et al. 2021; Parker 2023). An important pillar is support for the public utility Eskom’s coal transition.

The recently launched Just Energy Transition Partnerships (JET-Ps) with South Africa, Indonesia, Vietnam and Senegal similarly assist these countries in their transition efforts without explicitly targeting coal units. These countries will receive substantial funding in the form of loans and grants from public banks blended with private investment over the coming years. The JET-Ps could present a window of opportunity for DFIs to contribute to the phase-down of coal plants if funds are directed into financial mechanisms for the phase-down of coal plants (Pinko and Pastor 2023).

Other initiatives that have evolved in recent years explicitly target the phase-down of coal units, as highlighted in Table 3. The table includes information on the financer, aim, geography and status for each initiative. While most initiatives have a national scope, a few have a regional or even global focus. The four DFI-led initiatives (highlighted in blue), are elaborated upon in detail hereafter.

Table 3: Existing coal phase-down initiatives

Initiative	Financer	Aim	Geography	Status
Accelerating Coal Transition (ACT)	CIF and its MDB partners	Early retirement of coal assets	Global	Launched
ADB Energy Transition Mechanism (ETM)	ADB and private financiers	Retirement of coal plants, replacement with renewables	Asia	First pilot plant (Cirebon-1 in Indonesia)
Engie Energía Chile	IDB invest and CIF	Replacing Tocopilla coal units with wind farm	Chile	Realized
Eskom Just Energy Transition Project (EJETP)	World Bank, CCEFCF and ESMAP	Repurpose Komati coal plant using renewables and batteries	South Africa	Launched
Futuro Ativo Sines (FAS) Programme	Energias de Portugal (EDP)	Repurpose Sines coal plant into hydrogen hub	Portugal	Coal plant retired
Futur-e	Enel	Replacing Teruel coal plant with renewables	Spain	Coal plant retired
Market-based Energy Transition Mechanism (ETM)	ACEN Corporation, private banks and investors	Early retirement of SLTEC coal plant, build solar capacity	Philippines	Implemented, plant to be retired by 2040
Coal Phase-Out Act	Local public banks	Closure of lignite plants (compensation) and hard coal plants (auctioning)	Germany	Launched
Bond securitization	Rate-payers	Early retirement of coal plants	United States	Launched

Acronyms: Climate Investment Funds (CIF), Asian Development Bank (ADB), Canadian Clean Energy and Forest Climate Facility (CCEFCF), Energy Sector Management Assistance Program (ESMAP), South Luzon Thermal Energy Corporation (SLTEC)

Source: ACT (Climate Investment Funds 2021); ETM (Asian Development Bank 2022); Engie Energía Chile (Joan Miquel Carrillo, Hilen Meirovich and Fernando Cubillos 2023); EJETP (World Bank 2023b); FAS (World Economic Forum 2021); Futur-e (Endsea 2023); ACEN ETM (ACEN 2022); Coal Phase-out Act (Wettengel 2020); Bond securitization (Fong 2022).

Note: The table includes approaches that explicitly target the decarbonization of coal units, and excludes those that have a broader energy transition focus, such as the European Just Transition Mechanism or South Africa’s Just Transition Transaction. Initiatives with DFIs’ involvement are highlighted in blue.

ACCELERATING COAL TRANSITION—CLIMATE INVESTMENT FUNDS

The Climate Investment Funds (CIF) has instituted the Accelerating Coal Transition (ACT) program, a global investment initiative crafted to facilitate coal transitions, with a specific emphasis on replacing coal power generation with renewable sources. While CIF is not a bank, it channels funds from government donors and the private sector and partners with six MDBs. Thus, to achieve its objective, ACT harnesses blended finance from CIF and its MDB partners. As a consequence, some of the initiatives listed utilize funding provided by CIF.

In addition to infrastructure investment, ACT places significant emphasis on governance, as well as considerations for people and communities. As part of a gender-focused approach, it features a Women-Led Coal Transitions (WOLCOT) mechanism designed to enhance women's participation in coal transition strategies (Climate Investment Funds 2023a).

CIF's ACT is currently active in six countries: the Dominican Republic, India, Indonesia, North Macedonia, the Philippines and South Africa, with plans for further expansion to other nations. Substantial progress has been achieved in South Africa, where the program is facilitating the decommissioning of up to three coal plants while supporting communities to ensure a just transition. Similarly, in Indonesia, CIF assists in the retirement of up to 2 GW of coal capacity while supporting just transition activities like capacity building.

ENERGY TRANSITION MECHANISM—ASIAN DEVELOPMENT BANK

The Asian Development Bank (ADB) initiated its Energy Transition Mechanism (ETM) in 2021 (Asian Development Bank 2022). The primary objective of the ETM is to expedite the retirement of coal-fired power plants and replace them with low-carbon energy sources using concessional and commercial capital. It started with Indonesia, the Philippines and Vietnam as pilot countries, and subsequently expanded to Pakistan and Kazakhstan in 2023. The overarching goal is to set a precedent for a scalable coal retirement mechanism that can be applied to plants in various countries.

Significant progress has been achieved in Indonesia, where the ADB entered into a memorandum of understanding with key partners to retire the 660 MW Cirebon-1 coal power plant owned by Cirebon Electric Power (CEP), an independent power producer (IPP). Notably, CEP has an existing PPA with Perusahaan Listrik Negara (PLN), the Indonesian public utility, which is set to expire in 2042. The ADB aims to advance the plant's retirement through refinancing using blended finance. However, the specifics of the financial deal are yet to be discussed, including alternative solutions for replacement with renewable energy sources. In addition, criticism has been raised over social and environmental damages to neighboring villages that are not addressed in the agreement (Albay 2023).

In the other countries, the ADB is currently assessing the feasibility of coal plant retirements under the ETM. For example, in the Philippines, the ADB is assisting the government in formulating an investment plan following the completion of a pre-feasibility study.

ENGIE ENERGÍA CHILE—IDB INVEST

IDB Invest, the private sector arm of the Inter-American Development Bank (IDB) Group, played a vital role in supporting the retirement of coal units in Chile. In 2019, the Chilean government entered into an agreement with Engie Energía Chile, wherein the utility committed to retiring coal units 14 and 15 of the Tocopilla coal plant by May 2024. IDB Invest incentivized the retirement of these two units before the slated 2024 date by using a monetization model for emission reduction resulting from the plant retirements.

Under this mechanism, Engie Energía Chile is reimbursed for the emissions mitigated through the retirement of units before 2024, contingent upon the establishment of clean power generation to compensate for the reduced power capacity. The compensation for avoided emissions is calculated based on a floor price for carbon that can be raised to market levels in case a carbon market is implemented in Chile in the meantime. Consequently, this approach not only facilitates early retirement but also motivates the introduction of carbon markets.

Following IDB Invest's intervention, Engie Energía Chile successfully developed the Calama wind farm in 2021, utilizing blended financing from CIF. Subsequently, in the following year, both coal units were retired (Joan Miquel Carrillo, Hilen Meirovich and Fernando Cubillos 2023).

This initiative proved successful not only in antedating the retirement of coal units—albeit only by two years ahead of the utility's committed date—but also in ensuring their replacement with renewable energy capacity. A key factor in this success was the close collaboration between IDB Invest, the Chilean government and the private sector to align goals and ensure feasibility. As a consequence, IDB Invest is presently exploring options for the early retirement of coal plants in the Dominican Republic, again with funding to be provided through CIF.

ESKOM JUST ENERGY TRANSITION PROJECT—WORLD BANK

In 2022, the World Bank Group approved the \$497 million Eskom Just Energy Transition Project (EJETP) to retire the Komati coal plant in South Africa, operated by Eskom (World Bank 2022). This ambitious initiative involves the repurposing of the coal plant site with renewable energies, specifically 150 MW of solar PV, 70 MW of wind and 150 MW of batteries, aimed at enhancing energy security. As a crucial aspect of the initiative, comprehensive transition plans are in place to support affected workers and communities, mitigating the risks arising from plant closure.

The financing for this project is structured as follows: \$439.5 million is provided through a World Bank loan on commercial terms, \$47.5 million through a concessional loan from the Canadian Clean Energy and Forest Climate Facility (CCEFCF) and \$10 million through a grant from the Energy Sector Management Assistance Program (ESMAP). During the workshop discussions, the predominant reliance on commercial loans in the project's financial structure was a point of criticism, particularly considering Eskom's substantial debt burden.

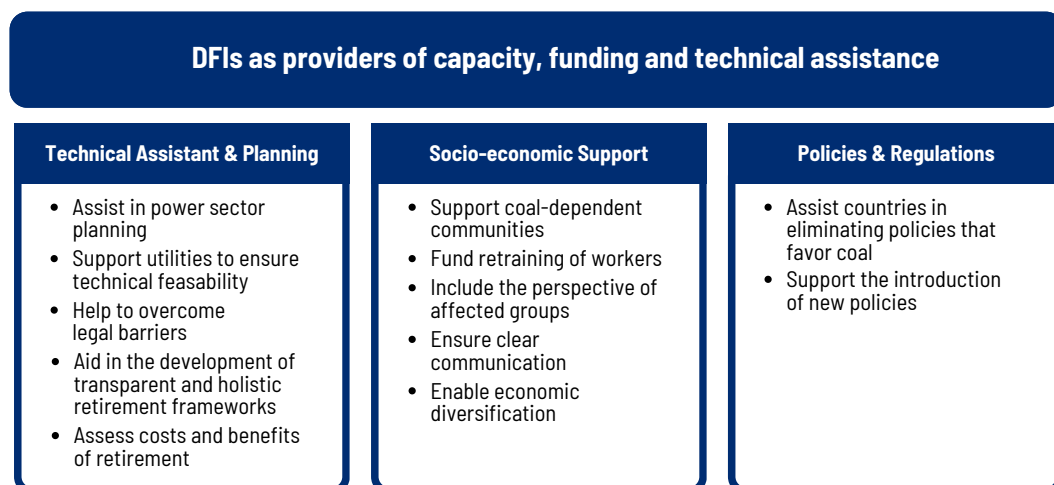
While the retirement of the Komati coal plant is the main goal of the EJETP, the World Bank in addition views the initiative as a demonstration project which can be replicated by other financial institutions in other countries.

Forging Ahead: Contribution to Enabling Environments

DFIs have a unique role to play in fostering an enabling environment for coal transitions in host countries. The available options for DFIs to leverage their knowledge and influence to promote coal plant phase-down through different forms of funding and assistance are outlined in Figure 4. It entails policy options at the government, the entity and the asset level, wherein the entity refers to the owner and / or the operator of the coal facility. Some of the explained policies resemble the options outlined as part of the virtuous cycle in Figure 1, however, this section specifically emphasizes the establishment of an ecosystem to facilitate the temporary or permanent closure of coal plants.

Figure 4: Policy options to provide enabling environments for coal plant phase-down.

ENABLING ENVIRONMENT



Source: Authors' elaboration based on the discussions at the November 2023 workshop.

TECHNICAL ASSISTANCE AND PLANNING

In terms of technical assistance and planning, DFIs have several options to facilitate the premature phase-down of coal plants. The first set of policies relates to long-term power sector planning, a crucial aspect to guarantee that future electricity demand is met, even following the decommissioning of coal plants. This also ensures the selection of low-cost pathways. In this regard, DFIs can assist governments through capacity building and the funding of projects aimed at developing power sector plans. The second set focuses on ensuring the technical feasibility of ceasing operation of coal plants. Utilities can be assisted in feasibility studies and strengthening power grids. The third set of options centers on addressing legal barriers that need to be overcome, such as contractual agreements. DFIs can aid governments in assessing the risks associated with contractual obligations and assist in the process of renegotiating both PPAs and CSAs, such as swapping PPAs from coal to renewables.

Another pivotal aspect involves the assistance provided by DFIs in the development of transparent and holistic long-term retirement frameworks. These frameworks describe which plant should be retired, when and why. To achieve the prioritization of coal plants for future retirements, criteria from three different groups should be considered: techno-economical (i.e., lifetime emissions, costs, efficiency, combustion type), regulatory and contractual (PPAs, CSAs, financial commitments, etc.) as well as social factors (e.g., health benefits, security of power supply, dependency on the respective coal plant, impact on affected workers). Existing literature has identified several potential frameworks to prioritize coal plants for retirement based on a combination of the aforementioned factors (Maamoun et al. 2020; 2022; Edianto et al. 2023; R. Y. Cui et al. 2021). Building on this available knowledge, DFIs can support governments in drafting coal retirement frameworks that are not only feasible, but also aligned with power sector plans.

Assessing the costs and benefits of retirement or other forms of phase-down, for instance by conducting a cost-benefit analysis (CBA), is crucial to prioritize plants. In addition, CBA plays a pivotal role for DFIs and host governments in evaluating the overall benefits of halting operation of specific

plants. It aids in identifying the required capital and determining the specifications of phase-down, including options for replacing coal capacity with renewables. In economic as in social terms, ceasing operation of a coal plant may not necessarily result in net benefits (Jindal and Shrimali 2022; R. Cui et al. 2022). This relates to questions of emission mitigation, impacts on workers and the environment or alternative sources of electricity. The outcome largely depends on the scope of consideration, whether at the local, national or global levels. It is essential to consider not only the direct economic costs but also full local costs, encompassing health and environmental aspects, social costs in terms of effects on workers and communities and the costs associated with the different financing mechanisms. These considerations are explored in a paper currently in development (Erbas, Manych, and Gallagher forthcoming).

SOCIO-ECONOMIC SUPPORT

Anticipating undesirable social and economic aspects resulting from coal plant phase-down *before* they emerge is pivotal to ensure a just transition. DFIs play a key role in helping governments prepare economies and communities to adjust successfully to the energy transition. One important aspect is to incorporate the perspective of communities into the process, ensuring that local voices are heard. Additionally, there is a need to provide clear information about the necessary changes and communicate unambiguously about the negative effects of coal transitions and how they will be overcome. Here, DFIs can both offer and fund retraining opportunities for workers in the coal industry.

Another key aspect concerns the financial impact of phase-downs and especially of early retirements on the economies of low- and middle-income countries. It is of utmost importance to ease negative impacts and ensure economic development on the local, regional and national level. One option for DFIs is to promote new economic activities and economic diversification as part of a broad economic transformation. This approach alleviates the adverse effects of coal transitions on the economy, especially on workers and communities dependent on coal. DFIs can assist governments in these endeavors through capacity building and by providing funding for projects that explicitly address one or several of these challenges.

POLICIES AND REGULATIONS

Policies and regulations are deemed essential prerequisites for the cessation of coal-fired power plants. Currently, many low- and middle-income countries have an existing policy framework in favor of coal, leading to high proportion of coal in these countries' power mix. Therefore, as a first step, DFIs can assist countries in eliminating policies that support coal. Artificial advantages for coal might manifest in policies, such as various subsidies for coal, pass-through provisions for coal price fluctuations and a strong focus on baseload power generation (Manych and Jakob 2021). Removing these policies helps to level the playing field for renewable energies.

In a subsequent step, it is crucial to introduce new policies that form the basis for the phase-down of coal assets. An essential measure is a country wide coal phase-out commitment, such as those by many Powering Past Coal Alliance members. Another valuable option is the establishment of carbon markets, such as Article 6.4 mechanisms from the Paris Agreement or jurisdictional approaches as proposed by the Energy Transition Accelerator (ETA) (Pinko and Pastor 2023). While there are concerns about the additionality and the correct price, carbon markets can enable utilities and investors to monetize avoided emissions and thus incentivize the phase-down of coal plants.

The resulting policy blend is expected to enhance the competitiveness of renewables and simultaneously encourage the early phase-down of coal assets. An important aspect is that the evolving policy landscape will, in turn, alter the political economy in place, generating winning coalitions that

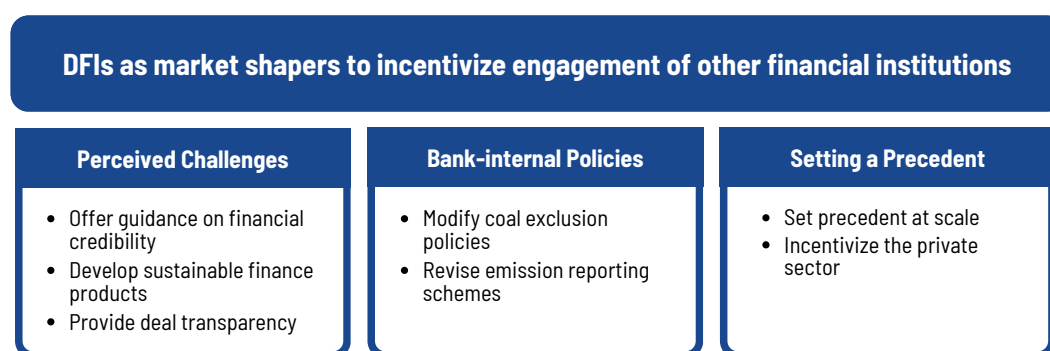
advocate a shift from coal to renewables (Meckling et al. 2015). By providing their expertise and fungible policy loans, DFIs can thus play a vital role in host countries' transition efforts by aiding in the removal of existing policies and the formulation and implementation of new ones.

Forging Ahead: DFIs as Market Shapers

Private and public banks might exhibit hesitancy in supporting the early phase-down of coal plants for a number of reasons. DFIs can play a pivotal role in encouraging and enabling other banks to support DFI-led initiatives or commence their own phase-down approaches. This can be achieved by effectively addressing some of the barriers through various policy options, as highlighted in Figure 5.

Figure 5: DFIs as market shapers to incentivize banks' engagement

BANKS' WILLINGNESS



Source: Authors' elaboration based on the discussions at the November 2023 workshop.

This section provides a detailed exploration of the available policies, organized as follows: The first set of policy options addresses the perceived challenges for banks, notably those related to their reputation. The second set centers on solutions to overcome bank-internal barriers, such as financial reporting. The third set aims to set precedent and demonstrate the viability of early coal plant closures. Through these efforts, DFIs can incentivize other banks, in particular those from the private sector, to replicate such initiatives.

PERCEIVED CHALLENGES

Addressing perceived challenges, such as reputational concerns and financial infeasibility, is paramount in the context of coal. Banks and investors are increasingly distancing themselves from coal-related projects, evident in the adoption of fossil fuel exclusion policies. While this distancing is necessary to curb the construction of new coal plants, it poses a potential obstacle to banks' involvement in phase-down initiatives. DFIs play a crucial role in overcoming this barrier by offering guidance on the credibility of financing temporary or permanent plant closures. Additionally, they can foster engagement by developing sustainable finance products tailored to appeal to financial institutions.

Beyond concerns about reputation, doubts about financial feasibility pose a significant hurdle. To convince banks and investors of the economic rational of financing the phase-down of coal plants,

DFIs can enhance transparency in their deals. This involves providing clear details on the valuation approach and loans specifics, such as interest rates and loan tenors.

BANK-INTERNAL POLICIES

Beyond perceived difficulties, two bank-internal policies might render support unfeasible. One such policy is the adoption of a coal exclusion list, as previously outlined. This policy restricts banks from financing fossil fuels like coal, irrespective of a project's intent. To facilitate coal transitions, banks must ensure that financing the decarbonization of coal plants is not covered by such exclusion lists. DFIs could play a pivotal role by spearheading this policy modification.

The second obstacle lies in a bank's climate reporting metric, wherein funding coal—even for retirement—is incompatible with the goal to reduce portfolio emissions. To address this predicament, different emission accounting schemes can be employed. These include 'Rebaselining,' involving an adjustment to the emissions of the target's baseline year, and 'Bad Portfolio,' wherein emissions from specific projects are kept separate from the overall portfolio (Pinko and Pastor 2023). Once again, DFIs could offer guidance on how to navigate and effectively implement these adjustments.

SETTING A PRECEDENT

One of the most important aspects of DFIs' role as market shapers is to set precedents at scale to encourage widespread coal asset closures, particularly from the private sector. Leveraging their expertise and access to concessional finance, DFIs play a crucial role as pioneering entities, initiating demonstration projects that serve as models for replication by other financial institutions. The World Bank envisions this specific goal through its project in South Africa, intending for it to be replicated by both public and private banks.

The private sector is of utmost importance and is expected to play a significant role in the future (Nedopil, Yue and Volz 2022; Calhoun et al. 2021). DFIs have the capacity to attract interest from the private sector, enabling companies or governments to leverage blended finance opportunities (Carbon Trust, Asia Group Advisors and Climate Smart Ventures 2021). In the long-term, this will encourage the private sector to initiate their own initiatives, with some initiatives already under way, as outlined. Notably, the Glasgow Financial Alliance for Net Zero (GFANZ), a global coalition of private financial institutions, is exploring options to fund coal plant retirement (Glasgow Financial Alliance for Net Zero 2023).

Private capital from these initiatives and banks is essential to scale up as the virtuous cycle gains momentum, given that the primary source of transition finance will need to be the private sector (World Bank 2023c). However, before private finance can expand on a larger scale for coal phase-down, concessional finance from DFIs is required to shape the market.

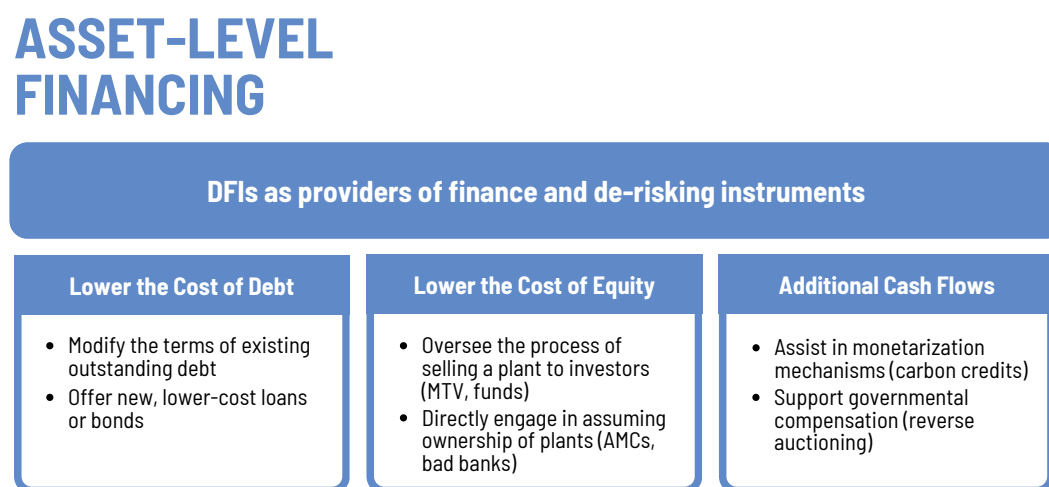
Forging Ahead: Asset-level Financing

Once the necessary enabling environments are established, DFIs play a vital role in funding the phase-down of coal assets. Ceasing operation of plants before they reach their envisaged lifetime without adequate financial support would result in foregone profits for asset owners, posing risks for lenders. Financing mechanisms, i.e., financial products and services, can alleviate the burden on asset owners and mitigate risks for involved banks. However, due to diverse contexts, including ownership structures and existing policies, there is no one-size-fits-all approach to financing from DFIs. Consequently, the choice of the appropriate financing mechanisms becomes critical to ensure

efficient and cost-optimized emission mitigation from coal plants. This section outlines the available mechanisms and explores the associated opportunities for DFIs.

The literature outlines a huge variety of different financing mechanisms that DFIs could deploy for the phase-down of coal plants, with most studies focusing on early retirement (Bhat et al. 2023; Bodnar et al. 2020; Calhoun et al. 2021; Buchner et al. 2022; Nedopil, Yue and Volz 2022). Most of the proposed mechanisms can be grouped into three categories (or a mix thereof), as shown in Figure 6. Two of them aim at bringing down the weighted cost of capital by lowering either the costs of debt, such as refinancing using low-cost capital, or the cost of equity, including the use of managed transition vehicles or portfolio acquisitions. The third group builds on maximizing future cash flows, e.g., delivering alternative or additional revenues.

Figure 6: DFIs as providers of finance to overcome financing challenges on the asset-level



Source: Authors' elaboration based on the discussions at the November 2023 workshop.

Given the variations between countries and plants, the careful selection of the appropriate mechanism becomes crucial. Some of the instruments, including carbon credits and loan guarantees from DFIs, are applicable in all countries, including low- and middle-income countries. Others, such as reverse auctioning and bond securitization, might require developed markets in high-income countries (Pinko and Pastor 2023). The remainder of this section provides detailed explanations of the three groups and outlines how DFIs can utilize the respective mechanisms.

LOWERING THE COST OF DEBT

The first group of financing mechanisms targets the cost of capital by granting asset owners access to lower-cost debt, often referred to as 'refinancing' mechanisms. These instruments can help pay off banks and other investors whose returns are tied to the performance of the respective coal plant. As a result, the operator's reliance on the respective plant's generated income diminishes, facilitating its phase-down.

Options include modifying the terms of existing outstanding debt held by asset owners, achieved through measures such as longer loan tenors, reduced interest rates or debt relief facilitated by DFIs in the fashion of debt-for-nature or debt-for-climate swaps (Bodnar et al. 2020). Another approach to lowering the costs of debt involves offering new, lower-cost loans or bonds, for example those secured by ratepayers or assets, supported by guarantees from DFIs and governments and issued as green bonds. Additional potential financial products encompass key performance indicator

(KPI)-linked debt instruments, such as loans and bonds with favorable terms that are tied to emission reductions resulting from plant decommissioning (Bhat et al. 2023).

DFIs are well positioned to support these mechanisms, enabling the ‘refinancing’ of coal assets. While this could also be achieved by private investors and governments, DFIs hold the advantage of providing concessional finance and loan guarantees. In addition, they can attract private finance, facilitating the availability of blended finance.

LOWERING THE COST OF EQUITY

The second group of financing mechanisms targets the cost of capital by lowering the cost of equity for the asset owners. Similar to the mechanisms outlined, the objective of this group is to reduce the cost of capital in order to lessen the operator’s reliance on income generated by the coal plant. This group, however, does so by lowering the cost of equity, for instance by transferring ownership of the plant.

The most-discussed option involves selling the plant to investors, achieved through mechanisms including Mergers and Acquisitions or managed transition vehicles (MTVs). MTVs are funds designed to acquire assets at a lower cost of equity or at a discount, facilitating early retirement while still yielding returns in a shorter timeframe (Calhoun et al. 2021). The idea behind these ‘buy-outs’ (Clark et al. 2023) is that the new asset owner can operate the plant with lower costs as a result of competitive advantages, such as blended finance tools or technical knowledge (Bhat et al. 2023). One possibility for approaches that target retire and replace would involve two funds: the first acquiring the coal asset to retire it early and the second being a ‘clean energy fund’ that reinvests revenues in renewable energy technologies (Carbon Trust, Asia Group Advisors and Climate Smart Ventures 2021).

An option that was examined as part of the workshop involves asset management companies (AMCs) (Qian forthcoming). AMCs, with their extensive experience in acquiring and managing assets for investors, can effectively enable the early phase-down of units. The necessary steps include reaching agreements with the involved banks for early repayment, managing the temporary or permanent closure of the asset in full cooperation with involved stakeholders and securing profits through the operation of the plant or repayment of loans at a discount. AMCs are complementary to other initiatives and offer specific advantages, such as not requiring high-level agreements, being adept at working with debtors to restructure debt and serving as a ‘bad bank’ that takes on a plant’s emissions before closure.

To lower the cost of equity for coal plant owners, DFIs can both manage and finance funds that acquire the respective coal asset. In addition, DFIs play a crucial role in providing finance or technical assistance to the new owner of the plant to reduce operational costs. Given that the utilization of AMCs has received limited attention for coal asset closure, DFIs can, as an initial step, fund projects to evaluate the feasibility of AMCs to cease operation of coal plants. Of utmost importance is the option for DFIs to take a stake in AMCs and the regulations in host countries that might impede AMC involvement. DFIs can provide support to AMCs in management and financing, while also leveraging their own AMC subsidiaries.

ADDITIONAL CASH FLOWS

The third group of financing mechanisms does not target the cost of capital, but instead focuses on maximizing future cash flows for the asset owner. In contrast to the other two groups, the financing mechanisms outlined in this section do not attempt to make the phase-down of a plant profitable, but rather acknowledge it as a loss-making action. These losses are mitigated with new revenue streams for the asset owner.

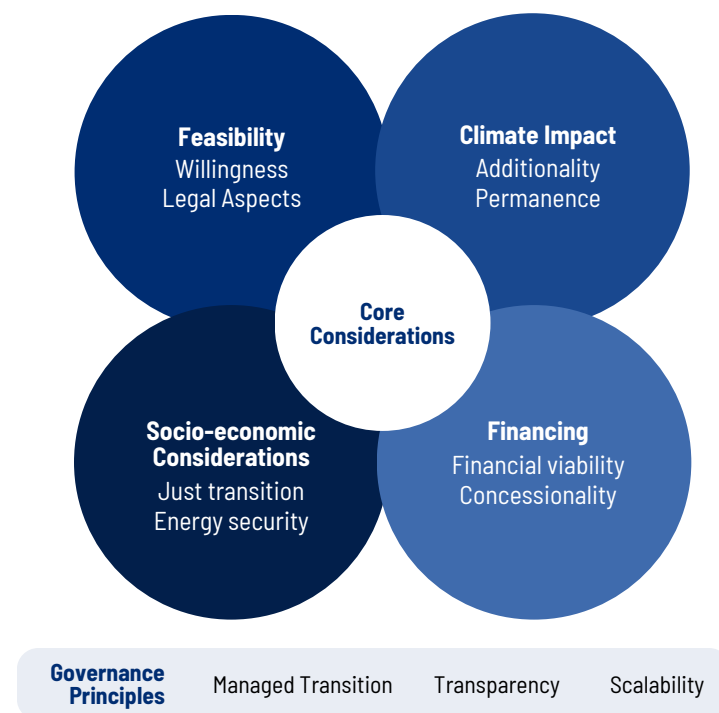
Additional revenue can be generated through monetarization mechanisms including for health benefits or carbon emission mitigation. The former can be achieved through government incentives, while the latter can be pursued via carbon markets or carbon avoidance bonuses for mitigated emissions (Nedopil, Yue and Volz 2022). The mitigated emissions can be translated into carbon credits, also known as transition credits when coal is replaced with renewable energies. These credits can be purchased by companies for voluntary offsetting purposes or by domestic and international governments to facilitate retirements (Monetary Authority of Singapore and McKinsey & Company 2023). Other options include governmental compensation for coal phase-out, such as reverse auctions (assuming that the compensated companies reinvest in low-carbon technologies), or revenue contracts for replacement of energy generation with renewables (Bhat et al. 2023).

To facilitate additional revenue streams, DFIs can bolster the mentioned mechanisms through various channels. As detailed in the previous section, they can aid in policymaking to promote the implementation of carbon markets and in designing safeguarding measures to ensure their intended effects. In addition, DFIs can utilize carbon credits to facilitate retirement, as exemplified by IDB Invest and CIF in Chile. Concerning governmental compensation such as reverse auctions, DFIs can provide funding and streamline the processes.

CONSIDERATIONS AND PRINCIPLES

There are eight essential considerations and three principles that require consideration from DFIs when supporting the phase-down of coal-fired power plants. Based on the literature (Calhoun et al. 2021; Buchner et al. 2022; Pinko and Pastor 2023) and the workshop findings, the following section discusses these considerations (i-viii) and outlines the core principles (I-III) that should guide DFI support for the phase-down of coal plants more broadly and early retirement, in particular, as shown in Figure 7.

Figure 7: Considerations and governance principles



Source: Authors' elaboration based on a presentation by GFANZ at the November 2023 workshop.

FEASIBILITY

A prerequisite for coal transitions is the feasibility of ceasing the operation of coal units, a determination significantly impacted by the legal, socio-economic and political barriers to transition. Two primary considerations involve the willingness of key actors like governments and the prevailing political and legal contexts.

- i. The potential phase-down of plants hinges on actors' **willingness** to endorse such actions. Depending on the specific plant, numerous stakeholders might need to consent to measures, such as mothballing or retirement, including governments, operators, owners, utilities, banks and investors. In countries that require coal plant closures as showcased in Figure 2, public actors like governments and SOEs are oftentimes involved in coal plants, as seen in countries like Indonesia. Public actors' willingness may be contingent on factors such as energy security, public support, the political economy in place and the policy landscape. DFIs can play a role in incentivizing the decarbonization of coal units to secure the cooperation of pertinent stakeholders.
- ii. Ensuring the **legal feasibility** of decarbonizing coal plants is imperative for DFIs. As elucidated, contractual agreements like PPAs and CSAs can pose obstacles to transition plans. Furthermore, financing mechanisms, especially those involving the transfer of coal assets from the initial owner to a new entity, may encounter legal challenges. Therefore, it is crucial to establish an enabling regulatory environment concerning contractual agreements to cease operation of coal plants, especially when retiring the plant.

CLIMATE IMPACT

One of the main motivations for phasing down coal is its positive impact on the climate. The avoidance of emissions resulting from lower capacity factors or closure of a coal unit significantly impacts CBA outcomes, thereby shaping the determination of the value of financial support. The soundness of the proposition to phase-down coal plants early, from an emissions mitigation perspective, hinges on two critical factors: the additionality of emissions reductions or avoidance, and their permanence.

- iii. It is imperative to identify and ensure the **additionality** of emissions mitigated through early coal phase-down actions. This involves understanding how long the respective coal plant would have operated without intervention, which can be challenging to ascertain. An important aspect to consider regarding the additionality of emission savings is that coal plant operators may view phase-down plans as an opportunity to temporarily expand operations in the short-term, resulting in increased emissions. Carbon credits can be effective when they help to make ceasing operation of coal units viable through an additional revenue stream while supporting an overall reduction in emissions.
- iv. When planning the retirement of a coal unit it is key to ensure the **permanence** of emission mitigation, considering broader transition impacts that the shutdown will have on the long-term. The coal phase-down should facilitate a clean energy transition to remain below the 1.5°C warming threshold. Therefore, in addition to phasing out coal, investments in clean alternatives are imperative as outlined in the virtuous cycle in Figure 1. Natural gas, for instance, might not necessarily lead to emission mitigation due to substantial methane emissions and could lock in fossil fuels for decades. Carbon markets and jurisdictional carbon crediting standards can help to guarantee that emissions are permanently mitigated. This strategic approach ensures that coal plant retirements can realize their full transformational potential.

SOCIO-ECONOMIC CONSIDERATIONS

Coal phase-down and retirement can potentially have detrimental effects on workers, communities, regions and even nations. Consequently, it is imperative to carefully consider social and economic aspects before engaging in asset closure. These considerations should focus on aspects like just transition and securing a reliable power supply.

- v. Phasing down coal plants ahead of schedule may result in negative impacts that necessitate careful interventions to ensure a **just transition**. On a macro scale, it is central not to compromise the economic growth and development of countries and regions that are often linked to coal. On a more micro level, ceasing the operation of coal units can disproportionately affect vulnerable groups. Transition financing from DFIs can play a vital role in mitigating risks for workers and communities, such as through diversification of industries, enhanced social safety nets and retraining of workers. The required spending can be included in the CBA to accurately estimate the real costs and benefits of coal transitions. Recommended measures include initiating proactive communication with communities and local stakeholders to determine their needs. Furthermore, DFIs can assist governments in formulating gender-based just transition frameworks, which should be implemented *before* commencing measures to reduce emissions from coal plants.
- vi. It is essential to guarantee that regional and national **energy security** for households and industries is not compromised by coal transitions. Some low- and middle-income countries such as South Africa are already grappling with electricity supply challenges, which might be further exacerbated by the reduction of coal capacity. In addition, captive plants provide electricity directly to end users, whose energy consumption would be at risk. Several options exist to ensure sufficient supply of electricity, including the expansion of renewable energies. DFIs can tie their support for plant closures to the replacement with renewables, as demonstrated by IDB Invest in Chile. In addition, rather than simply decommissioning a plant, there is the possibility of repurposing it with solar and wind capacity or mothballing the plant. These alternative strategies can ensure energy security while reducing emissions.

FINANCING

A key component of transition support from DFIs is the financing of the coal plant phase-down, and various mechanisms lay to their disposal. Assisting governments and companies in their transition endeavors ultimately represents an economic decision undertaken by DFIs. Therefore, they must assess the viability of their financial commitments and the repayment capacity of countries and entities. Concessionality plays a pivotal role.

- vii. In both economic and social terms, halting the operation of coal plants may not inherently yield net benefits. This consideration involves factors, such as emission mitigation, impacts on workers and alternative sources of electricity. The outcome largely depends on the scope of consideration, whether at the local, national, or global levels. CBAs serve as a valuable tool to compare different alternatives, defining their value as either net benefits or net costs. This analytical approach helps answer essential questions regarding the **financial viability** of financial support for coal transitions and the overall economic benefits.
- viii. Many low- and middle-income countries that need to cease operation of coal units find themselves in severe debt distress, or such distress is anticipated in the near future. Similarly, owners of coal plants, especially SOEs such as Eskom and PLN, are facing financial challenges. Increasing the debt of countries or these respective companies might not be helpful, or even possible, given present balance sheets. A potential solution lies in **concessionality**. Grants or loans with longer-term maturity and lower interest rates bend down

the cost of capital, reducing the fiscal stress on countries and utilities. Concessional finance may also significantly affect the viability of coal plant closures and help to give effect to the principle of equity in reducing GHG emissions across nations.

GOVERNANCE PRINCIPLES

The effective governance of phase-down financing relies on three core principles to ensure the desired outcome and broader benefits to transition efforts. These guiding principles encompass a managed transition, transparency and scalability.

- I. The temporary or permanent closure of coal units should not happen in an arbitrary fashion, but rather following elaborate retirement plans as part of a **managed phase-down**. These plans can incorporate retirement schedules established on transparent criteria and frameworks, the identified financing mechanism, the necessary financial support per unit, costs and benefits analyses, impacts of plant decommissioning and the necessary transition financing to ensure a just transition. DFIs play a pivotal role in governing the phase-down process, ensuring adherence to these elaborate plans.
- II. The entire process of providing financing for the decarbonization of coal plants benefits from **transparency** at every step, including the rationale behind the selection of a particular coal unit, the chosen financial mechanisms, the methodology of determining the total financing amount and the anticipated climate and social impacts. DFIs can proactively enhance transparency by openly disclosing their support and envisaged effects, thereby ensuring accountability, improving reputation and facilitating scalability. The absence of transparency may raise concerns about legitimacy. By adhering to these approaches, DFIs can leverage transparency to generate political and social support and attract investment from the private sector.
- III. For retirement projects to yield significant impact, a multitude of such projects must be implemented by both private and public banks. DFIs play a crucial role as first-movers and market shapers, setting precedents. However, demonstration projects can only be replicated by other banks if the **scalability** of transition endeavors is ensured. Scalability involves guaranteeing that the approaches can be replicated for other plants within the same market and in different contexts, such as in other countries. While it is essential to consider country and asset-specific aspects, DFIs should aim for projects that are transferrable to various contexts.

POLICY RECOMMENDATIONS

The workshop's outcomes can be distilled into three policy recommendations for DFIs concerning their role in the phase-down of coal-fired power plants:

1. **A just, orderly and equitable phase-down of existing coal infrastructure should form a centerpiece of DFIs' climate strategies, supporting governments in accelerating renewable energy generation and economic diversification.** DFIs should implement holistic strategies that effectively organize and coordinate their support of governments, encompassing activities such as energy sector planning and risk mitigation associated with clean energy. The decarbonization of coal plants has to be recognized as an integral part of these transition support plans. In this regard, DFIs should establish dedicated programs specifically addressing emissions from existing coal plants in collaboration with governments, the private sector and civil society to ensure sustainable and efficient coal transitions. These plans can ensure economic development and a just, orderly and equitable energy transition.

2. **DFIs should support an enabling environment for coal plant phase-down and shape the market for other financial institutions to engage in coal plant decarbonization.** DFIs play a pivotal role in facilitating coal plant closures and other measures to significantly reduce emissions from coal assets by actively supporting conducive environments in host countries. This includes providing technical assistance to host governments for developing coal retirement frameworks, offering socio-economic support for economic diversification and targeted assistance to workers and communities and aiding in policy-making and regulation adaptation. Furthermore, DFIs serve a critical function as market shapers, incentivizing other private and public financial institutions to participate in coal plant retirement or mothballing endeavors.
3. **Strategies for the phase-down of coal plants should be scalable and built around concessional and grant financing mechanisms.** DFIs have to choose from a variety of innovative financing mechanisms based on country-specific attributes like policy frameworks and energy security, along with asset-specific factors such as ownership and PPAs. These mechanisms might necessitate internal DFI policy adjustments regarding fossil fuel investment exclusion lists, emission accounting schemes and limits to concessional finance. The importance of concessional financing is pronounced amid escalating debt levels in both countries and utilities, with the potential to significantly impact the success of coal plant phase-down. Acknowledging their pioneering roles, DFIs should prioritize transparency and strive for the scalability of their approaches, facilitating replication across diverse contexts and countries.

In line with these recommendations, DFIs can make use of their expertise and experience to assist low- and middle-income host countries with their low-carbon transition endeavors, in particular through support for the phase-down of coal units.

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APPENDIX

Many MDBs have introduced climate finance commitments and fossil fuel exclusion lists, as shown in Table 4.

Table 4: MDBs' and NDBs' green policies split into commitments to green finance and exclusion of fossil fuels

MDB / NDB	Climate Finance Commitment	Fossil Fuel Exclusion List
African Development Bank (AfDB)	<ul style="list-style-type: none"> Allocating 40% of project approvals to climate finance by 2021, with equal proportions for adaptation and mitigation (achieved 45% in 2022). Mainstreaming climate change and green growth into all Bank investments by 2021. Climate finance for low-income African countries of \$25 billion by 2025 (achieved \$3.6 billion in 2022). 	<ul style="list-style-type: none"> Coal altogether. Oil and gas exploration activities.
Asian Development Bank (ADB)	<ul style="list-style-type: none"> At least 75% of the number of ADB's committed operations (on a 3-year rolling average) will be supporting climate change mitigation and / or adaptation by 2030. Climate finance from ADB's own resources to reach \$100 billion cumulatively from 2019 to 2030 (mitigation \$66 billion; adaptation \$34 billion). 	<ul style="list-style-type: none"> Coal mining, processing, storage, transportation and any new coal-fired power generation. Natural gas exploration or drilling. Upstream or midstream oil projects. Selective in support for midstream and downstream natural gas and downstream oil projects.
Asian Infrastructure Investment Bank (AIIB)	<ul style="list-style-type: none"> More than 50% of approvals should be for climate finance by 2025 and full alignment of financing operations with the Paris Agreement. 	<ul style="list-style-type: none"> New coal-fired power and heating plants and projects that are functionally related to coal. Natural gas upstream activities. Oil sector investments.
European Bank for Reconstruction and Development (EBRD)	<ul style="list-style-type: none"> Double the mobilization of private sector climate financing by 2025. Become a majority green bank by 2025 Align all its operations with the goals of the Paris Agreement by 2023. 	<ul style="list-style-type: none"> Thermal coal mining or coal-fired electricity generation capacity. Upstream oil exploration. Upstream oil development projects (with few exceptions).
European Investment Bank (EIB)	<ul style="list-style-type: none"> Support €1 trillion of investments in climate action and environmental sustainability from 2021 to 2030. Increase the share of financing dedicated to climate action and environmental sustainability to exceed 50% of the operations in 2025 (achieved 58% in 2022) Align all its new operations with the goals of the Paris Agreement by the end of 2020. 	<ul style="list-style-type: none"> Power generation technologies resulting in GHG emissions above 250 gCO₂ per kWh of electricity generated. Production of oil and natural gas and traditional gas infrastructure. Large-scale heat production infrastructure based on unabated oil, natural gas, coal or peat.
Inter-American Development Bank (IDB)	<ul style="list-style-type: none"> Align 100% of new operations with the Paris Agreement goals by January 2023. Deliver a total of \$24 billion in green and Climate Finance 2022-2025. \$150 billion in direct and mobilized finance over the next decade. 	<ul style="list-style-type: none"> Thermal coal mining and coal-fired power generation. Upstream gas exploration and development projects (with few exceptions). Upstream oil exploration and development projects.
World Bank Group	<ul style="list-style-type: none"> Increase delivery to an average of 45% of total World Bank Group financing for climate by 2025. 50% of climate finance will support adaptation. Align with Paris goals by July 2025. 	<ul style="list-style-type: none"> Coal-fired power generation (with exceptions). Upstream oil and gas sectors (with exceptions).

MDB / NDB	Climate Finance Commitment	Fossil Fuel Exclusion List
Banco Nacional de Desenvolvimento Econômico e Social, Brasil (BNDES)	<ul style="list-style-type: none"> Alignment with the Paris Agreement to limit warming to 1.5 and Brazil's carbon neutrality by 2050. 	<ul style="list-style-type: none"> No coal or oil based thermoelectric generation.
Development Bank of Southern Africa (DBSA)	<ul style="list-style-type: none"> Contribute to target to achieve net zero emissions by 2050. 	<ul style="list-style-type: none"> No new fossil fuel investments which are not part of a clear and unambiguous Just Transition plan to a decarbonized future.
PT Sarana Multi Infrastruktur, Indonesia (PT SMI)	<ul style="list-style-type: none"> Increase the number of financings / outstanding related to climate change mitigation minimum 10% by 2024. Increase the renewable energy financing portfolio with an outstanding up to IDR 3 trillion by 2024. 	<ul style="list-style-type: none"> Reduce the number of financings / outstanding of coal-fired power plant projects maximum 5% by 2024.

Source: Banks' published policies.

