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WORLD ECONOMIC FORUM

Scaling Financing for Coal Phase-out in Emerging Economies

WHITE PAPER

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Foreword

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The task of transitioning from coal to cleaner energy sources has never been more urgent. With coal power generation in 2024 expected to have reached record levels according to the International Energy Agency (IEA), the path to a low-carbon future depends on accelerating this shift. Yet, financing coal phase-out remains one of the most complex and pressing climate challenges of our time.

This paper, developed through expert consultations under the World Economic Forum's Coal-to-Clean Initiative, offers critical new insights into scaling financing solutions for coal retirement in emerging and developing economies (EMDEs).

It highlights the important role coal retirement mechanisms (CRMs) based on financial restructuring can play in helping retire some plants early. These mechanisms offer a simple and replicable approach, providing strong incentives for asset owners concerned about transition risks. By enabling early equity payouts – potentially tied to reinvestment in renewables – re-gearing CRMs can make the business case more attractive and help expand the pipeline of coal-fired power plants (CFPPs) willing and eligible for early retirement, a key bottleneck in accelerating the coal-to-clean transition.

Of course, financial restructuring is just part of the suite of financial tools and policies which will be needed to accelerate this transition. Governments can play a crucial role by setting clear long-term goals backed by policies which impose costs on asset owners and address barriers to clean energy scale-up. Meanwhile, concessional financing remains key to crowding in private capital, particularly given that few demonstration projects exist, while larger and newer coal assets, which still have substantial capital investments to recoup, may require mechanisms like transition credits to facilitate early closure.

Further testing and discussion of these approaches are crucial to scaling the coal-to-clean transition. The World Economic Forum's Coal-to-Clean Initiative looks forward to working with its community to develop the broad suite of financing tools and policies, and the investible financing solutions needed to accelerate coal phase-out, while ensuring energy security and safeguarding the rights and interests of workers and communities.

Executive summary

Coal accounts for 36%[1] of total global power generation, making up far higher shares in many emerging and developing economies (EMDEs) – coal provided half of South-East Asia's total electricity in 2023, for instance.[2] Without urgently investing in alternatives and scaling back coal-related emissions in EMDEs, the existing global fleet of coal assets will consume half the world's remaining carbon budget to keep average warming of 1.5 degrees Celsius within reach.[3]

Yet, phasing out coal and scaling investments in replacement technologies is a complex challenge. It includes the need to build replacement capacity and invest in grids; to secure buy-in from system operators and plant owners, as well as upfront investments in jobs and communities; and to rapidly grow overall demand for energy. While coal phase-out must be accelerated to achieve global climate targets, failure to deal with energy security and affordability concerns or provide impacted workers and communities with new jobs and economic opportunities will only serve to slow the pace of the transition.

This paper, a result of expert consultations and analysis undertaken by the World Economic Forum's Coal-to-Clean Initiative, acknowledges the importance of addressing these issues, but focuses mainly on making more financing available for coal phase-out in EMDEs. The goal of this paper is to contribute something new to this discussion by confirming two core hypotheses:

– Coal retirement mechanisms (CRMs) can help retire some kinds of plants early, with lesser need for concessional capital.

– Structured the right way, CRMs can provide a business case for asset owners to consider early retirement.

The analysis showcased in this paper, based on 10 coal-fired power plants (CFPPs) in the Philippines, highlights the potential for tried and tested financial engineering approaches – namely financial re-gearing and loan tenor extension – to help retire some kinds of plants early, without using large amounts of concessional financing. This is equivalent to the coal capacity retirement achieved in the few phase-out transactions delivered in EMDEs to date.

These approaches have the additional advantage of facilitating an early payout to the CFPP owner in return for early retirement, equivalent to between 20% and 40% of the asset's remaining value. This could be linked to renewables investment or include commitments that the funds will not be reinvested in fossil fuels. Not only can this provide an important incentive to transition a CFPP, it can also help an asset owner mitigate the risk of stranded assets and diminished revenue flows.

These findings point to the value in further exploring how financial restructuring can help retire some types of plants early (for example, project financed CFPPs with substantial debt remaining). Accelerating the coal-to-clean transition overall, however, will require a broader set of government policies and financial tools. These include government commitments to transition, policies and regulations that make coal less valuable and more costly going forward, and addressing barriers to scaling up renewables. Many CFPPs will also require additional financing, including from transition credits and concessional capital, to bring forward retirement dates and crowd in private investment.

This analysis paves the way for the second phase of the Coal-to-Clean Initiative, a collaboration between the Centre for Energy and Materials and the Giving to Amplify Earth Action (GAEA) programme. It provides a foundation on which to test these concepts and develop investible and scalable financing vehicles to accelerate the coal-to-clean transition in EMDEs.

Introduction

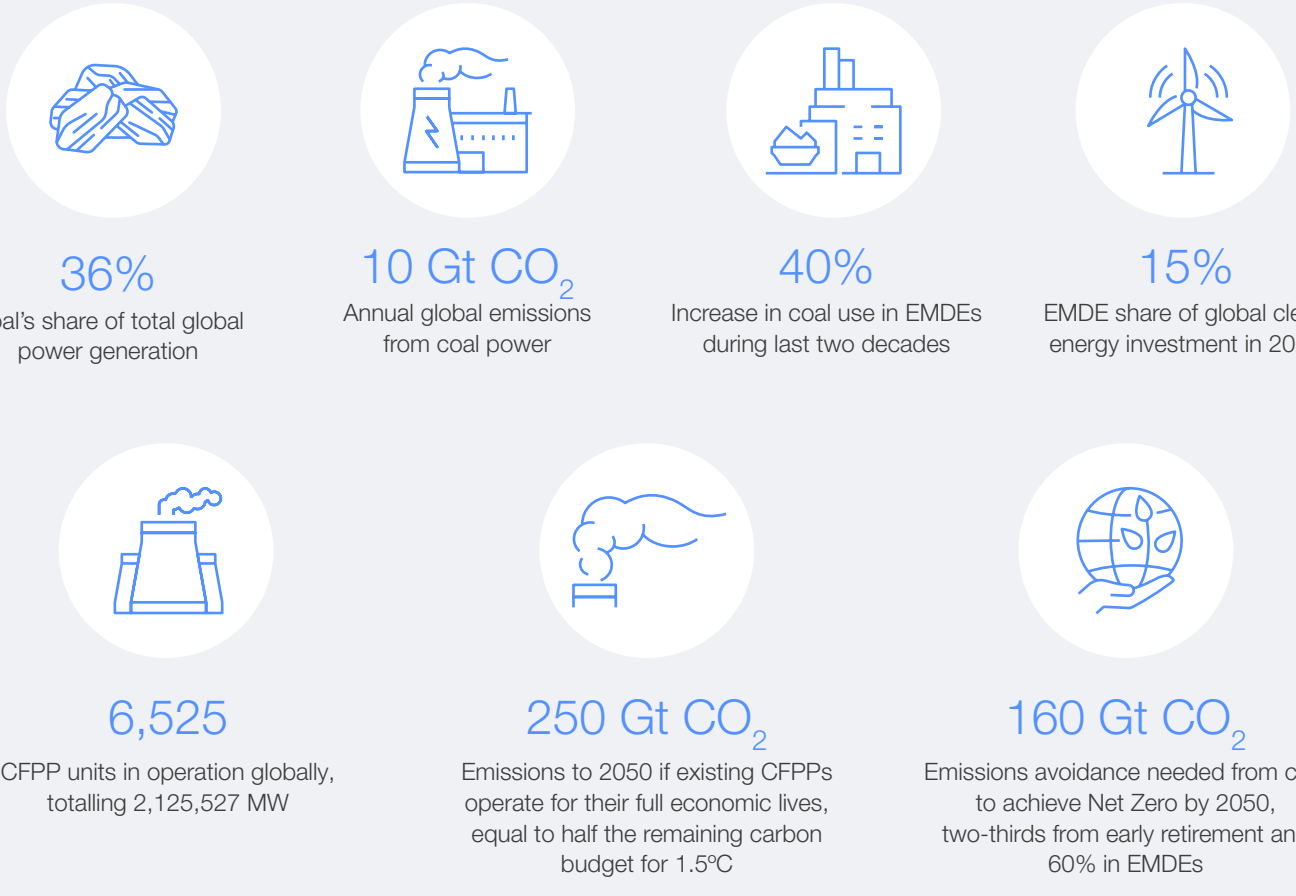
Coal-fired power generation continues to play a major role in electricity markets around the world, providing more than one-third of the total global power generation and pumping over 10.3 gigatonnes of carbon dioxide (Gt CO_2) into the atmosphere every year. This is equivalent to about 28% of total annual global CO_2 emissions in 2023.[4] This results in profound health impacts for people living near coal-fired power plants (CFPPs).[5] Yet, despite the environmental, climate and health dangers posed by coal, many countries have been slow to transition given the ready availability and affordability of coal power, as well as its capacity to provide baseload power generation.[6]

The challenge is particularly profound for many emerging and developing economies (EMDEs). While coal use in advanced economies has declined by 40% over the last two decades, it has more than tripled in EMDEs.[7] These countries now make up 85% of global coal consumption, with India and China alone accounting for over two-thirds.[8]

In addition to environmental and health costs, continued reliance on coal power could have a net negative impact on countries slow to transition. Not only will they forego the economic benefits of cleaner forms of energy – renewables are now cost-competitive with coal in almost all locations around the world – but trade competitiveness may also be undermined as climate policy instruments such as the European Union's (EU) Carbon Border Adjustment Mechanism (CBAM) impose tariffs on carbon-intensive exports.

At the same time, international companies are also increasingly looking for clean energy to power their operations as a key criteria for investing in countries. Governments and companies may also find their access to affordable borrowing constrained if their coal operations prevent them from meeting borrowers' increasingly ambitious environmental and climate requirements.

FIGURE 1. **The coal-to-clean challenge in numbers**



CFPPs in EMDEs tend to be insulated from market competition by long-term power offtake contracts, meaning they will continue to generate even when cheaper alternatives are available. Many of these countries have also struggled to attract the investments they need to scale up clean energy alternatives capable of replacing the role coal power generation plays in their electricity systems. In 2023, for instance, EMDEs accounted for just 15% of the world's clean energy investment, despite making up a third of global GDP and two-thirds of the world's population (these figures do not include China).[9]

Socio-economic considerations also present important challenges to accelerating coal phase-out. Coal often provides a major source of employment, income and economic activity at a local level. Transitioning away from it requires long-term commitment to growing viable alternatives and creating new economic and employment opportunities for those impacted. A just transition is essential to ensure that workers and communities dependent on coal are supported through this shift, with access to retraining, new jobs and sustainable livelihoods.

While ending construction of new CFPPs is key to advancing global climate goals, it will also be necessary to close many already in operation. Operating the existing global fleet of CFPPs to the full extent of their potential lifespans would emit 250 Gt CO_2 emissions to 2050, accounting for about half the remaining carbon budget for a 1.5-degree future.[10] The International Energy Agency (IEA) estimates that a 160 Gt CO_2 reduction is needed in coal emissions to achieve net-zero global emissions by 2050. Some two-thirds of this needs to come from CFPP retirements,[11] and over 60% in EMDEs.[12]

FIGURE 2 **Core challenges in CFPP phase-out**

Source: Coal-to-Clean Initiative

1 Bridging the economic gap: Financing levers for early phase-out

The challenge of closing large numbers of CFPPs early in EMDEs, many of which are relatively young, is substantial. Early phase-out necessitates bridging the economic gap between the value a plant would have generated in a business-as-usual (BAU) scenario and the value it will deliver if its retirement date is brought forward. The younger the plant is, the harder it is to retire as the return on investments is due over its expected lifetime. Dealing with this fundamental issue is key to incentivizing asset owners to engage in retirement discussions. Yet, the overall cost of closing this gap could be enormous.

In recent years, several pilot initiatives have identified financing mechanisms to deal with this issue. These aim to enable early retirement while ensuring asset owners are not negatively impacted financially. Broadly, these pilot transactions rely on one of two means to do this:

- **Lowering the cost-of-capital:** Reducing an asset's overall cost of capital, also known as the weighted average cost of capital (WACC), reduces the amount of interest to be paid. This frees up cash flows, enabling an asset owner to realize equity value earlier, thereby facilitating earlier closure of the plant. Reducing the cost of capital often relies on blending commercial and concessional financing (the latter is financing on below market rates from institutions such as multilateral development banks).

  The ACEN South Luzon Thermal Energy Corporation (SLTEC) transaction in the Philippines, and the Asian Development Bank (ADB)'s planned Cirebon-1 transaction in Indonesia under its Energy Transition Mechanism (ETM), are working to facilitate early retirement in this way (see Box 1).

- **Transition credits:** A new class of carbon credits designed specifically to support early retirement of CFPPs, transition credits compensate asset owners for the economic value they forego when they retire earlier than planned. Buyers of transition credits are likely to be corporates interested in voluntary carbon offsets, as well as governments pursuing decarbonization goals.[13]

  Rockefeller Foundation and the Monetary Authority of Singapore (MAS) are working to use transition credits to bring forward the retirement date of the SLTEC asset beyond the date achieved through the original ACEN transaction (see Box 1).

BOX 1 **Pioneering transactions provide a route map for early retirement**

Several pilot transactions demonstrate the viability of CFPP early-retirement approaches in real-world contexts:

- In Chile, a $125 million loan package from the Inter-American Investment Corporation (IDB Invest) and Clean Technology Fund (CTF) incentivized the energy company Engie to shut down two CFPP units in Tocopilla in northern Chile two years ahead of schedule. It did this by lowering the interest rate of the loan, in return for emissions avoided from the CFPP shutdown, to help fund a 162MW wind power plant.[14]

- In Indonesia, the 660 MW Cirebon-1 CFPP could be retired nearly seven years earlier than planned under the Asian Development Bank's (ADB) energy transition mechanism (ETM) using refinancing. A non-binding framework agreement was signed at COP28 by ADB, Indonesia's power utility PT PLN, independent power producer (IPP) PT Cirebon Electric Power and Indonesia Investment Authority, the country's sovereign wealth fund. This set the groundwork for a deal currently in negotiation, which could see the plant retired in 2035 instead of 2042.[15]

- In the Philippines, in 2022, ACEN, the energy arm of Ayala Group, announced the divestment of the SLTEC CFPP, using refinancing with cheaper debt and equity from Philippines-based banks and institutional investors. The transaction brings forward the plant's retirement date to 2040.[16] ACEN, in partnership with Rockefeller Foundation and MAS, is now working with the Coal to Clean Credit Initiative (CCCI) to further accelerate the closure date to as early as 2030 using transition credits.[17]

2 Strategic use of concessional financing: Insights from the Philippines

Given the volume of operational CFPPs worldwide, scaling coal phase-out using concessional capital will be challenging. Similarly, transition credits may take time to scale and could also be limited in availability.

To help address this challenge, the analysis underpinning this paper set out to stress-test opportunities and limitations in CFPP phase-out mechanisms using cost-of-capital levers, assessing also the options to limit concessional financing as far as possible. The analysis is based on publicly-available data from 10 real-life plants in the Philippines.[18]

2.1 Overview of the analysis

The analysis explores how refinancing with debt can maximize emissions reduction from coal plant retirements while minimizing the use of concessional finance. It looked at the maximum abatement achievable for these plants given a set of market assumptions outlined below.

To do this, it assessed abatement impacts of a relatively large tranche of highly concessional debt (at 1% interest rate) in a blended capital stack (containing commercial debt and up to 31% concessional debt), combined with other refinancing tools capable of reducing overall cost of capital including gearing increase and tenor extension of debt (see Box 2 for explanation of these financial engineering options).[19]

The analysis then worked back to explore how much abatement remains achievable when the concessional component of the debt is progressively reduced to zero, leaving alternative financial engineering options to deliver the decarbonization impact (see Box 2 for explanation). In all scenarios, loan tenor extension is maximized to the full extent possible.

FIGURE 3 | **Illustration of financing approaches analysed**

Refinancing with cheap debt and re-gearing delivers early payout, while enabling early retirement and delivering the same net present value vs business as usual (BAU)

Note: 1. Weighted average cost of capital; **2.** Senior debt is debt that gets priority in repayment

Source: Coal-to-Clean Initiative illustration

The analysis also considered the need to build a business case for asset owners to commit to early retirement. It therefore prioritized delivery of equivalent equity value to the asset owner against a business-as-usual scenario (no financial loss), and included an upfront payout to the asset owner in return for agreeing to retire early. This early payout can support asset owners in mitigating exposure to risks stemming from increased competition from other power generation types as the transition unfolds, and increase the value delivered by the transaction by monetizing a portion of the asset's equity value earlier than previously anticipated (see Box 3). It could also be linked to commitments to re-invest in clean energy, or not to re-invest the funds in fossil fuels.

Three financing levers were considered to lower an asset's overall cost of capital, and thereby enable early retirement:

1. **Refinancing existing debt with new, lower cost debt,** achieved by blending concessional and commercial financing.
2. **Financial re-gearing** by replacing more expensive equity with debt.
3. **Extending the payback period of new debt** provided to the asset compared with its existing debt to two years before the early retirement date (loan tenor extension).

BOX 2 | **Cheap debt, gearing and loan tenors – How financial engineering enables early retirement**

Injection of cheaper debt, increased asset gearing and lengthened loan tenors work in different ways to enable early retirement.

Refinancing with cheaper debt

Refinancing with cheaper debt lowers the debt servicing burden for an asset owner. This frees up cash flow, which can be used for alternative purposes, including making dividend payments earlier than previously possible. Asset owners can realize equity value faster while still meeting their debt obligations.

Financial re-gearing

Increasing the ratio of debt to equity in an asset's capital structure lowers overall cost of capital because debt is almost always cheaper than equity. As CFPPs operate, they gradually pay off their debt, raising the overall share of equity in an asset, and increasing the opportunity for re-gearing.

Where possible, analysis in this paper has taken publicly available information on gearing ratios at commissioning. Where not available, it has assumed a flat 70:30 debt-to-equity split. The model has then adjusted the gearing ratio based on assumed debt repayments made by the asset owner between commissioning and the time of the early retirement deal (January 2025).

In all the simulations, a maximum 80% debt ceiling is allowed, but gearing increase possibilities for all plants are limited to well below this threshold due to cash flow limitations (cash flows have to satisfy the requirements of 1.25x debt service coverage ratio (DSCR) and one-year debt service reserve account (DSRA) in the simulation). Increasing gearing may entail additional risk for some lenders, requiring guarantees or other payment assurances.[20]

Extending loan tenors

Spreading debt repayments across a longer payback duration frees up cash flow. As with cheaper debt, this cash flow can be used to monetize equity value by providing dividend payments earlier, enabling an asset owner to bring forward a plant's retirement date.

Debt tenors for most CFPPs at financial close in EMDEs mirror offtake contracts. The modelling has assumed extending the tenor of new lending to the plant until two years before its (new) retirement date. For some lenders, this may require guarantees or other payment assurances.

The plants in the dataset comprise a total capacity of 3,275 MW and represent about one quarter of the Philippines' total CFPPs.

FIGURE 4 | **Context of simulations – 10 plants in Philippines**

Philippines

10
plants in the Philippines analysed

3,275 MW
total capacity

55-70%
current assumed gearing

Age of plants	Number of plants	Total capacity
5 to 8 years	3	1,468 MW
8 to 14 years	3	789 MW
14 to 18 years	4	1,018 MW

Based on straight-line paydown from the initial gearing at commissioning

Analysis of CRM[1] facility application scenarios

CO_2 abated (metric tonnes)	Debt rate concession				
Gearing increase	0.0%	0.5%	1.0%	1.5%	2.0%
0%					
5%					
10%					
15%					
20%					
25%					
30%					

Note: 1. Coal retirement mechanism

Source: KPMG

To provide a baseline against which the retirement date of the plant and its emissions could be compared, the analysis included a set of assumptions as to what would happen to a CFPP as the Philippines' energy transition unfolds through to 2050.[21] This reflects the changing role of coal power as cleaner alternatives increasingly provide electricity more consistently and cheaply. It also reflects the hypothetical impacts of increasingly stringent government policy and regulations on generation and revenue.

FIGURE 5 **Assumptions included in the analysis**

5 years' extension is presumed on duration of power supply agreement in business-as-usual case

Capacity reduction post expiry of power supply agreement is 30% in load factor

Spot market tariff is based on Aurora central average

Early retirement transaction date is January 2025

Existing loan tenor is assumed to be equivalent to longest active power supply agreement

Repayment duration of debt = remaining plant life minus tail period[1]

Repayment is sculpted with a minimum DSCR of 1.25 and one year DSRA provision[2]

Note: 1. The tail period is the time between the repayment of project debt and the end of the project's operational life, providing a buffer for risk mitigation and additional financial returns. **2.** DSCR (debt service coverage ratio) is a financial metric that measures a company's ability to cover its debt obligations with its operating income; DSRA (debt service reserve account) is a reserve fund established to ensure sufficient funds are available to cover a borrower's debt payments in case of cash flow shortfalls.

Source: Coal-to-Clean Initiative

In the model's BAU scenario, a CFPP's lifespan is capped at 40 years or 2050, whichever comes first, after which it is assumed the plant would retire anyway. Most plants in the Philippines have agreed PSAs, but not for the full remaining duration of their economic lives. A PSA extension of five years at the same tariff as the CFPP's current PSA(s) is also assumed. After this, the CFPP moves onto the Philippines Wholesale Electricity Spot Market (WESM) where it competes against other sources of power based on cost and availability. The price drops to a middle-of-the-road WESM forecast and utilization drops by 30%.[22] This reflects rising costs for the asset owner to keep the plant operating as it gets older, as well as declining competitiveness against other power generation.

2.2 Findings

Scenario 1

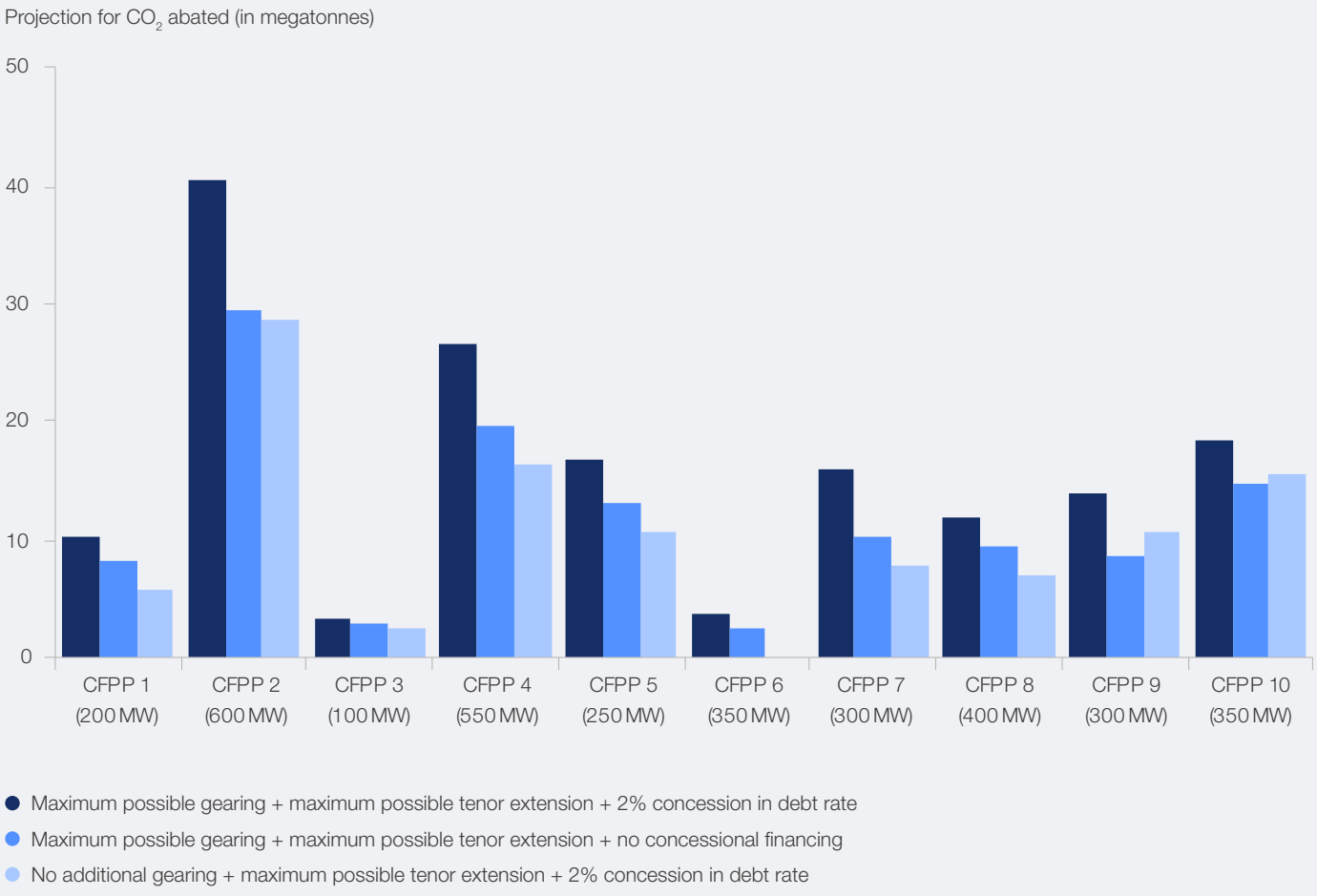
Maximum possible re-gearing + maximum concessional financing used in analysis (31% in capital stack)

Unsurprisingly, combining all three financing levers – including concessional debt at maximum deployment allowed in the model – delivers the highest level of abatement for each asset in the analysis. This leads to an average of almost 10 years' abatement, and a total of 160 million tonnes (Mt) CO_2 avoided across the portfolio.

In this scenario, new retirement dates for all 10 CFPPs in the analysis fall within a relatively narrow time frame: between 2038 and 2042 for the oldest three plants, 2037 and 2041 for the middle three, and 2039 and 2041 for the newest. This close clustering is because of the 2050 cut-off date for all plants in the BAU case. If a plant's 40-year lifespan runs beyond 2050 (for example, the plant was commissioned in 2015), it is considered the plant will close anyway in 2050. As such, the plant's remaining economic life will be 25 years (from a transaction date of January 2025), rather than 30 years. As such, possible retirement dates are similar to older plants in the analysis (for example, those commissioned in 2010), whose 40-year life expires in 2050 and which therefore also have 25 years of remaining economic life.

Concessional financing requirements in this scenario are very high. Retiring all 10 plants in this way would require a total of $1.3 billion in concessional debt, out of a total of $4.2 billion in new debt.

FIGURE 6 **Abatement impact by scenario**



Source: Coal-to-Clean Initiative simulations, with data from Transition Zero[23]

Scenario 2

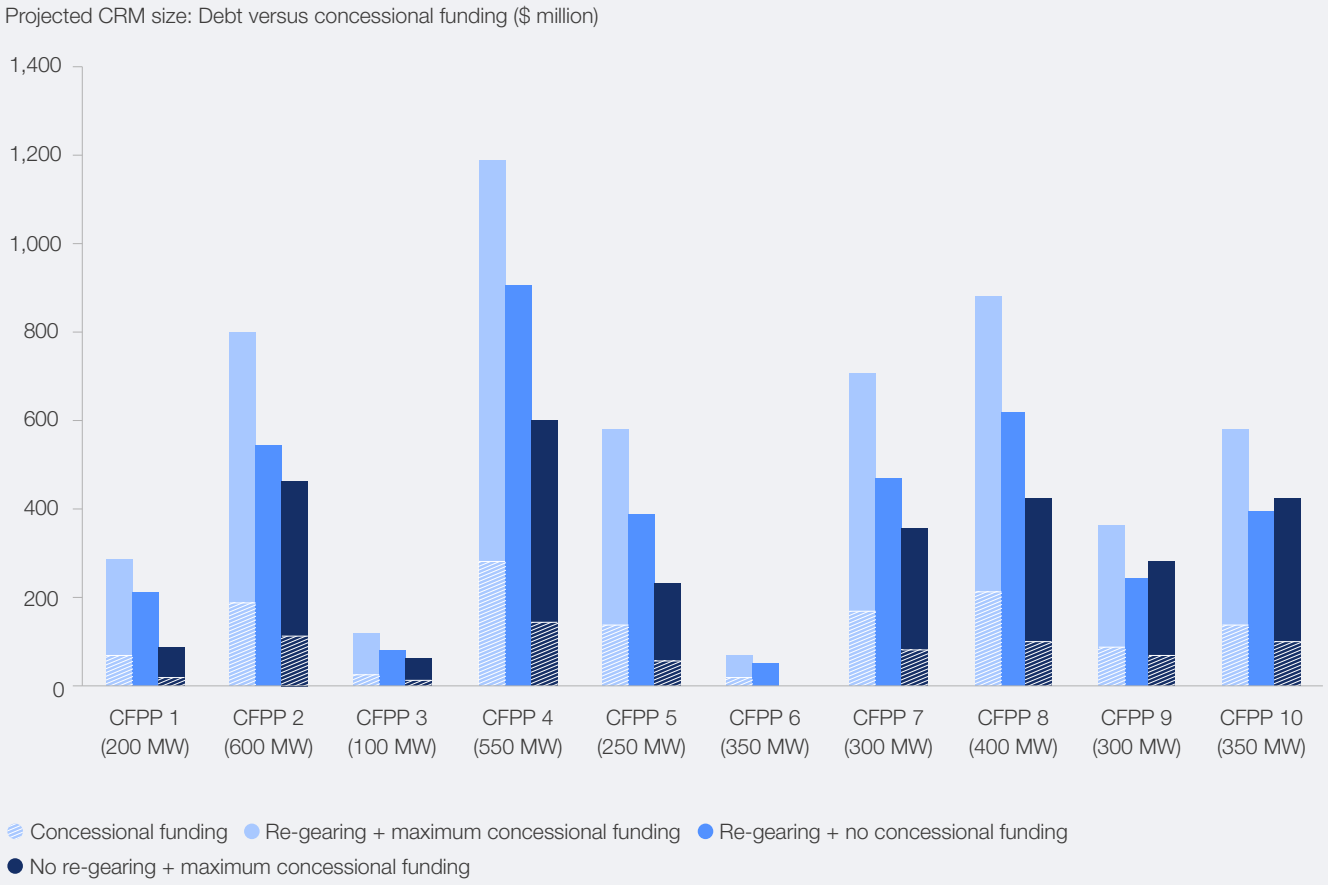
Maximum possible re-gearing + no concessional financing

Reducing the concessional component of the early retirement loan to zero, while maximizing gearing increases based on what is possible for each plant while extending loan tenors delivers interesting results.

In this scenario, the oldest plants can be retired between 2040 and 2043, middle-aged plants between 2042 and 2044, and newest plants between 2041 and 2044. Average abatement falls to almost 8 years, with a total of almost 118 Mt (metric tonnes) CO_2 emissions avoided across all plants. In this scenario, total CRM debt size is $3.9 billion, with no concessional debt.

The abatement impact achieved is lower. However, the saving in use of highly concessional financing to achieve these results is $1.3 billion. In this scenario, the overall reduction in CFPP lifespan is within one year or equal to what was achieved in the SLTEC transaction for two of the 10 plants (25 years). For three others, abatement impact would represent an improvement on SLTEC, with plant lifespan reduced to less than 25 years.

FIGURE 7 **CRM size by scenario**



Source: Coal-to-Clean Initiative simulations, with data from Transition Zero[24]

Scenario 3

No re-gearing + maximum concessional financing used in analysis (31% in capital stack)

In general, the projections show that maximum possible concessional financing with no-regearing would deliver moderately reduced abatement in comparison to no concessional capital with maximum possible gearing. Overall, CRM loan requirements are around half of what is required in Scenario 1 because the volume of capital is limited by the fact that there is no gearing increase. Total debt requirements are $2.2 billion, of which $700 million would need to be concessional debt (at 1% interest rate). The projected abatement in this scenario is 104 Mt CO_2, which is 14 Mt CO_2 less than in Scenario 2.

Evidently, there is a trade-off between Scenarios 2 and 3. In Scenario 2, the overall facility size to achieve slightly higher emissions abatement is far higher at $3.9 billion, but with no need for concessional finance. In Scenario 3, achieving slightly lower abatement requires far less CRM funding overall at $2.2 billion, but remains expensive in terms of concessional finance at $700 million.

Scenario 2 will involve additional costs to deliver re-gearing, though not in the capital stack. These additional costs and how to respond to them are explored in the following section.

Re-gearing and concessional debt have comparative abatement impacts

The results show re-gearing and concessional debt can have roughly equivalent impacts on abatement. Considering a moderate 5% gearing increase, with no concessional financing, against a moderate 1% decrease in debt interest for a representative 327.5 MW plant from the sample demonstrates comparable abatement impact. Both approaches deliver carbon abatement of about 11 Mt CO_2. The total debt required in the gearing increase-only scenario is higher, at $407 million, but all at commercial rates. In the 1% decrease scenario, blended debt totals $329 million, of which $52 million is at a highly concessional 1%.[25]

Applying sensitivity analysis to gearing ratios in incremental 5% increases demonstrates an optimum gearing increase of between 10% and 20% across the portfolio rather than greater debt increases. This can help extend abatement impact without significantly increasing the cost per unit of CO_2 avoided. The capacity to re-gear is also limited by the fact that lower cash flows are available to a plant at higher rates of gearing.

FIGURE 8 **Re-gearing versus concessional debt abatement impact and CRM size**

Source: Coal-to-Clean Initiative simulations, with data from Transition Zero[26]

2.3 Implications for coal phase-out financing

FIGURE 9 **Summary of key insights**

CRMs leveraging large concessional financing are costly and have limited scalability

Loan tenor extensions and financial re-gearing deliver equivalent abatement impact to concessional financing

Financial re-gearing-based CRMs rely on simple, widely understood financing concepts, increasing replicability and scalability across EMDEs

Financial re-gearing offers higher payouts to asset owners compared to concessional financing, enhancing incentives

Newer, larger CFPPs are better suited to market-based CRMs given large remaining equity value and abatement potential

Older, smaller CFPPs are preferable options for concessional financing given that less concessional capital goes further

Source: Coal-to-Clean Initiative

The analysis suggests very high costs of early CFPP retirements which leverage large concessional financing in the capital stack. Even for the relatively small sample of the global CFPP fleet examined in this analysis, the potential to scale coal phase-out in this way is limited.

At the same time, the analysis demonstrates that loan tenor extension and financial re-gearing can have similar impact to concessional financing in terms of abatement, while crucially providing market returns to investors. This points to the need to further explore whether opportunities to re-gear and extend payback periods can apply to a broader set of CFPPs across EMDEs. If this is the case, there could be a greater role for such re-gearing-based CRMs alongside other financial tools and policies in delivering coal phase-out at scale.

In addition to reducing concessional finance requirements, re-gearing and loan tenor extensions are tried and tested financing methodologies familiar to commercial financing institutions everywhere. This simplicity means such approaches are more likely to be scalable and replicated.

Analysis from the Philippines also demonstrates that financial re-gearing can deliver substantial early payouts to asset owners in return for engaging in early retirement, which are higher than payouts delivered using concessional financing only. Maximizing possible re-gearing for each plant (with no concessional financing) delivers an average early payout of 40% of the remaining equity value of the CFPP, in contrast to a 15% payout for a debt facility in the scenario with the highest concessional capital only.

This is an important advantage, given the currently limited pipeline of CFPP assets viable for early retirement with willing asset owners, which acts as a major constraint to scalability. A financial re-gearing approach also has the advantage of not using concessional funds to pay out the asset owner.

BOX 3. The business case for asset owners

Asset owners face an uncertain outlook for their CFPPs. As the energy transition accelerates, more consistent availability of cheaper renewables generation will increasingly outcompete CFPPs that have high fuel and operational costs. This will result in reduced CFPP utilization and a consequent hit to revenue generation, particularly when power is sold on a spot market. Government policy and regulations, such as carbon pricing or stricter environmental controls, will also impose costs on asset owners and squeeze profits.

Early CFPP retirement can help asset owners deal with these downside risks if early payouts such as those explored in this study enable them to monetize value earlier than originally planned. This allows asset owners to hedge against the risk of stranded assets and diminishing revenue streams because the portion of the plant's equity value collected early will no longer be at risk.

The timing and scale of reinvestment that a CFPP asset needs to remain efficient and operational – including capital expenditure on equipment overhaul that can be costly – will also be important to this equation, since such expenditure will count against the cash flows that accrue to the asset owner.

Upfront equity returns

Asset owners receive substantial equity payout upfront

Risk mitigation

Early equity payout de-risks future CFPP revenue flows exposed to stranded assets and diminishing revenues

Improved competitiveness

Enhanced capacity to borrow on ESG (environmental, social and governance) aligned markets

This can also help tackle a core challenge inhibiting the transition away from coal: the need to develop a strong pipeline of viable and bankable CFPP early-retirement projects. Better incentivizing asset owners to consider early retirement would facilitate delivery of the costly technical and financial analyses needed to build a strong pipeline of CFPP phase-out projects.

Newer plants may be most suitable for financial re-gearing-based transactions with no concessional capital. With substantial remaining revenue still to be monetized, these plants have large remaining equity value. Debt refinancing requirements are therefore higher. This equates to very considerable concessional needs if blending is used to reduce the cost of debt.

However, plants with a long remaining operational life (over 16 years) and high capacity (above 400 MW in the analysis) offer high abatement impact from re-gearing and loan tenor extension alone. The ability to extend the loan tenor for a newer plant increases substantially because the plant's long life raises the re-gearing impact.

Also, newer plants have yet to realize a substantial portion of their future revenue. They therefore have higher incentives to take an early payout, given uncertainties regarding their future cash flows.

Older and smaller plants, in contrast, may provide better targets for concessional financing. With high proportions of their revenue already realized (since the plants are older) or with smaller revenue expectations overall (in case of smaller plants), lower volumes of concessional capital will have greater impact on overall cost of capital. This means greater abatement impact, and a higher likelihood that abatement will be delivered sooner.

Focusing scarce concessional resources on older and smaller plants could also help deliver demonstration projects. These will be critical to showing the feasibility of different phase-out pathways, and demonstrating options available to asset owners looking to move away from their coal operations.

Older plants are also nearer the end of their economic lives, and therefore have potential to deliver abatement impact earlier than newer plants. Importantly, plants with no remaining debt, which is one plant in the analysis, do not present good options for re-gearing. This is because all the new lending is used to fund the payout of the asset owner.

BOX 4. **Considerations of asset lifespan and utilization**

Results from the modelling point to the importance of asset valuations being both climate-ambitious and fair to the asset owner in terms of realistically reflecting what will happen to an asset's ability to generate revenue as the energy transition unfolds. This is important for delivering deals that make good use of both commercial and concessional resources, as well as providing early signals to the market to enable planning.

A more nuanced understanding of what will happen to CFPP assets going forward could help build consensus as to what constitutes a realistic and fair asset lifespan and utilization profile for CFPP valuation.

Many EMDEs have taken the important step of introducing moratoria on construction of new CFPPs.[27] Beyond this, some of the most powerful tools at governments' disposal to accelerate the coal-to-clean transition are policies and regulations that make coal-based generation less valuable and more costly going forward. This includes mandating a maximum lifespan for an asset, after which it must close down, introducing carbon pricing or taxation, and stricter pollution and environmental controls, and more broadly committing to a transition away from coal power generation over time. These policies will encourage asset owners to consider alternative options since they raise the costs a CFPP faces.

Ideally, the lifespan set by government should get incrementally shorter over time, reflecting an acceleration in uptake of renewable energy in the market, availability of new solutions, and the ability of a grid to accommodate and run higher penetration of variable renewable energy. Such a "ratcheting effect" is being used by the German government's reverse auction system to incentivize asset owners to come forward sooner in return for higher compensation for closing early.[28] This could translate into retirement deals offering asset owners incrementally smaller shares of the remaining equity value, for example, 95%, 90%, 85% and so on, the slower they are to come forward. This would incentivize early uptake.[29]

2.4 Access to finance

While the re-gearing approach has the advantage of using only commercial financing at market rates in the capital stack, some financiers may require additional payment assurances to be comfortable with lending. An important area of focus, therefore, is the means to provide these protections, and if they entail costs, how they will be paid for and how they compare against concessional financing requirements in the capital stack.

Coal power typically has a high marginal cost. It is therefore vulnerable to being pushed down the dispatch hierarchy as cheaper alternatives become more regularly available. As such, some commercial financing institutions may find it more challenging than others to lend for CFPP early retirement. Constraints are particularly pronounced when a portion of CFPP revenue is expected to be generated on the spot market, or relies on extension of a PSA or power purchase agreement (PPA) that has yet to be realized (as has been assumed for the purpose of this study), because revenue is not backed by a contract.

Increasing gearing and lengthening loan tenors may accentuate these risks for some lenders. Higher debt levels mean higher fixed costs and lower ability of equity to absorb loss. Longer loan tenors mean lesser likelihood that contractual backing to debt and revenue streams will be exposed to increased competition from alternatives.

International commercial banks may find these risks difficult to accept without payment assurance. Domestic lenders, in contrast, with greater knowledge of and comfort in the local electricity market, are more likely to be more tolerant of these risks.

These obstacles are not insurmountable, but may require alternative kinds of contracting or guarantees. Some suggestions are outlined in the table below.

TABLE 1. **Payment assurance through contracts or guarantees**

Mechanism to address risk	Description
Alternative contracting against revenue streams	Ancillary services support grid reliability, frequency response ensures system balance by adjusting to frequency fluctuations, and congestion services manage transmission bottlenecks to optimize power flow. These are all ways to contract generation, with ancillary service market, frequency response and congestion market contracts helping to build a bankable stack of revenue streams.
Capacity market	Capacity market contracts could provide alternative payment assurances to lenders. Some CFPP capacity would remain available to the system, but standing idle, with asset owners remunerated based on installed capacity, instead of generation. This can also help governments concerned about the impact of CFPP retirement on energy security. It allows governments to mitigate risks of energy insecurity, but with limited or no emissions from CFPPs. It could also facilitate early retirement planning, helping to stagger retirement dates for asset owners, though it would result in additional costs to government because it pays for power it does not use. Such an approach would entail risks from a climate perspective, given limited safeguards against a plant being returned to full use, for example, in the event of a change of government.
Revenue guarantees	A multilateral development bank (MDB), government or philanthropic guarantee could back payments against any non-contracted revenue. Depending on the coverage needed, payment guarantees are likely to be high-cost and therefore may run into scalability challenges. This may risk tying up large quantities of public or philanthropic capital, which could be better spent elsewhere.
Loan service guarantees	Tailored loan repayment guarantees to individual lenders may provide more affordable and targeted guarantee solutions. Even if this covers only a small portion of the loan required by the transaction, this could encourage domestic banks to come in if it brings a large international bank to the table.
Contracts for difference	Following a contracts for difference model, a guarantee system based on an agreed baseline spot price could provide a cost-effective means to deliver payment assurance, where revenue will be generated on the spot market. A guarantor would top up payments when the actual price is lower than an agreed baseline price, with a borrower paying back the difference when the actual price paid is higher.

Use of guarantees also poses risks that scarce concessional capital will end up being used to compensate lenders or asset owners if the CFPP performs less well than expected. If a CFPP goes out of business or generates less revenue than anticipated in the retirement deal, scarce concessional financing would be left compensating lenders anyway. Given the likelihood that power sector economics will change, there is also a possibility that mechanisms to de-risk future revenues could keep a plant operating longer than it otherwise would.

If, for example, a government were to introduce a reverse auction to retire plants early, a guarantee might end up being used to back value that might not actually exist. As such, it is preferable to limit guarantee use as far as possible.

2.5 Mobilizing complementary coal phase-out tools

Clearly, financial re-gearing can provide a means to accelerate retirement of some kinds of plants. However, addressing the overall scale of the challenge will require a broad set of solutions. It will be vital for governments to introduce policies and regulations that make coal power generation less valuable and more costly, such as environmental and pollution controls, carbon pricing or taxation, and capping the lifespans of CFPPs, as well as those that address barriers to scale-up of clean alternatives.

In any event, the financial restructuring solutions discussed on this paper will only be applicable to some kinds of plants in certain circumstances, and all 10 CFPPs in the analysis continue to operate into the 2030s and 2040s. This is a substantial improvement on their existing closure dates and, for many CFPPs, delivers retirement consistent with comparative transactions (such as the Philippines SLTEC transaction), and sometimes better. Further accelerating the retirement dates of these plants, and enabling early retirement of CFPPs not suitable for restructuring, or those with larger remaining equity value still to be recouped, will require additional kinds of capital and financial solutions, particularly concessional financing and transition credits.

Two approaches in particular stand out as warranting further discussion and focus:

– **Combining refinancing with transition credits:** The possibility for transition credits to be combined with refinancing, as being explored currently by ACEN, Rockefeller and MAS (mentioned above)

is a promising approach. This model has the advantage of being able to further accelerate retirement into the next five to 10 years above and beyond phase-out dates realized in the late 2030s and early 2040s achieved through market-based refinancing. Combining refinancing with a later injection of revenue from transition credits would have the additional advantage of capping the volume of transition credits required for the transaction, provided the volume of compensation required by the asset owner is reduced courtesy of the initial deal.[30]

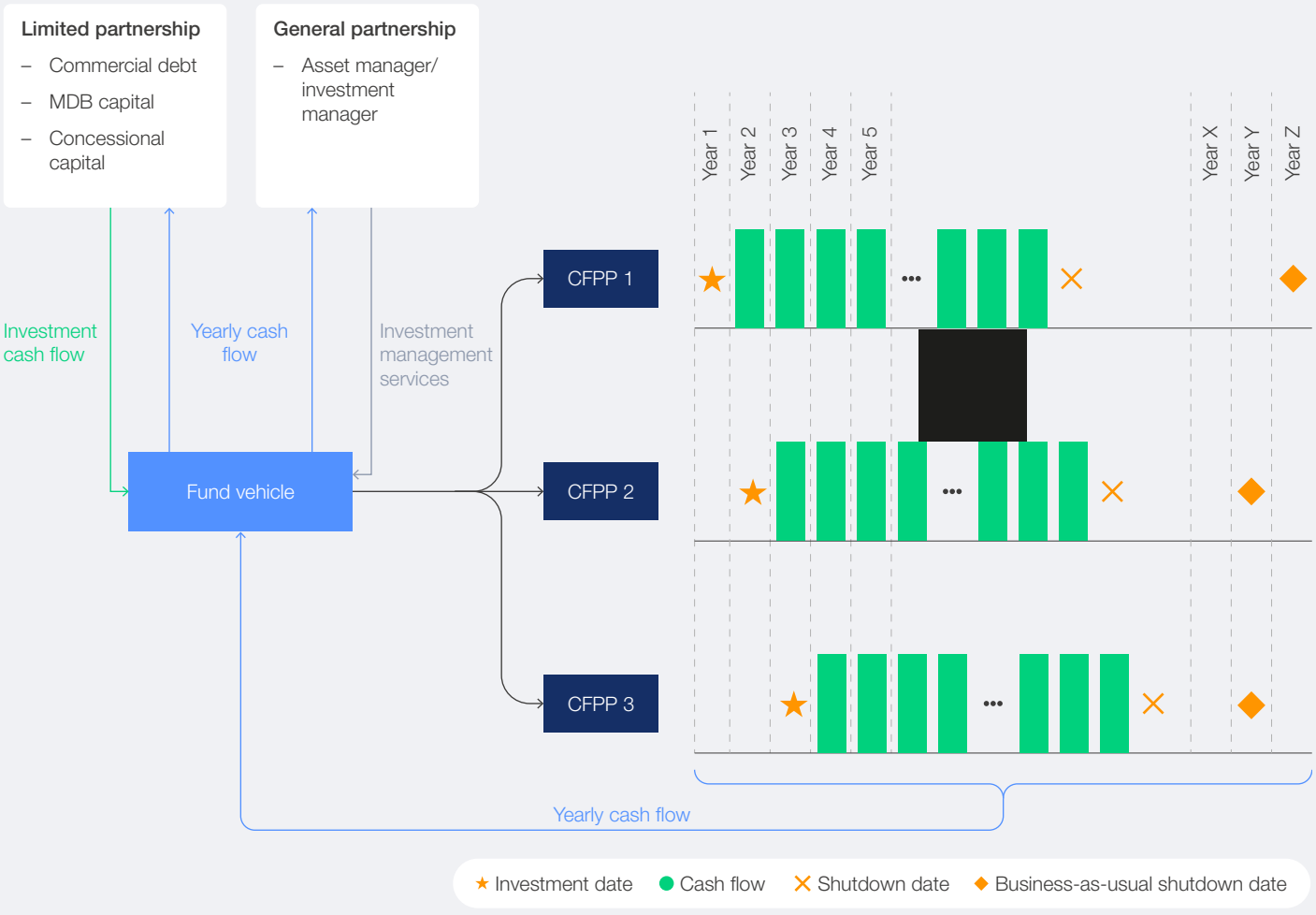
– **Repowering:** This involves replacing the CFPP with alternative generation technologies at the same site. This can include reusing the steam cycle while replacing the thermal source or simply building out alternative generation technologies at the same site, for example, solar with batteries. Repowering can help to capture substantial residual value from an asset's grid connection, land, permits and existing equipment. This can reduce capital expenditure requirements for replacing power capacity, while switching the coal PPA to a more sustainable PPA.

  Given that the retirement of a CFPP is linked to capacity replacement, engagement with sovereign entities may be improved in comparison with transactions that only involve CFPP retirement. Investors, moreover, may be more willing to commit capital because the transaction involves investment in clean power and immediate, or almost immediate, shutdown of the CFPP. Repowering approaches may face constraints relating to technological feasibility of different options at the site, land availability and transmission connection, which could limit viability depending on site specifics.

  The financial re-gearing approaches described above can provide substantial payouts to asset owners as demonstrated in this paper. This raises the prospect that asset owners who want to repower could obtain a more sustainable revenue source than their CFPP if the early payout is linked to repowering the CFPP site with more sustainable forms of power generation or battery storage.

In the second phase of its work, the Coal-to-Clean Initiative will interrogate these questions. It will also work to develop investible financing vehicles based on the re-gearing approach outlined in this paper. An indicative example is provided below.

FIGURE 9: **Description of ongoing cash flows (asset to fund, fund to investor) for multiple plants**



Source: Coal-to-Clean Initiative

BOX 5 | Obtaining system operator approvals and ensuring closure in line with phase-out time frames

System operator and regulator buy-in for CFPP early retirement is vital to obtaining the necessary approvals to remove CFPP capacity from the system. These entities will not approve these transactions if they cannot be sure that replacement capacity will come online at similar cost.

As such, phase-out transactions that incorporate renewables investments may be more likely to succeed, as well as find it easier to access financing. In practice, however, pairing CFPP retirement with renewable investments at another site can be hard to achieve from a regulatory perspective. Additionally, it is important to remember phase-out time frames included in this study are 12 years-plus, leaving plenty of time to consider replacement options in the intervening period and raising the question as to whether replacement options need to be in place at the time of the retirement deal.

Investors will also need assurance that the CFPP will close in line with the agreed phase-out time frame. Contractual covenants are therefore essential in ensuring closure in line with phase-out plans, as they legally bind asset owners to specific timelines and commitments, minimizing the risk of delayed closures by providing recourse to arbitration courts.

3 Building credible phase-out plans

CFPP early retirement transactions can be fraught with reputational risk for commercial investors, given that financing phase-out often requires new lending or acquisition of equity in an asset. This leaves commercial finance institutions open to accusations that they are continuing to invest in fossil fuels.

As part of their Net Zero commitments and efforts to reduce on-balance sheet financed emissions, many commercial finance institutions have introduced thermal coal exclusion policies. These prevent them from investing in CFPPs or entities with substantial exposure to coal power.

Taken as a whole, these represent commendable efforts to decarbonize the finance sector. However, given their blanket coverage, these commitments prevent many international commercial financiers from participating in coal phase-out because of the risk that coal phase-out financing will be conflated with traditional financing of coal power.

A small number of financiers have taken the courageous step of carving out room for financing phase-out within their coal exclusion policies, and have also been clear about how financing coal phase-out is distinct from traditional investment in thermal coal and why it is needed. Yet, reputational concerns continue to prevent many from considering phase-out projects, inhibiting the flow of finance.

Guarding against reputational risks and delivering genuine emissions abatement requires financiers to address two major questions:

1. Does the financing credibly contribute to real-world emissions reduction by bringing forward the CFPP closure?

2. How can financiers be confident that planned abatement impact will be delivered once the phase-out investment is made?

To help financiers navigate these complex challenges, standard-setters and regulators – including the Glasgow Financial Alliance for Net Zero (GFANZ),[31] ASEAN Taxonomy Board[32] and Monetary Authority of Singapore (MAS)[33] – have developed criteria to guide financing of CFPP phase-out mechanisms focusing on the credibility of carbon abatement plans. These can help financiers and asset owners chart the criteria they need to ensure their investments deliver real-world emissions reduction without resulting in increased emissions elsewhere, as well as being classified as transition finance.

This guidance aims to assist investors in assessing the credibility of CFPP phase-out plans against key overarching criteria according to three levels:

1. **Government and system-level:** Is there a wider enabling environment to support the CFPP phase-out?
2. **Entity-level:** Is the CFPP phase-out aligned with a science-based pathway, for example, a region- and/or sector-specific transition plan, and is there critical need for additional financing to enable the phase-out?
3. **Asset-level:** Does the asset owner/operator have a phase-out roadmap to ultimately retire the asset?

Once an investment decision is made, financiers and asset owners need to ensure implementation of CFPP phase-out and delivery of real-world emissions anticipated at the planning stage. The guidance noted above recommends establishing clear key performance indicators (KPIs) against which to measure progress.

A range of metrics can be used to measure progress against abatement goals, as outlined in Table 2.

TABLE 2 **Metrics to measure progress against abatement goals**

This table provides high-level considerations as to what kind of sources investors can consult to assess the credibility of a transition plan, as well as the possible metrics, using the ACEN SLTEC transaction as an example (see Box 1 above for further details).[34]

Criteria and level	Possible considerations	Sources from ACEN SLTEC example	KPIs and metrics
Government and system-level: Is a wider policy-enabling environment for CFPP phase-out in place and plans aligned with a science-based transition pathway?	Key focus areas could include credibility and viability of renewables investment plans, alignment with Nationally Determined Contributions,[35] granular detail on coal emissions reductions and phase-out, and just transition provisions.	The Philippines Department of Energy's Philippine Energy Plan (PEP) 2030-2050[36] provides detailed targets for clean energy addition, improving energy efficiency and reducing coal dependence.	Short- and near-term targets to align with Net Zero by 2050. Moratorium on new coal assets. Development of transition plan.
Entity-level: Does the asset-owner have a credible phase-out roadmap?	Key focus areas include credibility of plans, level of granularity regarding targets and roadmap to achieve transition targets.	The ACEN Net Zero Roadmap[37] outlines plans and interim measures to transition.	Short- and near-term targets to align with Net Zero by 2050. Commitment to no new CFPP development or procurement. Development of a transition plan.
Asset-level: Are CFPP phase-out plans credible, not resulting in increased emissions elsewhere, and additional (would not have taken place without phase-out financing)?	Key focus areas include details of forecast BAU CFPP operations profile (is it climate-ambitious, and offers a realistic reflection of the changing role of coal in the system), measures to ensure CFPP will actually close in line with the phase-out plan, and whether the plant would have closed anyway without retirement financing (additionality).	CFPP generation forecasts in business-as-usual (no phase-out) scenario used in retirement deal. Contractual clauses and covenants assuring closure.	Forecasted absolute emissions savings over lifetime of CFPP with early retirement versus business-as-usual scenario (independent verification) savings. Just transition roadmap. Land restoration.

While existing guidance and standards converge around a set of key criteria to assess a transition plan, the lack of harmonization between institutions and regions creates challenges for investors and raises risk. Better alignment between standard-setters, guidance providers and government authorities would help investors navigate this complex challenge, ultimately helping to unlock large finance flows for coal phase-out.

Conclusion

CRMs based on financial re-gearing can play an important role in scaling the coal-to-clean transition in EMDEs. Re-gearing CRMs are simple and therefore replicable and have the advantage of offering substantial incentives to transition risk-concerned asset owners to engage in phase-out in the form of early equity payouts, which can also be linked to reinvestment in renewables. This could help boost development of the pipeline of CFPP assets eligible for and interested in early phase-out, a central obstacle to accelerating the coal-to-clean transition.

Of course, scaling the coal-to-clean transition as a whole will require the full suite of policies and financing tools available. Governments can do the most to accelerate coal phase-out by sending long-term signals to industry that they are committing to the transition. Regulations and policies that impose costs on asset owners, such as pollution and environmental controls and carbon pricing, will also be key to reduce the value of coal power, as well as policies that address barriers to clean energy scale-up.

Financial restructuring can help bring forward retirement dates for many plants, but other financial tools will also be needed. Concessional financing – particularly for smaller and older plants – can help deliver much needed demonstration projects and crowd in private financing. Larger and newer assets, with substantial capital to recoup, will require deployment of additional capital such as transition credits to help them retire early.

The approaches suggested in this paper need further consultation and stress-testing. Particularly important will be an exploration of how they might interact with and support investment in renewables and other forms of energy necessary to provide alternatives to coal power in EMDE energy systems, as well as ensuring delivery of a just transition for workers and communities.

In the coming months, the World Economic Forum's Coal-to-Clean Initiative will test and develop these concepts with members of its community, with the aim to develop investible financing vehicles capable of delivering coal phase-out at scale based on the financing mechanisms outlined in this paper.

Acronyms

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
BAU	Business as usual
CBAM	Carbon Border Adjustment Mechanism
CCCI	Coal to Clean Credit Initiative
CCS	Carbon capture and storage
CFPP	Coal-fired power plant
CO_2	Carbon dioxide
CRM	Coal retirement mechanism
CTF	Clean Technology Fund
DSCR	Debt service coverage ratio
DSRA	Debt service reserve account
EMDE	Emerging and developing economies
ETM	Energy transition mechanism
GDP	Gross domestic product
GFANZ	Glasgow Financial Alliance for Net Zero
Gt	Gigatonne
IEA	International Energy Agency
IPP	Independent power producer
MAS	Monetary Authority of Singapore
MDB	Multilateral development bank
Mt	Megatonne
MW	Megawatt
NDC	Nationally determined contribution
NPV	Net present value
PEP	Philippine Energy Plan
PPA	Power purchase agreement
PSA	Power supply agreement
SLTEC	South Luzon Thermal Electric Corporation
WACC	Weighted average cost of capital
WESM	Wholesale electricity spot market

Glossary

Ancillary service	Support services ensuring the reliable operation of a power grid.
Business as usual	CFPP operations without early retirement transactions.
Capacity market	A market where electricity providers are paid to ensure sufficient generation capacity is available.
Capital stack	The hierarchy of funding sources for a project, including debt, equity and grants.
Carbon Border Adjustment Mechanism (CBAM)	A European Union tariff on certain carbon-intensive imports not already subject to carbon pricing (to take effect from 2026).
Carbon budget	The permissible amount of greenhouse gas emissions to stay within global temperature limits.
Coal retirement mechanism (CRM)	A financing structure to accelerate coal power plant closure by incentivizing early retirement.
Contracts for difference	A financial agreement where two parties agree to pay the difference between the current market price and a predetermined strike price for a specific asset or commodity, typically used in energy markets to stabilize revenues for renewable energy producers.
Debt service coverage ratio (DSCR)	A financial metric that measures a company's ability to cover its debt obligations with its operating income.
Debt service reserve account (DSRA)	A reserve fund established to ensure sufficient funds are available to cover a borrower's debt payments in case of cash flow shortfalls.
Dispatch hierarchy	The order in which power plants are called upon to generate electricity, based on factors like cost, availability and grid requirements.
Equity value	The market value of ownership in an asset or company.
Financial engineering	The use of advanced financial tools and techniques to design innovative funding structures, optimize costs and manage risks in investment or project financing.
Financial re-gearing or re-leveraging	Increasing the proportion of debt relative to equity in an asset's capital structure.
Frequency response	A service to stabilize grid frequency after a power imbalance.
IDB Invest	Inter-American Investment Corporation.
Loan tenor extension	Increasing the repayment period of a loan to lower annual debt payments.
Marginal cost	The cost of producing one additional unit of electricity, typically influenced by fuel prices, operational efficiency and system constraints.
Net present value (NPV)	The current value of future cash flows from an investment, adjusted for time and risk.
Payment guarantee	A financial assurance that payments will be made to lenders or investors.
Power purchase agreement (PPA) or power supply agreement (PSA)	Long-term contracts for electricity supply between producers and buyers.
Refinancing	Replacing existing debt with new debt under different terms.

Repowering	Re-using land, grid connections and equipment at a CFPP site while switching PPA and revenue streams to cleaner power generation alternatives.
Spot market	A marketplace where electricity is bought and sold for immediate or near-term delivery, typically within a day or in real time.
Stranded asset	An investment that has lost its economic value due to regulatory or market changes.
Transition credits	Financial incentives or credits provided to CFPP asset owners to incentivize early retirement by compensating asset owner for foregone revenue.
Weighted average cost of capital (WACC)	The overall cost of capital for a project or company, calculated as the average rate of return required by all sources of funding, including debt and equity, weighted by their proportion in the capital structure.

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15 Asian Development Bank (2023), *New agreement aims to retire Indonesia 660MW coal plant almost 7 years early*

16 World Economic Forum (2022), *World's first Energy Transition Mechanism (ETM) for early retirement of a coal plant*

17 ACEN (2023), *COP28: ACEN, The Rockefeller Foundation and Monetary Authority of Singapore partner to pilot the use of Transition Credits for the early retirement of coal plants*

18 CFPPs included in the analysis have been anonymized for the purposes of this report

19 Gearing increase means Increasing the proportion of debt relative to equity in an asset's capital structure

20 Debt service coverage ratio (DSCR) is a financial metric that measures a company's ability to cover its debt obligations with its operating income. Debt service reserve account (DSRA) is a reserve fund established to ensure sufficient funds are available to cover a borrower's debt payments in case of cash flow shortfalls

21 These assumptions are considered moderately ambitious, but realistic. They are intended to stimulate discussion and contribute to identifying solutions, rather than to reflect an accurate forecast of what will happen in the market in question

22 Aurora (2024), *Comment: Key themes & Aurora's energy forecasts in the Philippine power markets and grid*

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