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Repurposing Pakistan's coal-based assets

A practical case study for the early retirement of coal assets
in Pakistan

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Key findings

Pakistan's 3.6-gigawatt (GW) buildout of imported coal plants, fast-tracked under the China-Pakistan Economic Corridor (CPEC), eased load shedding but created expensive take-or-pay liabilities. Weak industrial growth, falling demand, and rising rooftop solar have reduced utilization to under 20% for plants like the Sahiwal Coal-Fired Power Plant (CFPP), while capacity payments inflate circular debt.

Early retirement of Sahiwal CFPP is economically viable within a USD0.4–1.5 billion compensation range, with modest 5–10 year acceleration scenarios. This could cost under USD100 million, compared to USD5 billion in continued capacity payments through 2046.

Two primary pathways identified for Sahiwal CFPP's early closure are: an upfront buyout, compensating owners for foregone future cash flows in a lump-sum settlement, or a negotiated Return on Equity (ROE) reduction to accelerate equity value. Redirecting upfront buyout funds into coal-to-clean projects could benefit both investors and the government.

The Sahiwal CFPP's early retirement could avoid 27–38 million tonnes of carbon dioxide emissions over a 10-year reduction scenario. It could create a replicable model for the accelerated closure of other CFPPs and ensure access to funds through climate and transition finance from the West as well as China.



Executive summary

Pakistan's drive to end widespread load shedding between 2014 and 2018 relied on a rapid buildout of imported coal power plants, financed through the China-Pakistan Economic Corridor (CPEC). Nine projects with a total capacity of 10.4 gigawatts (GW), backed by sovereign guarantees and dollar-indexed tariffs, were fast-tracked as "early harvest" ventures. By 2019, the strategy had alleviated shortages but created a new dilemma. Expensive take-or-pay contracts dominated the generation mix just as domestic demand, industrial output, and grid-connected rooftop solar reduced imported coal's dispatch. Consequently, average plant utilization across the imported coal fleet fell in the financial year (FY) 2024, while capacity payments for idle assets continued to inflate Pakistan's circular debt.

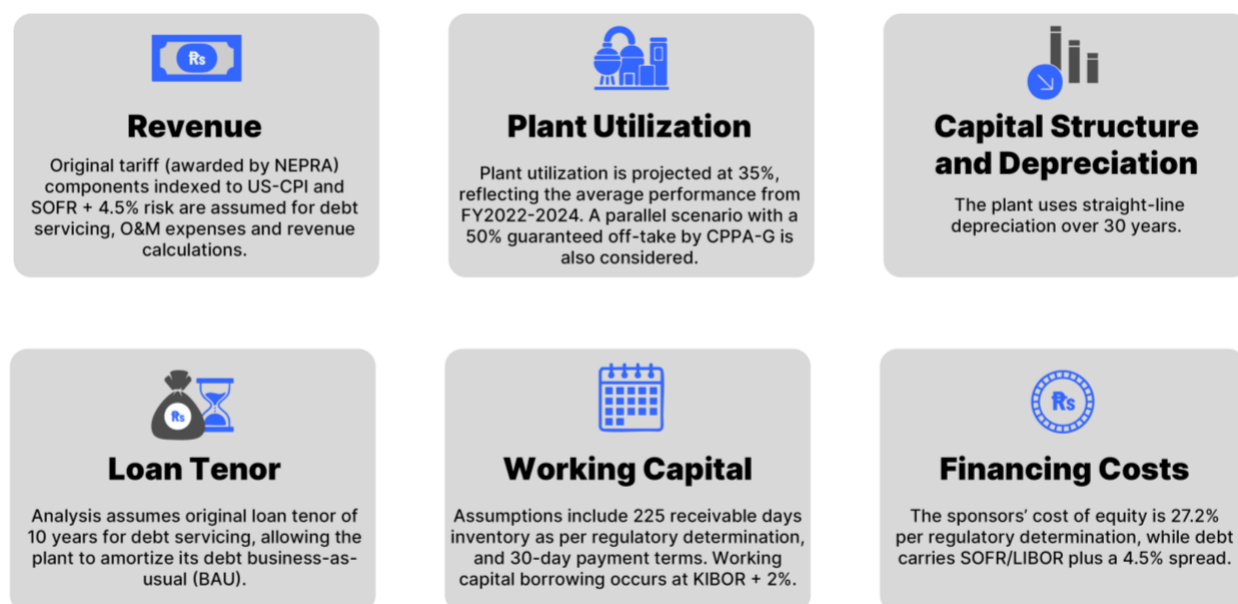
The 1,320-megawatt (MW) Sahiwal Coal-Fired Power Plant (CFPP) exemplifies this challenge. Commissioned in October 2017 by Huaneng Shandong Ruyi Energy under a thirty-year power purchase agreement, the plant is entitled to a 27.2% Return on Equity (ROE) and a 50% minimum off-take, both underwritten by Pakistan's federal government. Nearly a decade of debt service later, utilization of the imported CFPP has dropped to below 20% as cheaper distributed solar supply and stagnant industrial demand have eroded grid dispatch. Meanwhile, accumulated receivables from the single-buyer market exceed PKR82.7 billion (bn), straining liquidity. These conditions make Sahiwal a logical pilot for accelerated retirement as debt amortization is nearly complete, equity profits dominate, and ongoing payments impose rising fiscal stress without proportional public benefit.

This report analyzes the potential for Sahiwal CFPP's early retirement by modeling various buyout and renegotiation scenarios to determine the cost, practicality, and optimal timeline for shutdown. It also examines global and regional examples of accelerated coal retirement. The analysis determines whether Pakistan can draw guidance from state-driven mandates for coal phaseouts such as those in Germany and the United Kingdom (UK). It also explores Energy Transition Mechanisms (ETMs), including those for the South Luzon Thermal Energy Corporation (SLTEC) coal plant in the Philippines and the Cirebon-1 coal plant in Indonesia.

Pakistan's unique fiscal and contractual obligations and macroeconomic challenges complicate replicability. Nevertheless, suitable options are available that could accelerate early plant closure while preserving investor equity.

Discounted cash flow methodology and modeling framework

This analysis considers Sahiwal to be a standalone Special Purpose Vehicle (SPV) and reflects its actual financing structure. A Discounted Cash Flow (DCF) model forecasts free cash flows to equity from FY2025 to the contractual end-of-life in 2046. It discounts them at a weighted average cost of capital that evolves as debt amortizes. Inputs combine regulatory tariff schedules, recent operating data, and realistic market projections to calculate the plant's Enterprise Value (EV) and equity value. Both these values are critical metrics that assess the plant's current worth and can determine the financing requirements for a transaction.

Figure 1: Key assumptions for discounted cash flow (DCF) analysis

Source: Author analysis.

Note: US-CPI = United States Consumer Price Index; O&M = Operations and Maintenance; SOFR = Secured Overnight Financing Rate; CPPA-G = Central Power Procurement Agency Guaranteed; LIBOR = London Interbank Offered Rate; KIBOR = Karachi Interbank Offered Rate.

Valuation outcomes

At a 35% capacity factor, the EV is USD1.73bn, and the equity value is USD1.42bn. Raising utilization to the contractual 50% level adds a modest incremental fuel margin and increases EV to USD1.81bn and equity value to USD1.51bn. Additional valuation scenarios have been conducted based on actual 2023 cash flows and an ROE-only benchmark to determine a USD0.4bn floor for the plant valuation (see Appendix C).

These results define the economic threshold: retirement is feasible if investors receive at least the benchmark value in compensation, but not so high that the state loses the fiscal benefits of eliminating fixed charges.

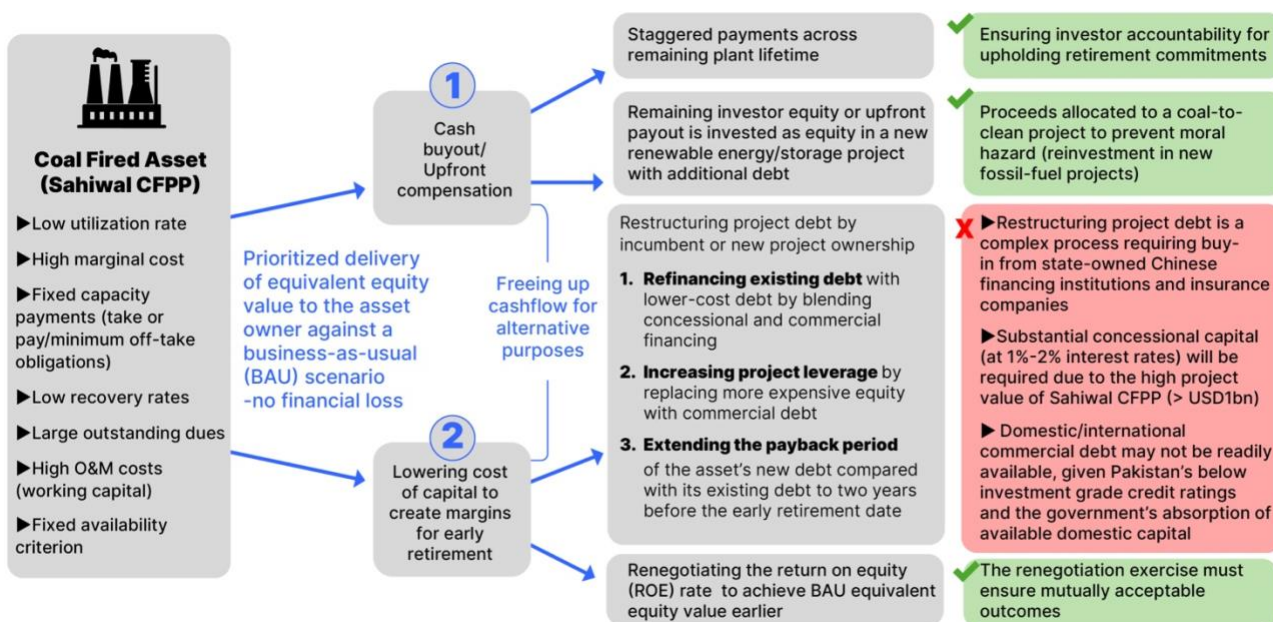
The range for retirement negotiations is between USD0.4bn and USD1.5bn. Public stakeholders can argue that covering the ROE entitlement fully satisfies investor rights, while sponsors can highlight the higher DCF outcomes that would result if capacity payments persisted.

Early coal retirement pathways

Early coal retirement methodologies adopted in regional emerging economies, such as the Philippines and Indonesia, through programs like the Asian Development Bank's (ADB) ETM or the Just Energy Transition Partnership (JETP), are highly reliant on the availability of concessional

finance. These aim to reduce the cost of capital through debt restructuring. Since Pakistan's imported coal fleet, including the Sahiwal CFPP, has been sponsored by Chinese state-owned enterprises and policy banks, debt restructuring will be diplomatically challenging. Investor confidence in Pakistan's power market has also diminished because of substantial outstanding dues owed to Chinese Independent Power Producers (IPPs), which makes retirement scenarios with early payouts to investors more attractive.

Figure 2: Early coal retirement pathways for the Sahiwal Coal-fired Power Plant (CFPP) in Pakistan



Source: Author analysis.

Pakistan faces persistent financial challenges, difficulties in raising domestic capital, and a lack of access to international capital markets for new investments in the power sector. Therefore, two primary pathways have been identified for assessing optimal timelines for early closure of the Sahiwal CFPP:

- 1) An upfront buyout, where the government or new investor acquires the plant by compensating the existing owners for foregone future cash flows in a lump-sum settlement.
- 2) A negotiated reduction in the ROE component of the plant tariff, allowing for early achievement of the designated plant equity value under a business-as-usual (BAU) scenario.

Pathway 1 – Upfront buyout

A lump-sum payment allows for immediate reconciliation of future cash flows by compensating plant owners for the net present value (NPV) of foregone future revenue streams. Shutdown horizons have been assessed at 35% and 50% plant utilization to calculate lump-sum compensation based on the incumbent plant owner's willingness to retire early and the government's urgency in avoiding capacity payments for idle plants.

It was found that:

- Retiring the Sahiwal CFPP plant 17 years early (closure in 2029) would cost USD250–294 million (mn)
- A 10-year earlier closure by 2036 would require USD48–59mn, while a 5-year accelerated closure by 2041 would need only USD12–15mn

The state could immediately eliminate capacity charges and remove 6 million tonnes of carbon dioxide equivalent (MtCO₂e) annually from the grid. However, arranging even USD50–300mn in concessional capital is challenging, and a cash buyout can foster moral hazard if investors perceive retirement as a publicly funded windfall.

Upfront compensation presents an opportunity for immediate recovery of economic value. However, using concessional finance or philanthropic capital to compensate coal plant owners for foregone cash flows risks moral hazard. It can lead to an inefficient use of public funds and create counterproductive incentives that delay a coal phase-out and reinforce BAU pathways.

There are two possible ways of securing these commitments from existing plant owners and investors in Pakistan:

Distributed compensation

Instead of a single payout, equity holders receive slices of compensation during the shorter operational timeline. Each installment is contingent on demonstrable plant utilization (at designated thresholds, such as 35% or 50%) and environmental compliance over the years remaining on the truncated Power Purchase Agreement (PPA) tenor. This mechanism mitigates moral hazard by preventing reinvestment into new fossil-fuel based ventures.

- A 10-year earlier shutdown would provide about USD17mn annually for the 50% plant utilization case or USD14mn annually for a 35% rate.
- A 17-year advancement would increase the annual transfer to approximately USD114mn or USD97mn for the 50% and 35% utilization rates, respectively.

Spreading payments eases fiscal shock, aligns with annual budget cycles, and preserves leverage. Future transfers can be withheld if the plant breaches the retirement covenant. It also allows the government to free up budgetary resources or arrange for sovereign loans or concessional financing to compensate for the cash shortfall. For investors, the stream approximates their original annuity, minimizing reinvestment risk.

Coal-to-clean reinvestment

Another strategic solution channels the calculated compensation into new renewable capacity and pledges profits to the owners of the Sahiwal CFPP. Using the determined upfront payment amount of USD59mn for a 10-year retirement acceleration as anchor equity, the transaction structures a 280MW hybrid array of solar, wind, and a battery energy storage system (BESS)¹ which costs about USD300mn at an 80:20 debt-equity ratio (standard project financing for IPPs in Pakistan).

Senior debt finances the balance between debt and equity. The technology portfolio is optimized for size according to the funds available while preserving the debt-equity ratio and maximizing the capacity factor (40%) for the selected mix. This results in a combination of 51MW solar, 197MW wind, and 31MW BESS for the clean energy replacement project.

The facility should supply around one terawatt-hour (TWh) a year to industrial buyers at roughly USD6.2 cents per kilowatt hour (¢/kWh), lower than prevailing grid tariffs for large customers.

Equity returns from this green asset are contractually assigned to the former coal shareholders for 20 years (the contracted length of the clean energy PPA). The tariff structure and ROE are designed so that the combined returns — from the shortened operation of the coal plant and the complete lifetime of the new clean energy project — match the BAU equity returns the coal-fired plant would have generated under its original PPA term. Investors thus swap exposure from a low-utilization coal unit to a cost-competitive renewables project, preserving value while supporting national decarbonization and energy security objectives. Execution risks, such as site development, off-taker contracting, and initial construction lag, are real but manageable, especially for sponsors already experienced in Pakistan's power sector.

¹ Project sizing and technology selection have been optimized to ensure that an overall plant capacity factor of 40% can be achieved. The hybrid project simulates a real project being set up in Balochistan, for which generation forecasting and financial feasibility analyses have already been carried out.

Pathway 2 – Negotiated reduction in equity returns

A negotiated reduction in required equity returns lowers the discount rate, and enables equivalent equity value achievement over a shortened operational period. This mechanism can significantly reduce the plant's remaining economic life while maintaining investor value. The approach provides flexibility in structuring retirement agreements based on available capital, stakeholder preferences, and policy priorities.

A downward revision in the return margins can significantly shorten plant life due to the exceptionally high ROE (27.2%) awarded initially. Discounting future cash flows at a reduced ROE allows for an accelerated achievement of the baseline equity value.

A mere 0.5% ROE reduction can lead to six years being shaved off the plant's technical lifetime, while reducing equity margins by 2%–3% can extend this reduction to 11 years. While additional ROE reductions could further accelerate the retirement process, such concessions become increasingly unrealistic from an investor perspective. Beyond 2%–3% in downward renegotiations, the practical feasibility of securing investor agreement becomes severely constrained.

Avoided emissions potential

Sahiwal CFPP has mainly imported coal from South Africa or Indonesia to meet its fuel requirements. The plant is calculated to have a carbon dioxide (CO₂) emissions factor of 0.82 tonnes per megawatt-hour (MWh) based on the average calorific value (23,322 British Thermal Units per kilogram [BTU/kg]) of the coal stock consumed and the plant heat rate (8,584 BTU per kilowatt-hour [kWh]) reported in April 2025.²

Actual plant emissions depend on the plant utilization rate and the amount of fuel burned to produce energy. Generally, higher utilization rates and shorter plant lifetimes lead to greater avoided emissions. Subsequently, additional revenues would depend on the volume of avoided emissions and the price of transition credits.

According to this analysis, avoided emissions under various early retirement scenarios could range between 13–65MtCO₂e, depending on plant utilization and the retirement timeline. The upper range is the result of shaving 17 years off a plant's life. A 10-year reduction in plant life could lead to 27–38MtCO₂e avoided emissions, depending on the utilization rate.

² NEPRA. [Fuel Cost Adjustment-Sahiwal CFPP](#). 04 July 2025.

Comparative assessment

The mechanisms identified under the two pathways can potentially meet the “no worse off” test. Choosing an option depends on financing cushions, governance capacity, and sector reform. A modest 5–10-year acceleration, coupled with distributed payments or partial reinvestment, could potentially retire Sahiwal CFPP for less than USD100mn in public exposure. This would be a fraction of the plant's booked equity value and far less than the cumulative capacity payments (USD5bn) Pakistan would otherwise pay until 2046. More ambitious timelines require larger compensation but cost substantially less than BAU scenarios.

System-level considerations

Pakistan currently faces surplus capacity. Plant retirements should align with grid planning. Removing Sahiwal CFPP does not immediately create headroom for utility-scale renewables unless parallel measures, such as industrial demand revival, time-of-day tariffs, storage procurement, and distribution loss reduction, materialize. The coal-to-clean model mitigates this by targeting industrial off-takers or island microgrids, avoiding further strain on the national dispatch merit order. Regulatory amendments will also be required to ensure replacement projects secure priority connection and streamlined approvals.

Recommendations

The Sahiwal CFPP study demonstrates that early coal retirement can be structured as a fiscally prudent, investor-neutral, and climate-positive transaction when project debt is largely amortized and utilization remains chronically low. Clear valuation baselines expose the cost of inaction. Sustaining fixed payments to an under-dispatched plant could exceed USD100mn in real terms without delivering corresponding energy. In contrast, redirecting upfront or staggered compensation into new renewable capacity could ease outflows, reduce emissions, and send a clear policy signal that Pakistan is moving beyond coal.

Successful implementation would also offer political and diplomatic advantages. It would demonstrate Pakistan's resolve to honor contracts while pursuing fiscal consolidation, offer Chinese sponsors a pivot from coal to renewables, and provide a replicable template for other CPEC plants. The deal could access transition credits or green bonds by anchoring compensation to measurable avoided emissions, further lowering costs. Transparent disclosure of valuation inputs, payment schedules, and monitoring arrangements would reassure taxpayers and lenders that public resources are converted into sustainable, growth-enhancing assets. These measures could also attract catalytic philanthropic support from international climate initiatives.

Introduction

Pakistan's energy landscape changed significantly in the mid-2010s, driven by an acute power crisis and a push to partner with China under the Belt and Road Initiative (BRI). A 5–6 gigawatt (GW) deficit in the national grid brought the economy to a standstill, with businesses, residents, and commercial enterprises experiencing widespread energy shortages and daily load shedding.

A combination of urgent demand, the government's need for large-scale power, quick development of domestic coal reserves, and policy incentives converged to make coal Pakistan's preferred choice under the BRI. Approximately USD15.5 billion (bn) of investments were planned to add 10,400 megawatts (MW) in the “early harvest” phase by 2017–2019, with coal as the primary choice.³

By the mid-2010s, wind and solar energy had become increasingly cost-competitive in many global markets. However, Pakistani policymakers doubted the grid's ability to absorb variable power at the necessary scale and pace. Hydropower had a history of construction delays and cost overruns.⁴

Moreover, Pakistan had extensive, previously untapped coal reserves in the Thar Desert. After decades of relying on domestic gas and expensive imported furnace oil, policymakers were interested in a potential indigenous coal resource. Declining domestic gas output (from 1.26 million terajoules [TJ] in 2007 to 0.88 million TJ by 2017) compounded the urgency to find an alternative.⁵ Generous government incentives, including premium returns on equity for local coal projects, further decreased investor interest in solar and wind. Thus, nine coal-fired power stations — out of 21 priority China-Pakistan Economic Corridor (CPEC) energy projects — were launched in rapid succession.⁶

Although this expansion alleviated the power shortfall and boosted economic output, it locked Pakistan into long-term coal contracts just as global momentum shifted to clean energy. By 2021–2022, coal provided about 32% of Pakistan's electricity, over 80% of which came from three 1,320MW imported coal-based plants.⁷

Pakistan continued commissioning thermal stations, even though China began pivoting away from coal in many overseas markets after 2020, and global demand for high-emission projects declined. By 2019, the risks of rising capacity payments and overcapacity were being discussed.⁸ Nonetheless, new projects continued to come online, underscoring Pakistan's unique position as the leading BRI energy destination and a notable coal outlier within China's overseas investments.

³ Global Energy Monitor. [China-Pakistan Economic Corridor Coal Projects](#).

⁴ IEEFA. [Pakistan's Power Future: Renewable Energy Provides a More Diverse, Secure and Cost-Effective Alternative](#). December 2018.

⁵ Climate Policy Lab. [What Drives Pakistan's Coal-Fired Power Plant Construction Boom?](#), 27 January 2022.

⁶ Modern Diplomacy. [CPEC and Pakistan's Energy Crises](#), 19 July 2018.

⁷ NEPRA. [State of the Industry Report 2022](#). Date accessed: 17 April 2025. Page 112.

⁸ Mettis Global. [Rising capacity payments: A big hurdle in cheap electricity provision](#), 18 July 2019.

Geopolitical shifts during the Russia-Ukraine conflict led to a surge in imported coal prices. The delivered price of South African coal in Pakistan increased from USD177/tonne to USD407/tonne in 2021–2022. Consequently, the cost of energy generated from imported coal rose from PKR10.17 per kilowatt-hour (kWh) to PKR29.12/kWh.⁹

While coal prices recovered, plant utilization rates for imported coal dropped further in the following years. This was due to stagnant economic growth and reduced demand for electricity amid low industrial output and a surge in privately developed distributed solar. In 2024, plant utilization factors for the three 1,320MW imported coal-fired plants, Huaneng Shandong Ruyi Sahiwal Coal-Fired Power Plant (CFPP), Port Qasim Electric Power Coal Plant, and China Power Hub Coal Power Plant, were 18.94%, 6.77%, and 13.90%, respectively.¹⁰

Underutilization of installed capacity has been a persistent challenge, resulting in excess capacity payments and a higher per-unit cost for electricity consumers. In 2024, Pakistan's installed electric power generation was 45,888MW, while the average annual utilization was only 33.88%. Consequently, electricity consumers paid for 66.12% of unutilized output.¹¹

The government is pursuing reforms to lower power costs for the public, including early termination of contracts for inactive thermal plants and renegotiation of Independent Power Producer (IPP) agreements to reduce capacity payments.¹² These efforts also extend to the imported coal fleet, where the Private Power Infrastructure Board (PPIB) has explored repurposing plants to run on Thar coal to increase utilization.¹³

Negotiations with Chinese stakeholders have stalled due to technical complexities, high costs of asset conversion, and the sovereignty of contractual obligations.

Pakistan is locked into unsustainable long-term power purchase contracts and a centralized grid with a high risk of stranded assets, as distributed solar energy decreases grid demand and industrial growth remains stagnant. Future power planning and generation capacity expansion clearly favor cost-effective and environmentally sustainable renewable energy. However, a surplus of generation capacity limits opportunities for new utility-scale renewable projects. Additionally, the rapid uptake of distributed energy resources (DER), such as rooftop solar photovoltaic (PV) arrangements and battery energy storage systems (BESS), increases lower demand and grid challenges.

Consequently, allowing large-scale thermal power plants reliant on imported fuels to remain idle creates a substantial economic burden, resulting in high take-or-pay costs and fixed capacity payments. Simultaneously, a challenging investment landscape, weak domestic financial markets,

⁹ NEPRA. [State of the Industry Report 2022](#). Date accessed: 17 April 2025. Page 112.

¹⁰ NEPRA. [State of the Industry Report 2024](#). Date accessed: 17 April 2025. Page 05.

¹¹ NEPRA. [State of the Industry Report 2024](#). Date accessed: 17 April 2025. Page 05.

¹² Dawn. [Govt ends contracts with five IPPs to save Rs411bn](#). 11 October 2024.

¹³ Dawn. [Govt ends contracts with five IPPs to save Rs411bn](#). 11 October 2024.

a lack of clear policies, and a young coal fleet with high retirement costs add further critical barriers to Pakistan's coal phaseout.

This report explores models for phasing out or repurposing coal-based assets in Pakistan to determine possible energy reforms.

The 1,320MW Sahiwal CFPP, owned by Huaneng Shandong Ruyi Energy Private (Pvt.) Limited and operating on imported coal, is used as a pilot case. The study assesses the feasibility of early retirement, considering the plant's operational constraints, low utilization rate, and the fixed returns guaranteed under long-term Power Purchase Agreements (PPAs). A Discounted Cash Flow (DCF) model is used to value the plant, estimate compensation values for various retirement scenarios, and explore potential financing avenues to facilitate the transition.

The environmental case for shuttering coal plants is strong because of the high potential for avoided carbon emissions, even at reduced utilization rates. With new concepts such as transition credits being explored in other markets to generate additional cash, retirement prospects could improve with shorter plant closure timelines and increased clean energy investments.

Is there a way out?

Countries with advanced economies have pursued their ambitions for coal phaseouts through legally binding targets backed by strong political leadership, liberalized energy markets, and sophisticated financial systems. Contrastingly, many of Asia's developing economies are locked into long-term PPAs, which shield young coal plants from market forces and competition. There is a lack of commitments, strong carbon pricing signals, and stringent environmental regulations to discourage carbon dioxide emissions. As a result, retiring coal plants early becomes costly, exacerbated by limited foreign and domestic capital. Table 1 illustrates the difference in early coal retirement strategies and financing mechanisms adopted by developed economies compared to emerging ones.

Grid modifications and upgrades required for transitioning from fossil fuel-based resources to more flexible renewable energy have also lagged, increasing the cost of retiring coal-based plants early on a system-wide level. The availability of blended or concessional finance through schemes such as the Energy Transition Mechanism (ETM) or the Just Energy Transition Partnership (JETP) can accelerate coal retirement in developing economies. Both mechanisms focus on specific projects, aiming to mobilize private capital with support from development bank finance and grants at a limited national scale.

Some developing economies have initiated pilot programs to overcome financial and political barriers and prove the viability of ETMs and JETPs:

- 1) **South Africa's JETP** – A country-level partnership between the South African government and the International Partners Group (IPG) comprising France, Germany, the United Kingdom (UK), the United States (US), and the European Union (EU). An initial USD8.5bn has been pledged as part of a larger Just Energy Transition framework.¹⁴
- 2) **Indonesia's ETM/JETP deal** - Under a broader energy transition framework, an agreement was signed between the Asian Development Bank (ADB), Indonesian state-owned power utility company PT Perusahaan Listrik Negara (PLN), 660-MW independent power producer PT Cirebon Electric Power (CEP), and the Indonesia Investment Authority (INA) to reduce the contracted lifetime for Cirebon-1 by seven years. Negotiations are underway to finalize a transaction structure, with concessional financing likely to be provided by ADB's ETM Partnership Trust Fund and the Accelerating Coal Transition scheme under Indonesia's Climate Investment Fund. The ADB is also supporting a USD20bn JETP package, which also includes other decarbonization efforts.¹⁵
- 3) **The Philippines' ETM** – The first market-based energy transition deal in the region, achieved by ACEN, the energy arm of the Ayala Corporation. With a 100% renewables-based generation portfolio commitment, the company fully divested from the 246MW South Luzon Thermal Energy Corporation (SLTEC) coal plant in Batangas to a new Special Purpose Vehicle (SPV) created for the transaction. The transaction leverages ADB's ETM, committing to retire the coal plant 15 years earlier than its technical lifetime and preventing about 50 million tonnes of carbon dioxide equivalent (MtCO₂e) (Appendix A provides further details on these initiatives).

Despite multiple regional coal phaseout pilots, an asset-level transaction has emerged only in the Philippines. Progress has been sluggish in other countries due to lengthy, complex negotiations and slow capital disbursement. Several key factors enabled an ETM deal in the Philippines. Burdened with rising electricity demand and emissions, the country committed to phasing out coal. The Ayala Corporation, ACEN's parent company, already had a portfolio of renewable energy projects. It was prepared to divest from the last coal-fired plant on its books and reallocate capital to its green investments. Banks established special deal structures to lend to ACEN's coal plant, while equity investments by local insurance bodies and financial institutes were instrumental in initiating the transaction.

Global development partners have proposed various mechanisms to facilitate early retirement of fossil fuel assets while encouraging new green investments. In many advanced economies, government-financed plans have driven early retirement.

Fully private retirement structures require the involvement of asset owners and willing private market counterparties. However, the assets involved need to be solvent to enable such deals to proceed.

¹⁴ Germanwatch. [Overview of the South African Just Energy Transition Partnership](#). Date accessed: 09 September 2025.

¹⁵ Reuters. [Indonesia, ADB, owners agree to shutter first coal-fired power station early](#). 03 December 2023.

Public-private structures, facilitated through JETP and ETM, focus on repeated deals addressing individual assets. These are highly complex, requiring multiple financing sources and the agreement of several parties. The financial difficulties facing Pakistan's current fossil fuel fleet, particularly the government-to-government arrangements that helped create these assets, make implementing such mechanisms challenging. A focused, asset-level approach to retirement, using direct negotiations, is likely the most feasible path forward.

Table 1: Comparison of coal retirement strategies in advanced and developing economies

Coal Retirement Strategies	Coal Phaseout Targets	Key Challenges	Policy Mechanisms	Financing Mechanism Deployed	Financial Resources & Support	Renewables and Grid Investments	Case Examples
Advanced Economies (UK, Germany)	Robust targets and timelines in place supported by a strong legal mandate with a defined timeline for a complete coal phaseout.	Technical and political challenges mostly overcome via strong leadership.	Carbon pricing, emissions intensity standards, reverse auctions.	Non-compliance penalties for coal plants, carbon taxes, government based compensation for early closures.	Budgetary allocations and market mechanisms. Significant government compensation (e.g., Germany €700 million for 10 GW closure).	Robust incentives and deployments of solar, wind, storage.	UK: Last coal plant closed Oct 2024. Germany: Auctions for 10 GW closure by 2026.
Developing Economies (Indonesia, South Africa, Philippines)	No clear or legally binding coal phaseout targets; mostly voluntary goals or none. Some countries have detailed phaseout plans but implementation has been slow due to slow fund disbursement and financing bottlenecks.	Fossil fuel lock-in through long-term power purchase agreements, lack of legal frameworks, absence/weak carbon pricing, financial constraints, complex negotiations, political/economic instability, Lack of market based carbon pricing mechanism.	Net-zero commitments conditional upon financing support from the west, Moratorium on greenfield coal fired power expansion, participation in ETMs/JETPs and other pilot coal phaseout schemes.	Re-financing of asset, cash buy-outs (Sovereign loans and grants), transition credits and coal to clean credit mechanisms.	Blended finance combining concessional loans, grants, private capital, export credits. ETM: refinancing coal plants with concessional + private capital. JETP: sovereign loans, export credits, limited grants, multi-billion dollar international finance packages.	ETMs/JETPs aim to replace coal with renewables and storage, but grid updates and investments depend on financing availability.	Indonesia: ETM platform formed, Cirebon-1 expected early retirement by ~2033, financing negotiations ongoing. South Africa: JETP with large pledge, but slow implementation and political challenges. Philippines: First ETM deal (SLTEC) completed, early retirement cut plant life by half, funds mostly from domestic sources.

Source: Author analysis.

Pakistan's market readiness for early coal retirement

Early coal retirement requires strong political pressure and financial and policy levers that create economic incentives. While avoiding continued capacity payments against idle plant generation has clear advantages, significant techno-economic hurdles must be overcome to ensure a viable arrangement. Pakistan's internal macroeconomics and the geostrategic implications of renegotiating projects under a bilateral initiative require a transaction structure that balances multiple factors.

Young coal fleet backed by sovereign guarantees and long-term PPAs

The young age of Pakistan's coal fleet is a persistent challenge hindering an accelerated coal phaseout. Coal plants in the country have an average age of 4.8 years. The oldest plant, owned by Huaneng Shandong Ruyi Energy (Pvt.) Limited, is only eight years old (Table 2). Significant

concessions are awarded to these plants, including high return on equity, dollar indexation, minimum off-take requirements, take-or-pay contracts, uninterrupted fuel supply agreements, and fixed capacity payments regardless of the actual off-take. Retiring these profitable plants requires compensating owners and operators for foregone earnings. Given the substantial amount of capital needed, financing the compensation cost is challenging.

In most developing economies, high project or country risk requires guarantees of payment and certainty of revenue streams as a means of mitigating risk. This is often provided through long-term PPAs, which lock in revenue for investors over a period of 25–30 years. In Pakistan, since the off-taker utility, the Central Power Purchasing Authority-Guaranteed (CPPA-G), is a state-owned enterprise (SOE), extra protection is built into these contracts through sovereign guarantees. These mandate the government to clear dues if the off-taking utility defaults on payments.

Additionally, over 90% of coal capacity is contracted through Government-to-Government (G2G) agreements under the CPEC framework. Renegotiating such agreements requires high-level cooperation between the Chinese and Pakistani governments. Therefore, retiring or repurposing any coal-based power plant would necessitate policy commitments from the Chinese government.

Table 2: Characteristics of coal-fired plants in Pakistan

Plant Name	Capacity (MW)	Fuel Type	Average Capacity Factor (FY 2020-FY2022) (%)	Average Capacity Factor (FY 2023-FY 2024) (%) (post solar surge)	Commercial Operations Date	Age (Years)	Energy Purchase Price (PKR / kWh)- May 2025	Capacity Purchase Price (PKR /kWh)
Huaneng Shandong Ruyi Sahiwal Coal-Fired Power Plant	1,320	Imported Coal	59.1	22.63	2017	8	16.74	10.1
Port Qasim Electric Power	1,320	Imported Coal	71.48	17.23	2018	7	12.89	10.5
China Power Hub	1,320	Imported Coal	90.52	8.58	2018	7	13.02	12.2
Engro Power Gen Thar	660	Domestic (Thar) Coal	84.8	96.75	2019	6	10.1	12.9
Lucky Electric Power	660	Imported Coal	71.97	95.6	2022	3	12.5	9.3
Thar Energy Ltd.	330	Domestic (Thar) Coal	N/A (Plant not commissioned/ Under construction)	63.27	2022	3	6.5	12.84
Thar Coal Block-I Power	1,320	Domestic (Thar) Coal	N/A (Plant not commissioned/ Under construction)	71.35	2023	2	5.59	12.3
Thal Nova Power	330	Domestic (Thar) Coal	N/A (Plant not commissioned/ Under construction)	76.75	2023	2	6.5	12.74

Source: IEEFA analysis based on data from ISMO¹⁶, NEPRA^{17, 18, 19}, PPB²⁰.

¹⁶ Independent System & Market Operator (ISMO). [Merit Order May 2025](#). 15 May 2025.

¹⁷ NEPRA. [State of the Industry Report 2023](#). Date accessed: 17 April 2025.

¹⁸ NEPRA. [State of the Industry Report 2024](#). Date accessed: 17 April 2025.

¹⁹ NEPRA. [Tariff IPPs Coal](#). Date accessed: 17 April 2025.

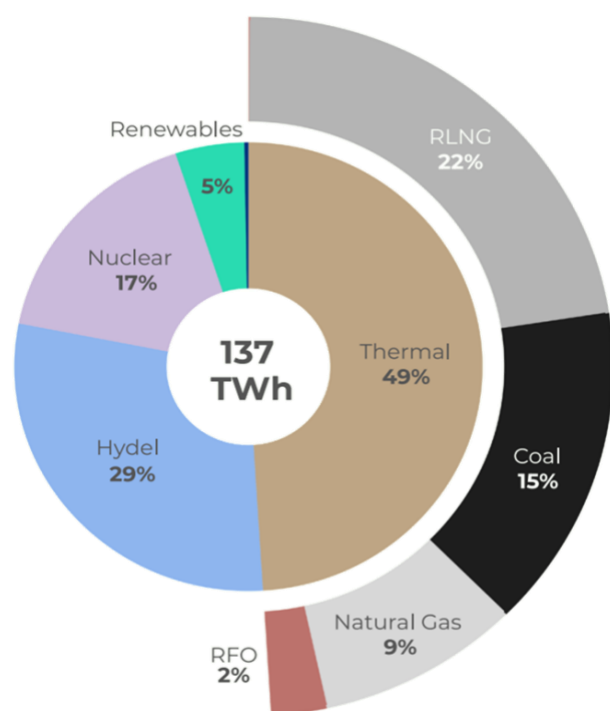
²⁰ PPB. [Commissioned IPPs](#). Date accessed: 17 April 2025.

Absence of a clear policy signal on early coal retirement

Pakistan's revised Nationally Determined Contributions (NDCs) state that the country will not build any more imported fossil fuel-based power plants. However, there is no clear commitment to phasing out existing fossil-fuel based or coal-fired power. The country has adopted renewable energy targets, aiming to have 60% of its power generation through renewables (including hydropower) by 2030.²¹ Currently, the grid's share of renewable energy is a mere 6%–7%.²² While Pakistan's generation expansion is not prioritizing any new coal power project based on economic merit and cost-competitiveness, the absence of a clear policy signal on coal phaseouts or early retirements prevents access to programs such as the ETM or JETP.

Pakistan showed interest in ADB's ETM scheme after the 26th UN Climate Change Conference of the Parties (COP26). Yet, no progress occurred after the pre-feasibility stage.

Figure 3: Electricity generated by energy sources in FY2024



Source: Renewables First²³.

²¹ UNFCCC. [Pakistan Updated NDCs](#). 2021. Date accessed: 20 April 2025.

²² NEPRA. [State of the Industry Report 2024](#). Date accessed: 17 April 2025.

²³ Renewables First. [Pakistan Electricity Review 2025](#). June 2025.

Macroeconomic instability limits the government's capacity to provide fiscal support

Pakistan's import-dependent economy has endured multiple boom-bust cycles over the past three decades, continuously running trade deficits that culminated in its most severe crisis in early 2022. The country risked sovereign default as economic conditions deteriorated.

International credit rating agencies downgraded Pakistan's sovereign rating to its lowest levels in decades. Fitch downgraded the country to CCC- with a negative outlook in early 2023²⁴, while Moody's followed suit, signaling substantial default risk to international investors and creditors.

This financial instability caused sovereign bonds, originally issued at a USD100 face value, to trade between USD35 and USD45²⁵ in secondary markets, reflecting widespread investor concern and capital flight. Other emerging economies facing similar sovereign debt difficulties included Ghana, Zambia, and Ethiopia.

While credit ratings have improved to B-, Pakistan's fiscal conditions remain uncertain. The country continues to navigate fiscal and balance of payment deficits. Additionally, unresolved arrears regarding dividend repatriation, particularly from power sector entities, undermine investor confidence and complicate economic recovery.

External and internal pressures heightened the 2022 economic crisis. Globally, the Russia-Ukraine conflict triggered commodity price volatility, with Brent crude oil reaching USD130 per barrel. This development significantly impacted Pakistan's import costs and current account balance. Domestically, catastrophic flooding affected approximately one-third of the country's territory, causing substantial infrastructure damage and creating additional fiscal pressures on already strained government resources. Political uncertainty also hindered effective policy implementation, eroding domestic and international investor confidence.

The Pakistani rupee depreciated, consumer price inflation soared to 40%, and energy costs, among the highest in the region, affected consumers and businesses. The government's financing options became severely constrained, with limited access to international capital markets. These factors led to the brink of sovereign default by late 2022.²⁶

In 2025, Pakistan's economy continues to recover. The country recently signed its 25th International Monetary Fund (IMF) program, a 37-month Extended Fund Facility approved in September 2024. However, this assistance comes with stringent conditions. A recent program review in May 2025

²⁴ Profit. [Fitch Endorses What the Government Has Been Claiming](#). 02 June 2025.

²⁵ Profit. [Fitch Endorses What the Government Has Been Claiming](#). 02 June 2025.

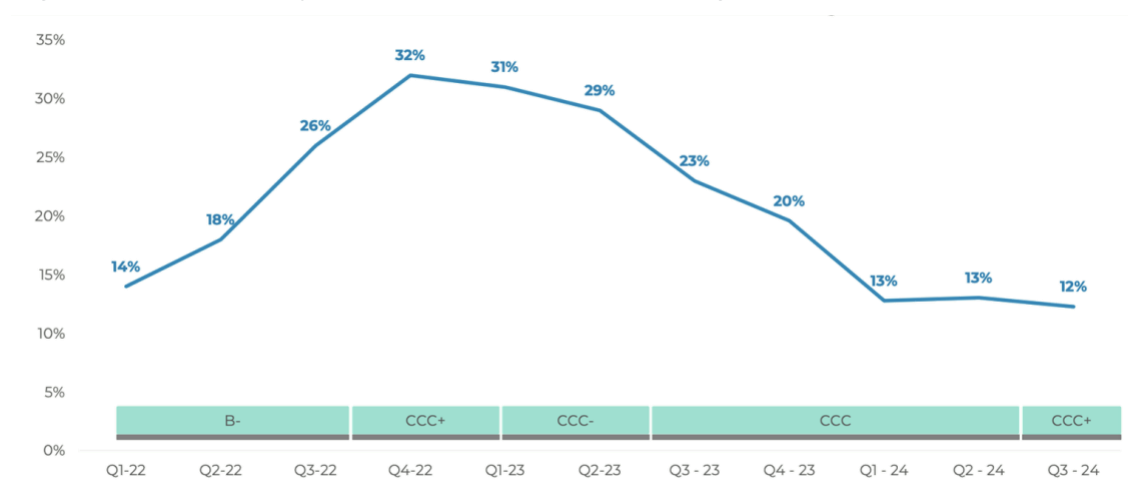
²⁶ Profit. [Fitch Endorses What the Government Has Been Claiming](#). 02 June 2025.

imposed requirements to set electricity tariffs at cost-recovery levels while removing the ceiling on debt service surcharges, potentially leading to higher electricity bills for consumers.²⁷

The federal budget for the financial year (FY) 2026 was drafted within the constraints of the ongoing IMF program and the country's fiscal vulnerabilities. The government is now targeting a primary fiscal surplus through expenditure cuts and increased revenue generation from indirect taxation. This approach indicates that the state lacks the resources to retire underutilized power sector assets.²⁸

Development finance institutions (DFIs) and multilateral development banks (MDBs) can play a crucial role in offering credit enhancement support and raising concessional capital to accelerate the retirement of coal-fired power plants.

Figure 4: Green bond yield and Pakistan's credit rating



Source: Renewables First²⁹.

Weak domestic markets

As seen in the Philippines, the availability of local capital and a strong domestic financing market can facilitate rapid transitions when displacing coal-based generation with clean energy. In comparison, Pakistan's weak domestic markets could be an obstacle in phasing out coal and replacing it with renewable energy.

Challenging macroeconomic conditions, such as a liquidity crunch and the discontinuation of the State Bank of Pakistan's concessional financing scheme, have reduced domestic funding for renewable projects. The private sector has been crowded out of the banking debt market as the

²⁷ International Monetary Fund. [IMF Executive Board Concludes 2024 Article IV Consultation for Pakistan and Approves 37-month Extended Arrangement](#). 27 September 2024.

²⁸ Renewables First. [Budget 2025-2026](#). June 2025.

²⁹ Renewables First. [Pakistan's Renewable Energy Auction Experience](#). 2025.

government absorbs most of the liquidity from commercial banks. Pakistan's previously low credit rating has also resulted in high interest rates, creating an uncertain investment environment.

Consequently, project financing in the power sector relies heavily on state-backed sovereign guarantees, limiting opportunities for small and local developers. Local developers also lack institutional history with banks and financial institutions, making it challenging for them to secure the high upfront capital needed for renewable energy projects.

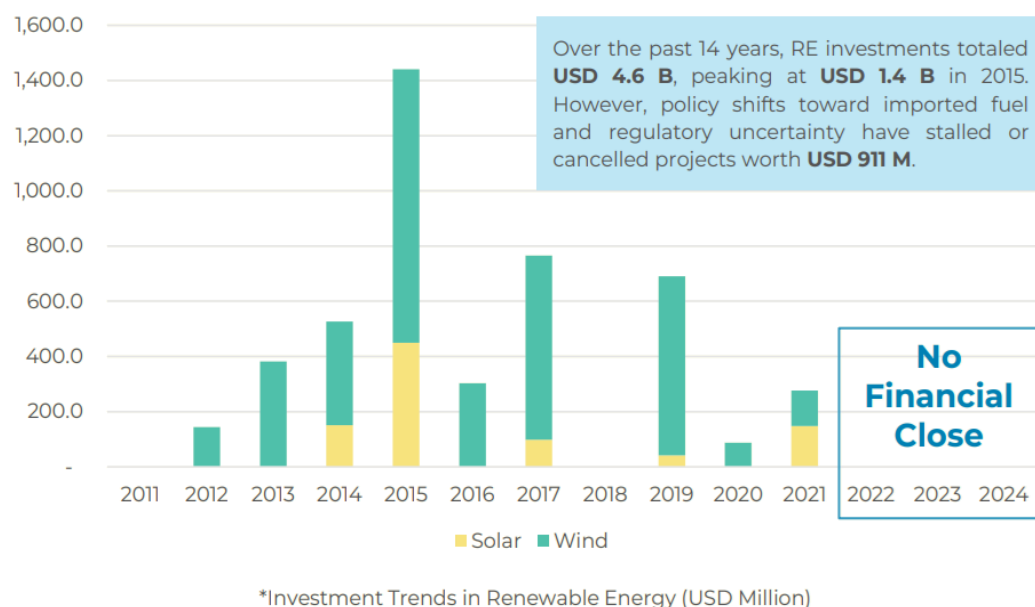
Table 3: Government guarantees (by sector and interest rate)

	Jun-23		Dec-23		Jun-24		Dec-24	
	PKR bn	US\$ bn	PKR bn	US\$ bn	PKR bn	US\$ bn	PKR bn	US\$ bn
(Sector Wise Breakup)								
Total Guarantees Stock	3,519	12.3	3,495	12.4	3,387	12.2	4,211	15.1
- Power Sector	2,545	8.9	2,483	8.8	2,353	8.5	2,317	8.3
- Aviation	249	0.9	250	0.9	247	0.9	269	1.0
- Financial	110	0.4	100	0.4	114	0.4	143	0.5
- Manufacturing & Mining	102	0.4	45	0.2	45	0.2	45	0.2
- Oil & Gas	166	0.6	145	0.5	170	0.6	134	0.5
- Commodity Operations	-	-	-	-	-	-	852	3.1
- PPP	-	-	7	0.0	7	0.0	7	0.0
- Others	348	1.2	465	1.6	452	1.6	446	1.6

Source: Ministry of Finance, Government of Pakistan³⁰.

Financial institutions prefer experienced contractors who have established relationships with banks, a reliable credit history, and well-developed supply chains. As a result, it is challenging to obtain non-collateralized loans for clean energy projects. Loans awarded have short tenors, while projects often face long lead times. Therefore, no utility-scale renewable energy projects have reached financial close since 2022 (Figure 5).

³⁰ Ministry of Finance, Government of Pakistan. [Semi-Annual Public Debt Bulletin \(July – December 2024\)](#). 28 March 2025.

Figure 5: Investment trends in renewable energy (USD million)

Source: Renewables First³¹.

Lack of carbon pricing mechanisms

Pakistan has actively attempted to access climate finance by participating in carbon markets. The Ministry of Climate Change and Environmental Coordination (MoCC) launched its 'Policy Guidelines for Trading in Carbon Markets' in November 2024, which serves as the foundation for the establishment of a carbon trading mechanism in Pakistan, aligned with Article 6 of the Paris Agreement.^{32, 33} While this is a step in the right direction, the country requires institutional mechanisms for calculation, verification, and monitoring of carbon credits, critical for credibility in international markets.

The absence of clear pricing signals on carbon emissions through a carbon tax or an emissions trading system (ETS) makes it challenging to integrate carbon pricing into approval processes for new power generation projects or the retirement of existing fossil-fuel based power plants.

Any carbon financing would need to be through privately arranged carbon credits, verified by independent third parties. This adds further challenges in arranging funding for renewable energy projects through climate finance.

³¹ Renewables First. [Budget 2025-2026](#). June 2025.

³² Ministry of Climate Change, Government of Pakistan. [Pakistan Policy Guidelines for Trading in Carbon Markets](#). 2024.

³³ SPAR6C. [Pakistan Publishes its Carbon Market Guidelines](#). 26 November 2024.

Falling electricity demand amid rising DER adoption

Pakistan's clean energy landscape is rapidly transforming through the addition of DER such as rooftop solar PV systems and BESS. Driven by high domestic electricity prices and falling solar PV module and lithium-ion battery costs, almost 16GW of rooftop solar PV has been installed between 2022 and 2024 in both off-grid and on-grid configurations across various sectors.³⁴ As consumers generate and use electricity on-site, there is a reduction in grid demand. During this period, Pakistan's national grid has experienced a cumulative 11% decline in energy consumption.³⁵ Table 2 highlights how rising distributed solar levels have impacted utilization factors for the imported coal fleet after the solar surge.

Pakistan's surplus generation has exacerbated and limited the potential for replacing retired coal-fired assets with utility-scale renewable projects.

After decades of focusing on developing indigenous coal resources, the government is reluctant to abandon its relatively young coal fleet. Macroeconomic and fiscal instability limit its capacity to restructure outstanding arrears or provide credible commitments. Weak private capital markets further constrain cost-effective domestic investment or refinancing. The absence of carbon pricing also hinders green funding. Meanwhile, inaction on arrears and continued reliance on expensive fossil fuels for grid-based electricity supply have driven wealthier consumers toward rooftop solar generation, sharply reducing utility demand and further straining public finances.

Financing for early coal retirement in Pakistan – An opportunity for China

With energy transition initiatives facing challenges in the West, there is an opportunity for others to take a leadership role in financing coal retirement. China has been the world's largest public financier of overseas coal power over the past decade, largely through its BRI. In 2021, President Xi Jinping announced that the country "would stop providing financial support for overseas coal" and instead support green energy in developing countries.³⁶ This marked a strategic shift, favoring China's national push into green technologies, creating an opportunity for it to aid its partners in transitioning away from coal.

In October 2023, China unveiled a new Green Investment and Finance Partnership (GIFP) at the Third Belt and Road Forum as part of its upgraded "Green BRI" efforts.³⁷ The GIFP is envisaged as a project pipeline and financing platform to mobilize large-scale capital for clean energy and

³⁴ IEEFA. [Increased battery energy storage system \(BESS\) adoption presents opportunities for grid modernization and system planning in Pakistan](#). 05 June 2025.

³⁵ IEEFA. [Net Metering Reforms and Grid Challenges Amid Pakistan's Solar Rise](#). April 2025.

³⁶ Reuters. [China's development banks provided no green energy finance in 2022 -research](#). 14 November 2023.

³⁷ China Global South Project. [A Peer-to-Peer Pivot in China's Overseas Development Finance](#). 01 July 2025.

sustainable infrastructure in BRI countries. President Xi indicated that around USD100bn in annual financing could be made available to support energy transitions in developing countries.³⁸ Although no specific deals have been announced yet, GIFP signals China's intent to channel significant funds toward low-carbon projects abroad.

China could potentially pilot an ETM-like coal retirement project, demonstrating global leadership in a domain dominated by the West. Pakistan could be a potential candidate with a large coal power portfolio financed largely by Chinese banks and companies. The country currently has about 5–6GW of coal-fired capacity, mostly commissioned in the last 5–7 years under the CPEC program. These plants have lifespans lasting until the 2040s. However, Pakistan's power sector is under financial strain. Capacity payments to power producers have ballooned, and there is excess generation relative to demand, leading to idle plants and debt accumulation. The early retirement of some coal plants could alleviate future payment burdens and reduce carbon emissions, but the country cannot financially compensate plant owners independently. A China-led ETM could be transformative in this situation.

“ Through the GIFP, China could arrange a financing package to buy out or refinance a selected coal plant in Pakistan in exchange for its closure or conversion. For instance, Chinese policy banks such as the China Development Bank and China Eximbank, which originally financed the coal project, could refinance outstanding loans at concessional rates and provide new credit for renewable projects to replace the coal capacity.

Alternatively, an equity buyout could be an option for plants where debt restructuring is unlikely. China's Silk Road Fund or SOEs could take an equity stake in the restructured venture, ensuring the original investors (Chinese companies) are compensated for foregone future profits. China can use its financial leverage — possibly backed by GIFP's green funds — to reorganize the coal plant's ownership, debt, and equity to make it economically viable for an early shutdown. Research supports the feasibility of this approach. A 2024 study by the Green Finance & Development Center analyzed six Chinese-financed coal plants in Pakistan and Vietnam and found that “early retirement could actually increase the enterprise value” of the assets when combined with portfolio refinancing and renewables investment.³⁹ In Pakistan's case, the modeling showed that refinancing could allow three plants to retire 7–9 years ahead of schedule while still improving their Enterprise Value (EV). This counterintuitive result implies that, under the right financial structuring, stakeholders are not necessarily disadvantaged by retiring coal early — value can be recovered through reduced risk, carbon credit revenues, or clean energy returns.

Piloting such a project in Pakistan would yield multiple benefits for China. Strategically, it would demonstrate China's commitment to a green BRI, aligning with global climate goals. It would also

³⁸ South China Morning Post. [Opinion | China steps up climate fight with belt and road green finance partnership](#). 19 October 2023.

³⁹ Nedopil et.al. [Can investors benefit from the early retirement of coal plants: A plant-level analysis of Chinese-sponsored coal stations in Vietnam and Pakistan](#). October 2024.

enhance China's leadership role in climate finance by addressing the environmental impact of past investments. Assisting Pakistan in transitioning its energy mix could stabilize a key partner's economy (easing circular debt in the power sector) and expand China's role in Pakistan's energy infrastructure through renewables (China is already supplying solar and hydro investments in Pakistan). Furthermore, a successful coal-to-clean transition in Pakistan, enabled by Chinese finance, could be a replicable model for other countries where China has financed coal projects (such as Indonesia, Vietnam, and Bangladesh). Chinese-led financing may operate more rapidly or with different risk tolerances than Western consortia, accelerating action.

Challenging investment landscape hampers new financing opportunities

Pakistan's coal-fired capacity has been sponsored by state-owned Chinese financing institutions such as China Development Bank (CDB), the Export-Import Bank of China (CHEXIM), and the Industrial and Commercial Bank of China (ICBC). All investments in Pakistan are insured by Sinosure, also known as the China Export & Credit Insurance Corporation. This state-owned insurer provides export credit insurance and other financial services to support Chinese businesses involved in international trade and investment. Therefore, any decision involving debt restructuring (an established practice for accelerated coal retirement) would need to be discussed with the lending consortium and Sinosure. Chinese banks and financing institutions have not considered the prospects of early coal retirement so far.

Western countries and the IMF have been reluctant to extend loans to Pakistan to service its Chinese debt.^{40, 41} For an early coal phaseout of CPEC coal plants, the process would be simpler if China provided both financing and replacement clean energy. However, given the financial and security challenges facing Chinese businesses in Pakistan, the availability of capital on a commercial basis may be limited. Appendix B highlights Chinese concerns in more detail, including technical criteria, a lack of precedence for overseas and in-house coal retirement in China, and Pakistan's boom-and-bust economic cycles, which could lead to an increase in energy demand in the future.

Despite insurance from Sinosure against non-payment of dues, the accumulation of significant arrears for CPEC power plants has been a persistent issue, frequently highlighted by plant owners. Requiring insurance is considered a last resort. The project must be in default and determined to be insolvent and non-recoverable to receive a payout. Therefore, investors prefer to continue absorbing losses or appealing to government authorities.

Financial recovery rates for individual plants range between 89% and 96%, leading to USD1.5bn in payables by the CPPA-G.⁴² Low recoveries impact project liquidity, decrease the availability of working capital, and allow only partial returns to project sponsors. Renewable energy projects such as solar and wind have lower operational costs due to the absence of fuel-related expenditures.

⁴⁰ Reuters. [U.S.' Pompeo warns against IMF bailout for Pakistan that aids China](#). 31 July 2018.

⁴¹ Middle East Institute. [The IMF, CPEC, and Pakistan: Will the Chinese save Islamabad yet again?](#). 06 August 2024.

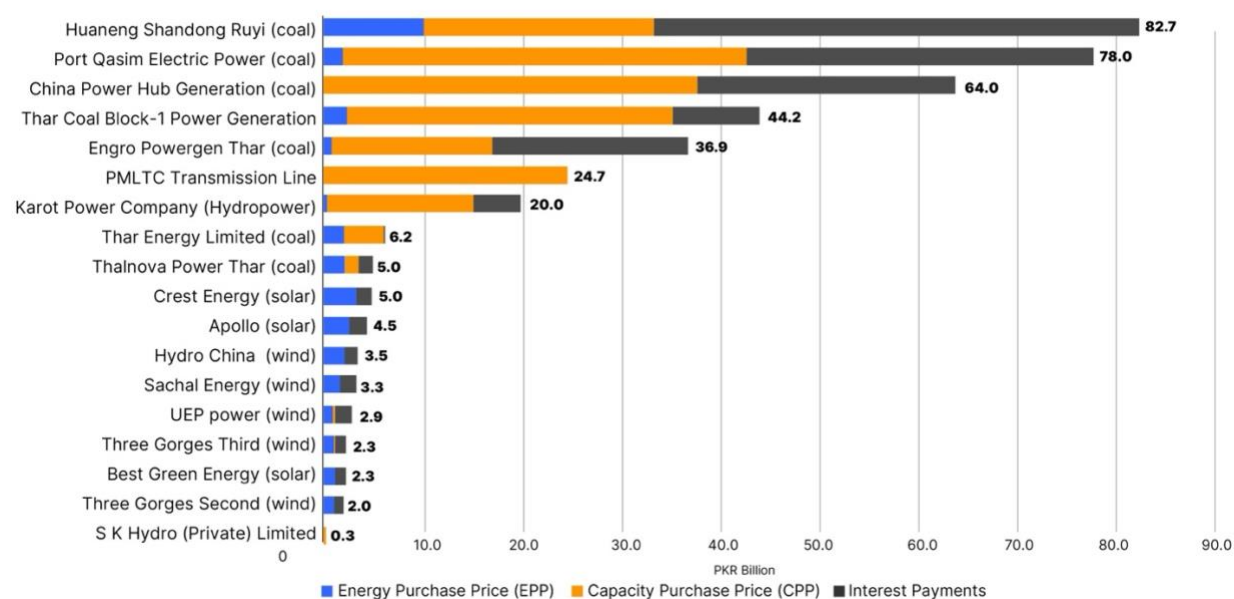
⁴² Business Recorder. [Chinese IPPs face Rs500bn in unpaid dues](#). 30 June 2025.

However, limited capital can be challenging for fossil fuel-based power plants, where timely payments are critical for fuel procurement and plant operations. For instance, the Sahiwal CFPP and Port Qasim Electric Power Company (PQEPC) have threatened closure on multiple occasions due to non-payment of dues.^{43, 44}

In May 2023, PQEPC served a formal notice of payment default to CPPA-G, citing PKR77.3bn in overdue settlement.⁴⁵ The plant threatened to halt operations again in October 2024 as its overdue receivables had risen to PKR88bn.⁴⁶ The issue of non-payment of dues remains unresolved in 2025. The PQEPC's Chief Executive Officer (CEO) wrote a letter to Pakistan's Finance Minister requesting an immediate reconciliation of outstanding payments as the total payment due had reached PKR93.5bn by February 2025.⁴⁷

Similarly, the National Grid Company (formerly the National Transmission and Despatch Company [NTDC]) failed to clear overdue payments for the 660MW Pak Matiari–Lahore Transmission Company (Pvt.) Ltd. (PMLTC). In a letter addressed to the Managing Director of NTDC, the president and CEO of PMLTC expressed concerns over unpaid dues to the transmission line from December 2024 to May 2025. The Pakistani government owes PMLTC PKR55bn, with PKR47bn long overdue.⁴⁸

Figure 6: Outstanding receivables of CPEC plants as of December 2024



Source: Central Power Purchasing Authority-Guaranteed (CPPA-G), IEEFA analysis.

⁴³ Business Recorder. [1,320 MW coal plant: PQEPC threatens to halt operations](#). 06 October 2024.

⁴⁴ The News International. [Sahiwal coal-fired power plants feared closure on non-payment of dues](#). 03 April 2018.

⁴⁵ Dawn. [Chinese IPP serves notice of payment default on CPPA](#). 31 May 2023.

⁴⁶ Business Recorder. [1,320 MW coal plant: PQEPC threatens to halt operations](#). 06 October 2024.

⁴⁷ Business Recorder. [Overdue payment issue: PQEPC threatens to suspend plant operations](#). 18 March 2025.

⁴⁸ Business Recorder. [Chinese IPPs face Rs500bn in unpaid dues](#). 30 June 2025.

While the government periodically clears these dues, this issue will likely persist because of Pakistan's weak macroeconomic conditions and the distribution utilities' inability to fully recover the cost of electricity supplied.

Financing for new investments within the power sector is also affected. For example, Pakistan has proposed converting three imported coal-based plants under CPEC to local Thar coal. However, any formal consideration by the Chinese remains pending, despite an agreement to explore project feasibility through a joint working group. While conversion may increase savings and reduce tariffs, Chinese stakeholders are concerned about aspects such as technical adaptation. Furthermore, there are differences between the cost estimates projected by the government's consultant and those by the project sponsors. Chinese enterprises would have to retrofit plants to utilize Thar coal, requiring a complex approval process and additional financing.⁴⁹

Given Thar coal's lower calorific value and differing characteristics, the plants would require material modifications to boilers and larger coal and ash handling equipment. The impact on operational performance and reliability would need to be scrutinized. Such a conversion would require further capital investment, which would need to be recovered through tariff payments, in addition to the original investment cost.



Without an explicit commitment from the Government of Pakistan or its Chinese counterparts on early retirement of overseas coal-based assets, an official feasibility assessment to find a suitable pilot candidate cannot be undertaken. An accelerated coal phaseout requires political commitment, legal maneuvering, and renegotiation of the PPAs for these power plants.

Attempts at renegotiating PPAs with IPPs in Pakistan have encountered resistance from Chinese enterprises, sponsors, and plant owners. Discussions often reach an impasse as pending dues owed by the Pakistani government hinder progress.⁵⁰

Another example was the stalling of the circular debt management plan in August 2025. The initiative aimed to reduce PKR1.3 trillion from the power sector's circular debt by 2031 through new borrowing at lower interest rates. This required Chinese IPPs to waive the Late Payment Surcharge (LPS), which they refused, as their financial position would be at risk.⁵¹ Critics argue this plan was flawed, as it would have led to higher consumer tariffs, which would be counterproductive.⁵² Pakistan's geostrategic ties with China make it politically challenging to enact such concessions. Therefore, resolving financial arrears will need to be part of any future transaction.

⁴⁹ Business Recorder. [Conversion of power plants to coal: NEA of China seeks to set up working group for talks](#). 01 November 2024.

⁵⁰ Business Recorder. [Capacity tariff of Chinese IPPs: China appears unwilling to renegotiate?](#). 06 September 2024.

⁵¹ The News. [Chinese IPPs 'unwilling' to waive LPS to clear Rs1,257bn circular debt](#). 20 August 2025.

⁵² Business Recorder. [Circular debt debacle: financial fixes cannot solve the problem](#). 14 July 2025.

Chinese and Pakistani governments would need to work together to identify which plant to target and ensure the legal and regulatory frameworks allow for an early shutdown. For example, it would be necessary to renegotiate or buy out the PPA contract with Pakistan's electricity purchaser, without invoking contractual obligations that classify it as a default by the Pakistani government. Deciding who bears the cost of any stranded coal mine or grid infrastructure linked to the plant should be addressed as part of a comprehensive transition plan for the local area. This is an issue that Western JETPs also face. However, China has the advantage that its state-driven approach could execute decisions more quickly. If GIFP is endowed with real capital and authority, it could directly fund negotiated settlements to retire coal plants.

China has been a key investment partner in Pakistan through the BRI and CPEC, with G2G agreements enabling the Thar coal power plants. However, the generous contractual terms granted to Chinese investors have strained Pakistan's utilities. Simultaneously, China has refocused its national development efforts towards green technologies. This creates both challenges and opportunities for China to renegotiate coal-related issues in Pakistan and deploy its leading green technologies. Progress will require compromises, including an equitable, reliable pathway to resolve arrears with Pakistani creditors. China's new GIFP could create a path to a China-sponsored ETM, similar to JETPs, but both countries would need to engage in high-level agreements and coordinated actions.

Modeling an exit scenario for a select CFPP in Pakistan

Retiring a coal plant requires extensive negotiations involving investors, lending institutions, government bodies, and high-level leadership. Therefore, plant selection should be detailed and based on technical and economic evidence.

From a policymaking perspective, the best retirement candidate would require minimal government compensation but provide the most significant financial, operational, and environmental benefits when removed from the grid.

From an asset owner's outlook, the ideal candidate would have limited upside under current ownership or declining market value, but could achieve a higher valuation through an early retirement transaction.

From a transition investor's perspective, the ideal asset should require the lowest payment while offering the highest returns and achieving the earliest possible closure.⁵³ While the country's entire imported coal fleet may be eligible for an early retirement scenario based on low utilization rates and high marginal costs (Table 1), this section only focuses on the Sahiwal CFPP as a case study to build a replicable model that can be applied to other plants as well.

⁵³ IEEFA. [Making the energy transition mechanism meaningful: A case study from Pakistan](#). 05 October 2023.

Figure 7: IEEFA's proposed framework for an energy transition deal in Pakistan



Source: IEEFA⁵⁴.

Plant Selection

The Sahiwal CFPP is an IPP operating the 1,320MW coal-based power plant in Qadirabad, District Sahiwal. Huaneng Group Company Limited, a state-owned Chinese company, is the parent of the Pakistani entity that owns the plant. It was commissioned on 28 October 2017 for 30 years with a guaranteed 50% off-take with CPPA-G. Meanwhile, the Implementation Agreement provides a sovereign guarantee, contingent upon adherence to agreed performance benchmarks (85% availability and 39.75% efficiency).

⁵⁴ IEEFA. [Making the energy transition mechanism meaningful: A case study from Pakistan](#). 05 October 2023.

The plant maintained high utilization rates in its initial years of operations. However, as the volume of distributed solar installations increased nationwide, plant utilization decreased for Pakistan's imported coal fleet. The Sahiwal CFPP had a plant capacity factor of just 26.3% and 18.9% in FY2023 and FY2024, respectively.⁵⁵

Traditional coal retirement models being explored by ETMs and JETPs rely on a combination of concessional finance and debt restructuring to create margins for compensating plant owners against reduced economic value.⁵⁶ However, for Chinese-sponsored plants in Pakistan, debt restructuring and re-profiling are complicated processes, requiring high-level renegotiations with Chinese banks and Sinosure.

“Sahiwal CFPP's relatively older age (8 years) means that the plant's 10-year debt servicing period will soon be over. Consequently, potential retirement scenarios may exclude debt restructuring. This would allow retirement scenarios to be planned around equity returns with fewer stakeholders and more room for negotiation.

Sahiwal CFPP's relatively older age (8 years) means that the plant's 10-year debt servicing period will soon be over. Consequently, potential retirement scenarios may exclude debt restructuring. This would allow retirement scenarios to be planned around equity returns with fewer stakeholders and more room for negotiation.

The plant also had the highest volume of outstanding payments (PKR82.7bn) among the CPEC portfolio (Figure 6). This suggests that settling these dues as a part of the transaction could lead the plant to consider retirement as a means to recover some economic value when facing a low plant utilization future.

Modeling retirement options

Approach

A comprehensive financial modeling exercise was conducted to determine the economic costs and feasibility of various phase-down scenarios, evaluating early retirement options for the Sahiwal CFPP. The analysis established baseline plant valuations, quantified financial impacts of accelerated retirement timelines, and assessed different compensation mechanisms for project sponsors.

⁵⁵ NEPRA. [State of the Industry Report 2024](#). Date accessed: 17 April 2025. Page 05.

⁵⁶ Global Development Policy Center. [Capitalizing on Coal Early Retirement Options for China-Financed Coal Plants in Southeast Asia and Beyond](#). July 2023.

Methodology and scenarios

A valuation model, based on the Discounted Cash Flow (DCF) method, established the plant's economic value by varying operational parameters, including utilization rates and cash flow predictability. This baseline valuation was then used to calculate forgone financial value across early retirement scenarios ranging from 5 to 17 years shorter than the plant's expected operational life.

The objective was to determine how rapidly retirement could be achieved, what financing would be required, and which options were feasible.

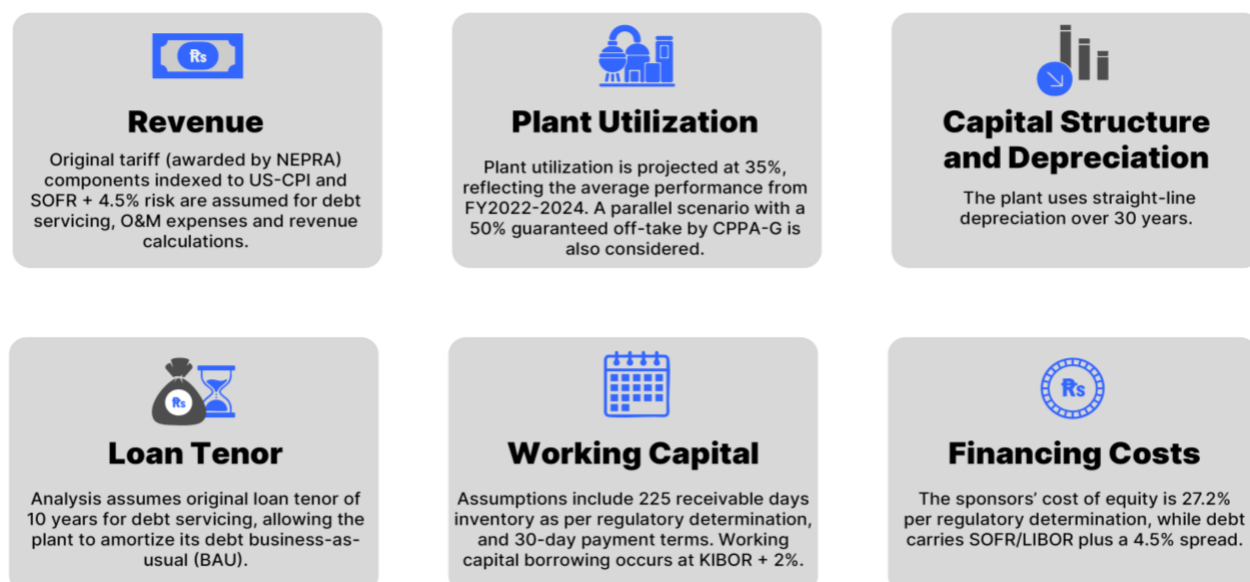
Transaction structuring aspects of the retirement deal were also examined, exploring multiple scenarios for compensating project sponsors. These included upfront compensation, distributed payments over the reduced life of the PPA, rate of return renegotiation, and alternative investments in distributed renewable energy projects serving as clean-to-coal transition pathways.

Each scenario was evaluated based on financing requirements, implementation feasibility, and cost-effectiveness to determine the most viable approaches for achieving rapid retirement while maintaining stakeholder interests.

Baseline evaluation

A DCF (Appendix C) baseline evaluation is used to value the plant at different utilization rates. The evaluation treats Sahiwal CFPP as a standalone SPV, mirroring its actual financing structure. A DCF model forecasts free cash flows to equity from FY2025 to the contractual end-of-life in 2046, and discounts them at a weighted average cost of capital that evolves as debt amortizes. Inputs combine regulatory tariff schedules, recent operating data, and realistic market projections to calculate the EV and equity value of the plant. These values are important metrics that provide a snapshot of the plant's current value, which can be used to determine the financing requirements for a transaction.

Figure 8: Key assumptions for DCF analysis



Source: Author analysis.

Note: US-CPI = United States Consumer Price Index; O&M = Operations and Maintenance; SOFR = Secured Overnight Financing Rate; CPPA-G = Central Power Procurement Agency Guaranteed; LIBOR = London Interbank Offered Rate; KIBOR = Karachi Interbank Offered Rate.

Scenario 1 is based on the authors' proprietary model. The first set of valuations assumes a 35% plant utilization rate, based on the average of actual plant utilization from 2019–2024, to gauge what future cash flows are likely to be, considering increasing solarization and decreasing industrial grid demand. The second set of valuations assumes a 50% guaranteed off-take, as stipulated by the PPAs signed by imported coal-fired plants in Pakistan.⁵⁷

Increasing the plant utilization rate leads to a higher EV and equity value.

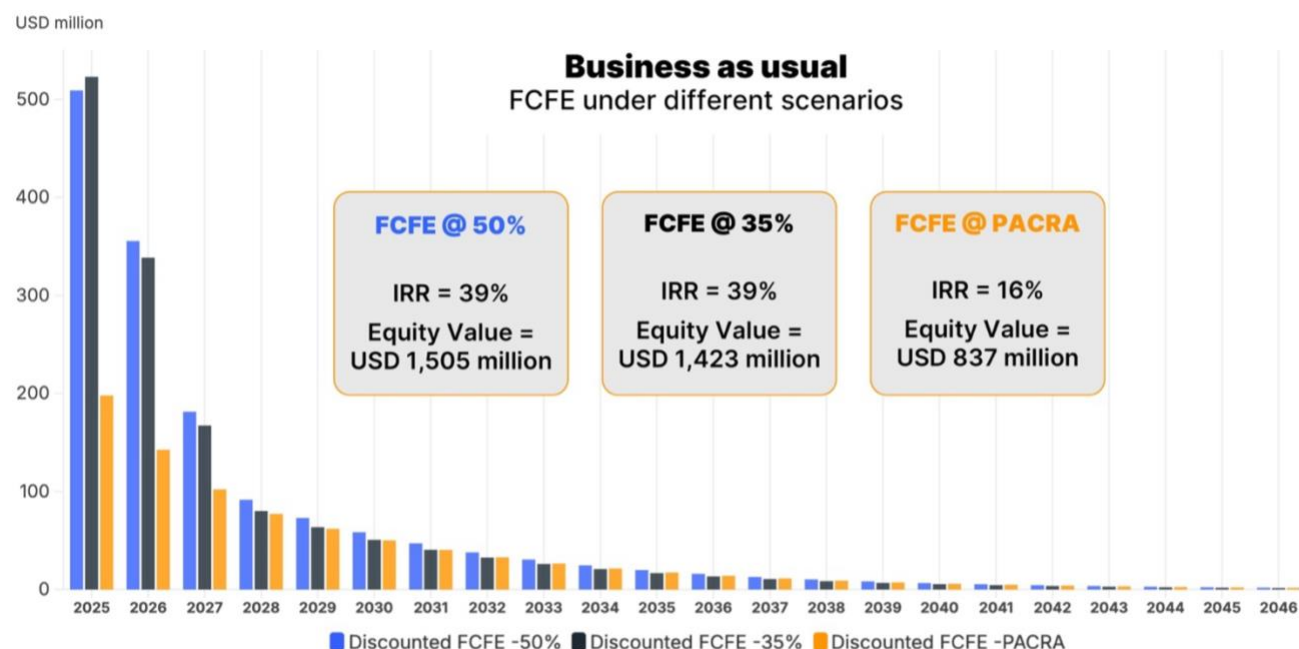
The results are as follows:

Table 4: Plant valuation under different utilization rates

Valuation Criterion	Scenario 1 @ 35% Plant Utilization	Scenario 2 @ 50% Plant Utilization
Enterprise Value USD mn	1,726	1,809
Equity Value USD mn	1,423	1,505

Source: Author analysis.

⁵⁷ CPPA-G. [Power Purchase Price Forecast Report FY2019-2020](#). Accessed on 21 July 2025.

Figure 9: Free cash flows to equity under varying plant utilization rates

Source: Author analysis.

Note: FCFE = Free Cash Flow to Equity, IRR = Internal Rate of Return.

Economic threshold for retirement

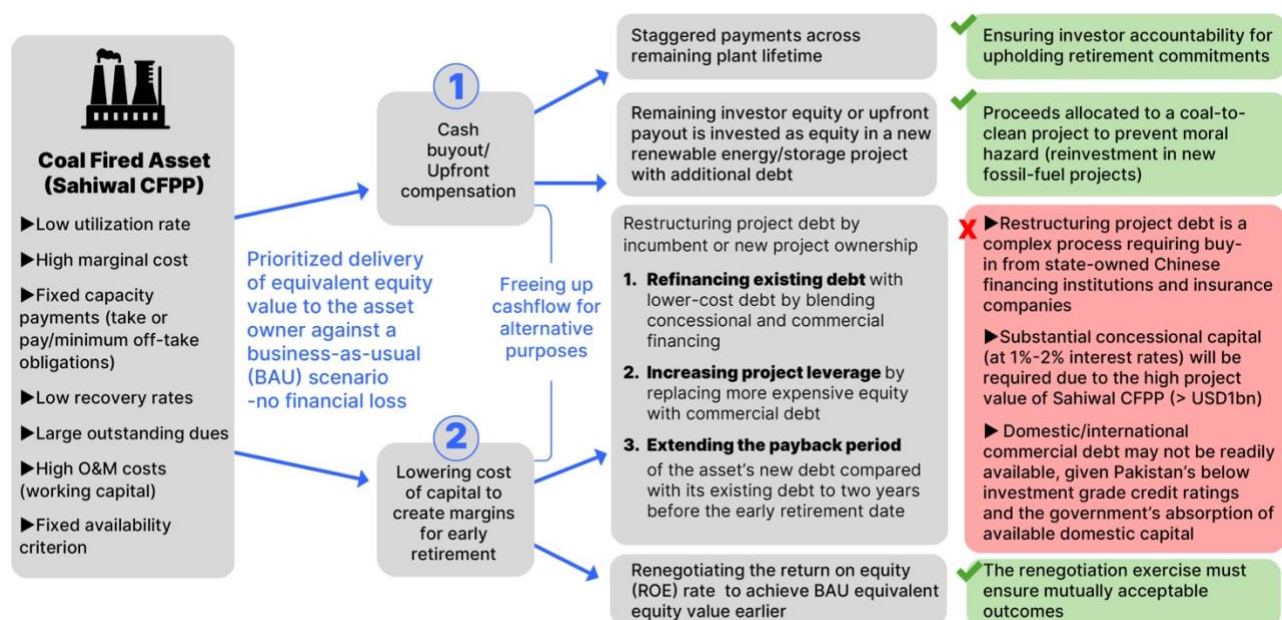
Early retirement becomes financially viable when sponsors can achieve an equivalent or superior valuation compared to continuing operations or the baseline valuation.

Two-pathway retirement strategy

Two primary pathways were identified for assessing optimal timelines for early closure of the Sahiwal CFPP:

- 1) An upfront buyout, where the government or new investor acquires the plant by compensating the existing owners for foregone future cash flows in a lump-sum settlement
- 2) A negotiated reduction in the Return on Equity (ROE) component of the plant tariff, to accelerate plant equity value under a business-as-usual (BAU) scenario

Figure 10: Early coal retirement pathways for Sahiwal CFPP in Pakistan



Source: Author analysis.

1. Upfront compensation

Direct payment to equity holders compensates for the net present value (NPV) of foregone cash flows under early retirement. This approach provides immediate liquidity and certainty for investors while enabling retirement within an agreed timeframe. The model experiments with various reduced timeframes to arrive at a range of upfront compensation that would be required to accelerate plant phaseout.

Table 5: Upfront compensation required under different scenarios (USD million)

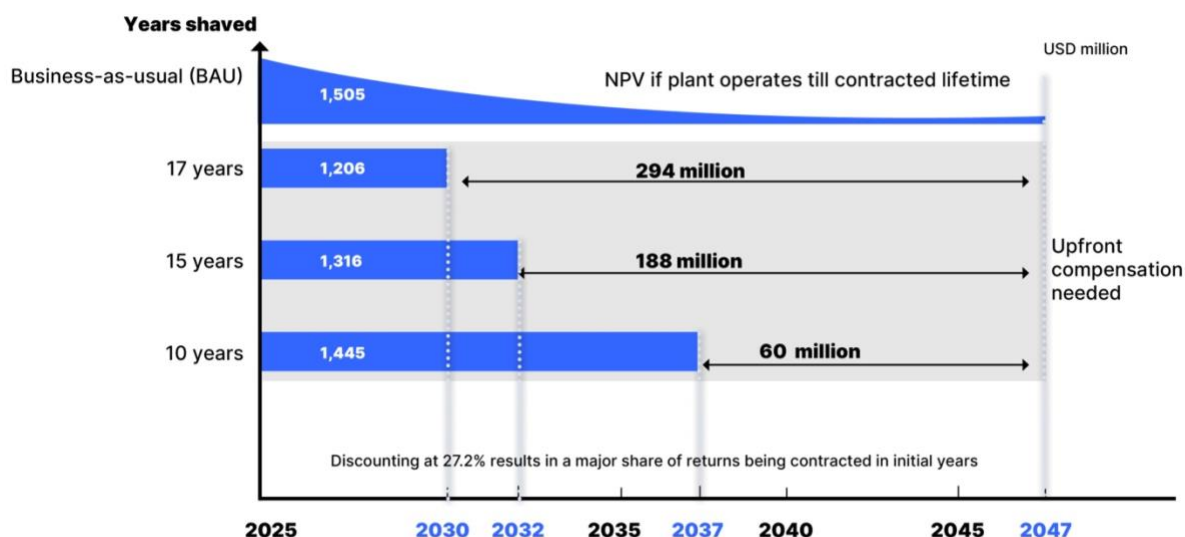
Reduced Timeframe	Scenario 1 @ 35% Plant Utilization	Scenario 2 @ 50% Plant Utilization
17 years shaved	250	294
15 years shaved	158	188
10 years shaved	48	59
7 years shaved	22	27
5 years shaved	12	15

Source: Author analysis.

Depending on the scenario, upfront compensation to Sahiwal CFPP could range between USD12mn and USD294mn, resulting in a reduction of 5 to 17 years in the plant's contracted lifetime. An alternative valuation is also explored based on the plant's cash flows reported by the Pakistan Credit Rating Agency (PACRA) for FY2023. Additionally, an exit valuation methodology is explored to

establish equitable exit pricing for sponsors and to provide the government with negotiating room during discussions. Under these methodologies, the range would be between USD5mn and USD255mn (Appendix C).

Figure 11: An upfront payout to compensate plant owners for foregone future cash flows could allow for early retirement



Source: Author analysis.

While upfront compensation ensures immediate recovery of economic value, using concessional finance or philanthropic capital to compensate coal plant owners for foregone cash flows risks moral hazard. Such suboptimal use of public funds could delay a coal phaseout and reinforce BAU pathways.⁵⁸

Addressing these risks would also require a commitment from the plant owners not to reinvest transaction proceeds in greenfield coal projects or other fossil-fuel based ventures. Pakistan's two-part electricity tariff, which provides capacity payments to plant owners regardless of the actual plant off-take, offers secure returns over 25–30 years, with government payment guarantees. Considering Pakistan's recent termination of five IPP contracts and renegotiation of returns for 18 others, existing investors may not be inclined to precipitate these payments while being discounted to the present.⁵⁹ Investors may want the possibility where additional value is created by channeling revenue to another venture, which may not be a clean energy project.

⁵⁸ Institute for Climate Economics. [Financing Coal Phase-out: Public Development Banks' Role in the Early Retirement of Coal Plants](#). 07 March 2024.

⁵⁹ IEEFA. [Pakistan's PKR2.1 trillion capacity payments crisis triggers power purchase agreement renegotiations with independent power producers](#). 05 December 2024.

There may be two ways of securing these commitments from existing plant owners and investors in Pakistan:

I. Distributed payments

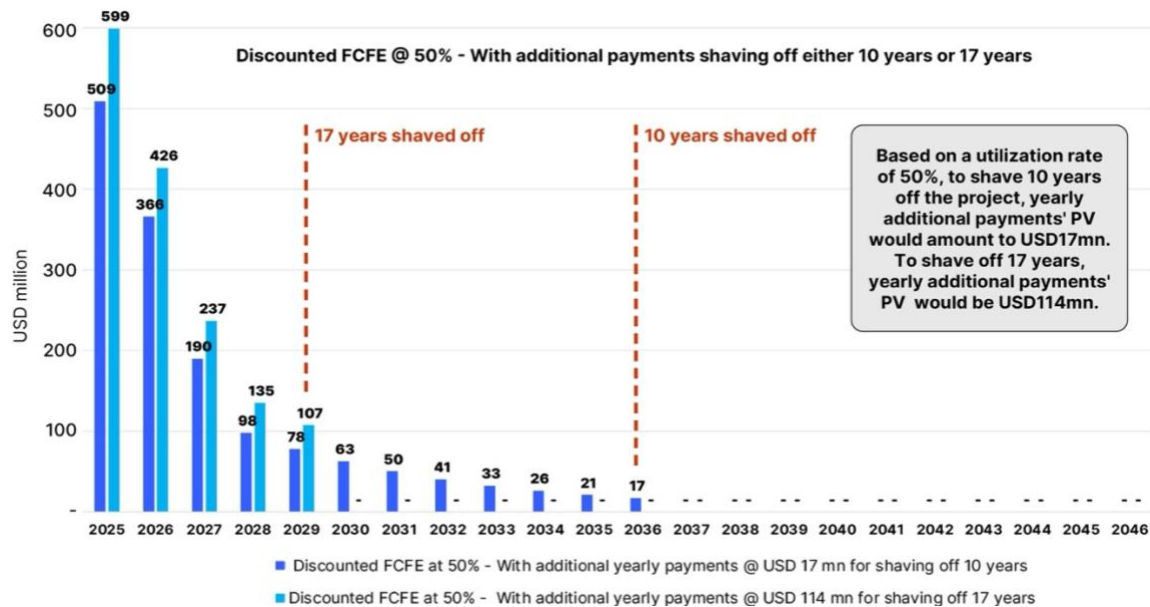
The distributed payment mechanism extends the upfront compensation framework through the temporal restructuring of retirement incentives. Compensation for early retirement is allocated across the plant's reduced operational tenure, creating sustained compliance incentives while the economic benefits remain partially unrealized. This creates an obligation upon incumbent plant owners to retire the plant according to the agreed time as well. The temporal distribution of funds simultaneously mitigates concentrated fiscal exposure for government entities over extended periods, allowing tapping into diverse financing avenues (budgetary allocations, concessional loans, grants, transition finance) for clearance of dues.

From a plant owner's perspective, the substantial financial arrears for CPEC plants mean that guarantees for timely payments — potentially supported by MDBs such as the ADB or the JETP framework — would be needed for sponsors to agree to such an arrangement.

Under this framework, equity holders receive annual installments based on valuation scenarios. The yearly payments needed to retire the plant 10 years early are USD17mn at 50% capacity utilization, USD14mn at 35% utilization, or USD15mn under the PACRA cash flow projections (Appendix C). For a 17-year early retirement scenario, the installments increase to USD114mn at 50% utilization, USD97mn at 35% utilization, and USD99mn under the PACRA scenario (Appendix C).

These structured payments continue throughout the plant's reduced operational tenure, enabling project sponsors to achieve threshold equity value targets while maintaining cash flow predictability. This approach provides enhanced liquidity management for both compensating and compensated parties, as annual disbursements align with budgetary cycles and reduce concentrated capital requirements. The methodology ensures that equity value preservation occurs through systematic value recognition rather than immediate capital deployment, creating operational flexibility while maintaining investor return expectations within the abbreviated asset lifecycle framework.

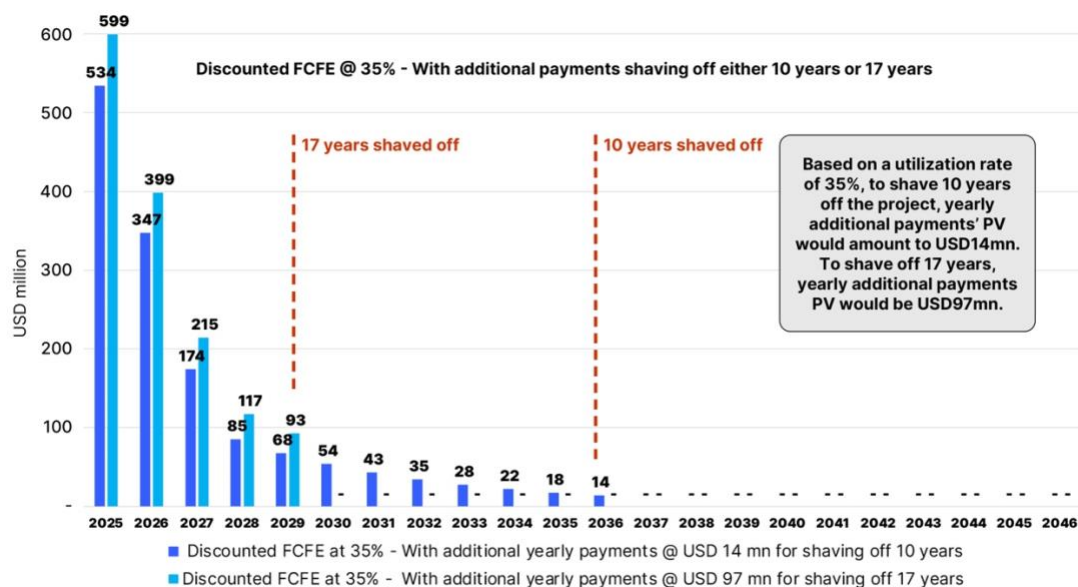
Figure 12: Staggered payments to investors under a distributed payment mechanism at 50% utilization



Source: Author analysis.

Note: FCFE = Free Cash Flow to Equity, PV = Present Value.

Figure 13: Staggered payments to investors under a distributed payment mechanism at 35% utilization



Source: Author analysis.

Note: FCFE = Free Cash Flow to Equity, PV = Present Value.

II. Earmarking returns from a greenfield renewable energy project

Structured transition modeling that maintains coal-to-clean energy principles provides essential pathways for economically viable early retirement strategies, while ensuring compliance with clean energy objectives. This framework redirects the proceeds towards a greenfield BESS-enabled renewable project, rather than providing equity compensation through an upfront payment. The cash flows from a project's return on equity streams are contractually earmarked for CFPP equity holders, creating value-equivalent compensation while advancing clean energy capacity expansion.

This mechanism provides dual benefits. It preserves investor returns through alternative asset deployment while accelerating renewable infrastructure development. Retirement compensation is aimed at fostering portfolio-level energy transition coherence within Pakistan's broader decarbonization framework.

The coal-to-clean scenario optimizes transition alignment through strategic asset substitution. Instead of direct compensation disbursement, the government deploys the USD59.96mn (calculated in Scenario 1 for a 10-year early retirement) compensation into commissioning distributed renewable energy infrastructure.

The equity value or upfront compensation (USD59.96mn) is used as an anchor value for debt sizing while maintaining an 80:20 debt-to-equity ratio. Based on the available funds — approximately USD300mn — technology selection and sizing are optimized to achieve the maximum capacity factor for a hybrid combination. This results in selecting a 280MW configuration comprising 52MW solar, 197MW wind, and 31MW BESS.

At a 40% capacity factor, the clean energy project will have an annual generation output of 1 terawatt-hour (TWh), roughly a third of the output assumed for Sahiwal CFPP in this modeling analysis.

The new clean energy project does not replace the exact energy output of the CFPP in this analysis. Instead, it aims to correspond with the extremely low capacity factors (0.05%–9.89%) forecast for Sahiwal CFPP by Pakistan's new Indicative Generation Capacity Expansion Plan between 2027–2035.⁶⁰

Due to shrinking grid-based demand, the clean energy project is suitable for an off-grid (distributed) setting, where the plant's output may be sold to commercial and industrial entities, such as special economic zones or data centers. A levelized tariff of USD6.2 cents per kilowatt hour (¢/kWh) or PKR 17/kWh (USD5.9¢/kWh or PKR16.2/kWh for the PACRA scenario) could create an incentive for these entities to purchase cheaper electricity from the clean energy project instead of expensive electricity from the grid or captive generation based on diesel or liquefied natural gas (LNG).

⁶⁰ NEPRA, [Indicative Generation Capacity Expansion Plan \(IGCEP\) 2025-2035](#), May 2025. Page 78.

The renewable project generates 20-year ROE streams (from 2027–2046, incorporating a 14-month construction timeline) that are contractually earmarked for the Sahiwal coal project sponsors. This mechanism enables equity holders to achieve equivalent value realization compared to BAU scenarios through 2046 while contributing to national renewable energy targets at affordable rates.

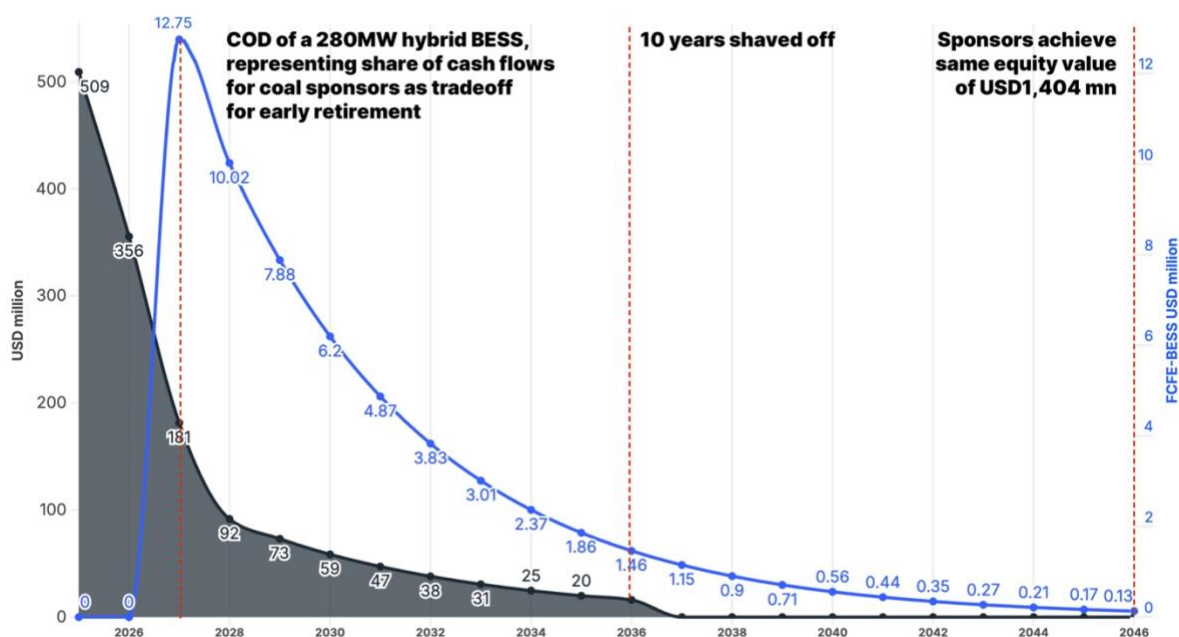
Table 6: Techno-economic variables for coal to clean energy projects

Assumptions - BESS project commissioned through retirement proceeds (50% utilization scenario)		
Fixed assumptions		
Capacity (52MW solar + 197MW wind + 31MW BESS)		280
Generation (MWh)		1,002,433
Capacity factor (%)		40
Engineering procurement and construction (EPC) Cost	USD million	255.0
Project development cost & land	USD million	21.0
Insurance during construction	USD million	2.7
Financing fees		6.00
Interest During Construction (IDC)		15.07
Operations and maintenance (O&M)	USD million	7.4
Construction period	Months	14.0
Project tenor	Year	20.0
Debt tenor	Year	12.0
Debt - Foreign	USD million	239.8
Debt - Local		-
Equity	USD million	59.96
Variable assumptions		
Secured overnight financing rate (SOFR)		4.3%
Spread		4.5%
Foreign financing rate		8.8%
Installment quarterly		48.0
Return on equity (ROE)		35%
Exchange rate (USD-PKR)		284.0
Discount rate		14%
Levelized tariff	USD cents	6.2

Source: Author analysis.

This approach achieves portfolio optimization by transforming retirement compensation into productive clean energy assets, ensuring that transition costs directly support replacement clean generation capacity. The framework maintains investor value expectations while creating systemic benefits through accelerated renewable deployment and coal asset retirement synchronization.

Figure 14: Discounted Free Cash Flow to Equity (FCFE) of CFPP at 50% utilization with discounted FCFE from 280 MW hybrid BESS project



Source: Author analysis.

Note: FCFE = Free Cash Flow to Equity, COD = Commercial Operations Date.

A coal-to-clean investment structure also makes the project accessible for transition credits. Transition credits are a new class of 'high-integrity' carbon credits, which can serve as a complementary source of revenue generation to accelerate the early retirement of CFPPs.⁶¹ This additional source of financing could help hasten the retirement timeline by creating additional cash flows for avoided emissions.

Early coal plant closure requires compensating existing plant owners for foregone earnings and fixed revenue streams. Transition credits can fill this gap by providing an additional source of income by monetizing the avoided carbon emissions from early coal plant closure and any 'additional' renewable energy source replacing the coal plant.⁶²

Income flows in such a structure would be sourced through revenue from the new PPAs for renewable power generation and funds from investors who would purchase verified carbon credits

⁶¹ Monetary Authority of Singapore (MAS). [Transition credits](#).

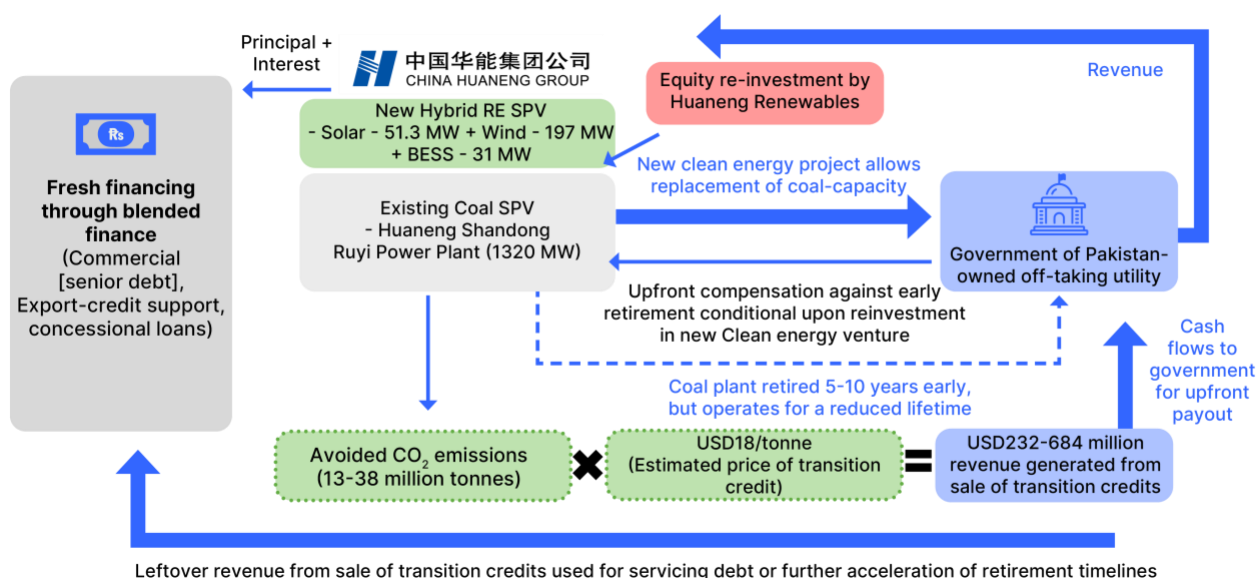
⁶² IEEFA. [Transition Credits: A Potential Financial Enabler for the Coal-to-Clean Switch](#). April 2025.

from investment-grade buyers. Secured PPAs and carbon credit sale agreements could serve as assets and collateral for loans, opening avenues for equity and debt financing for the transaction.⁶³

Verra's VM0052 methodology, developed under the Coal to Clean Credit Initiative (CCCI), establishes an eligibility criteria by requiring 'at least 10% of the retired plant's capacity be replaced by renewable electricity at project inception, increasing to a minimum of 40% within the first crediting period'.⁶⁴ At 280MW, the hybrid clean energy project is roughly 21% of the installed capacity of the 1,320MW Sahiwal CFPP so that initial eligibility criteria would be met. Scaling up to 40% of the CFPP's capacity or beyond could be a challenge, depending on the pace of Pakistan's economy growth and the need for large-scale renewable energy. Nonetheless, repurposing the plant site for utility-scale BESS installations to provide ancillary services or energy storage should be explored.

A transition credit deal should address the exact replacement capacity required. A complete agreement and pathway to achieve 40% of the retired capacity would need to be identified upfront as part of the deal. Crediting periods are usually in 5-year increments, so future capacity additions should be planned while considering local constraints and future demand indicators.

Figure 15: Schematic of a coal-to-clean energy project utilizing revenues from transition credits



Source: Author analysis based on research by Rocky Mountain Institute⁶⁵.

⁶³ IEEFA. [Transition Credits: A Potential Financial Enabler for the Coal-to-Clean Switch](#). April 2025.

⁶⁴ Sustainable Development Policy Institute. [Coal to Clean Credit Initiative A Case for Early Retirement of Coal Power Plant Using the VM0052 Methodology and Estimation of the Carbon Credit Revenue](#). May 2025.

⁶⁵ Rocky Mountain Institute. [Transition Finance Case Studies: Tocopila Units 14 and 15 – Results-based Loan Incentive](#). 25 June 2024.

However, access to finance through transition credits has stringent credibility requirements. For instance, transition credits under the Monetary Authority of Singapore's (MAS) transition credit scheme requires credits to be aligned with globally recognized standards such as the Core Carbon Principles (CCPs) established by the Integrity Council of Voluntary Carbon Market (ICVCM) and other Article 6 integrity requirements, as mandated by the United Nations Framework Convention on Climate Change (UNFCCC).⁶⁶

Similarly, the CCCI has developed a Verified Carbon Standard (VCS) methodology through Verra. The methodology has strict provisions for project additionality, social safeguards, and community protection. All emission analysis must align with the CCPs set out by ICVCM and VCS rules.⁶⁷

Since this is a new and advanced methodology, significant capacity building and technical assistance would be needed before introducing carbon credit generation in Pakistan.



If Pakistan's CFPPs meet the eligibility criteria under these standards, transition credits could provide a complementary revenue stream to bridge the gap between what the Government of Pakistan or philanthropic capital can offer and the compensation required by plant owners for forgone economic value.

While there is a lack of experience, investing in such methodologies would make the country a pioneer in the field.

2. Renegotiating the rate of return

A negotiated reduction in required equity returns lowers the discount rate and enables equivalent equity value achievement over a shortened operational period. This mechanism can significantly reduce a plant's remaining economic life while maintaining investor value.

This approach provides flexibility in structuring retirement agreements based on available capital, stakeholder preferences, and policy priorities. The quantitative framework ensures that retirement decisions are grounded in rigorous financial analysis while supporting Pakistan's broader energy transition objectives.

⁶⁶ Monetary Authority of Singapore (MAS). [Transition credits](#).

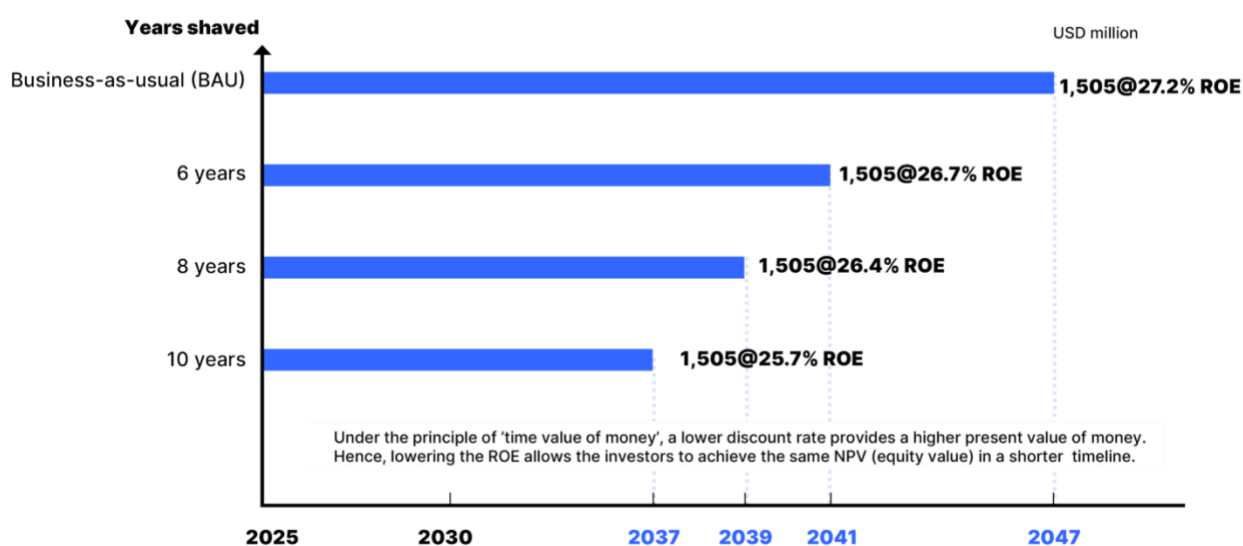
⁶⁷ Verra. [New Verra Methodology Supports Coal Phase-Out and Just Energy Transition](#). 06 May 2025.

Table 7: Potential reduction in plant lifetime under renegotiated returns on equity

Years shaved	Scenario 1 @ 35% plant utilization	Scenario 2 @ 50% plant utilization
6	0.5%	0.5%
8	0.9%	0.9%
10	1.5%	1.6%
11	2.0%	2.1%
15	6.14%	6.65%
17	11.37%	12.31%

Source: Author analysis.

There is significant potential to reduce the plant lifetime by a downward revision in the return margins because of the initial high ROE (27.2%) awarded. Discounting future cash flows at reduced ROEs allows for achieving the baseline equity value at an accelerated rate.

Figure 16: Lowering investor return on equity could allow early retirement of CFPP

Source: Author analysis.

As illustrated in Table 6, a 0.5% reduction in the ROE can lead to six years being shaved off a plant's technical lifetime, while reducing the equity margins by 2%–3% can extend this reduction to 11 years. While additional ROE reductions could accelerate the retirement process, the scope for such concessions depends on context.

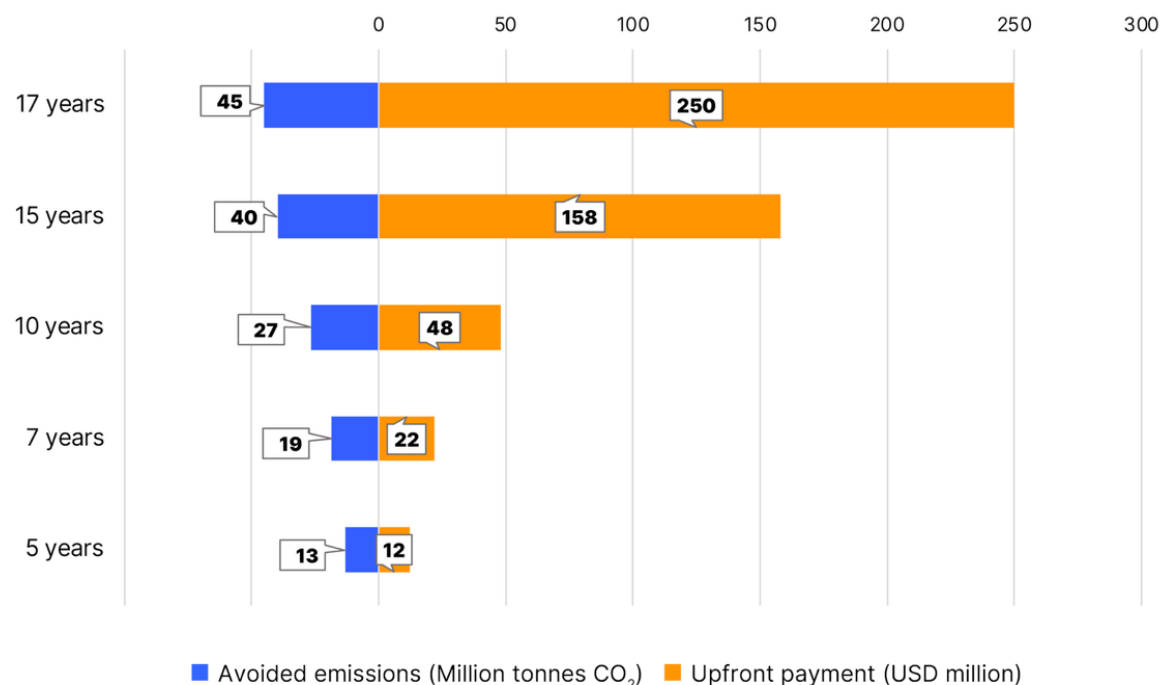
Therefore, if plant retirement is targeted within a shorter horizon (3–5 years), investors may prefer closure through an upfront compensation mechanism.

Avoided emissions potential

Sahiwal CFPP has mainly imported coal from South Africa or Indonesia to meet its fuel requirements. The plant is calculated to have a carbon dioxide (CO₂) emissions factor of 0.82 tonnes per megawatt-hour (MWh) based on the average calorific value (23,322 British Thermal Units per kilogram [BTU/kg]) of the coal stock consumed and the plant heat rate (8,584 BTU per kilowatt-hour [kWh]) reported in April 2025.⁶⁸

Actual emissions depend on the plant utilization rate and the amount of fuel burned to produce energy. Scenarios 1A, 1B, 2A, and 2B (Figures 17, 18, 19, and 20) explore how avoided CO₂ emissions may materialize depending on the chosen retirement pathway and plant utilization.

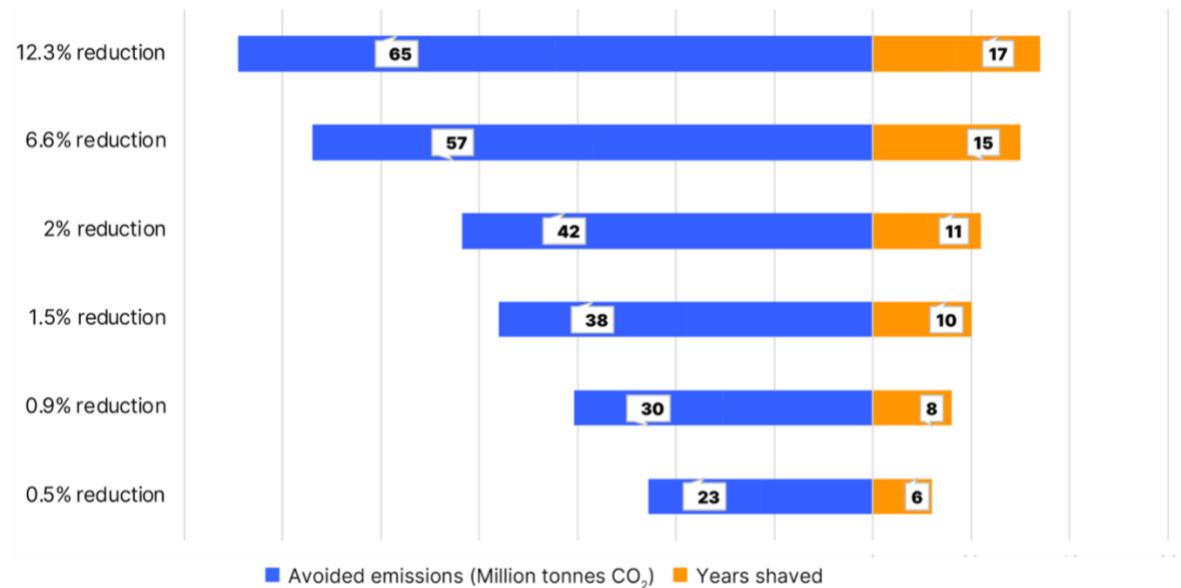
Figure 17: Scenario 1A: Avoided emissions under upfront compensation retirement mechanism at 35% plant utilization



Source: Author analysis.

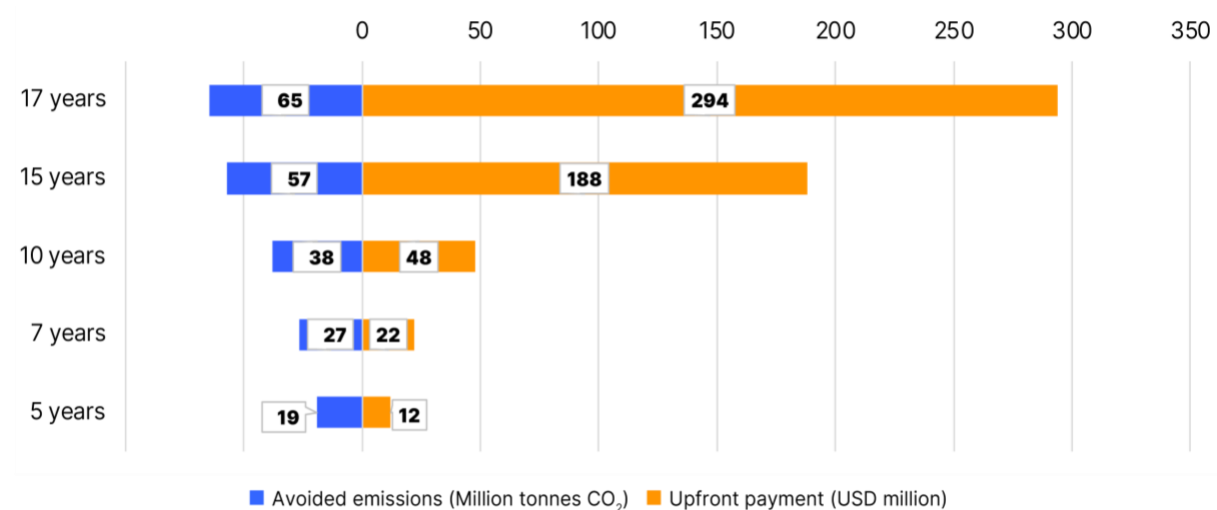
⁶⁸ NEPRA. [Fuel Cost Adjustment-Sahiwal CFPP](#). 04 July 2025.

Figure 18: Scenario 1B: Avoided emissions under downward ROE renegotiation at 35% plant utilization



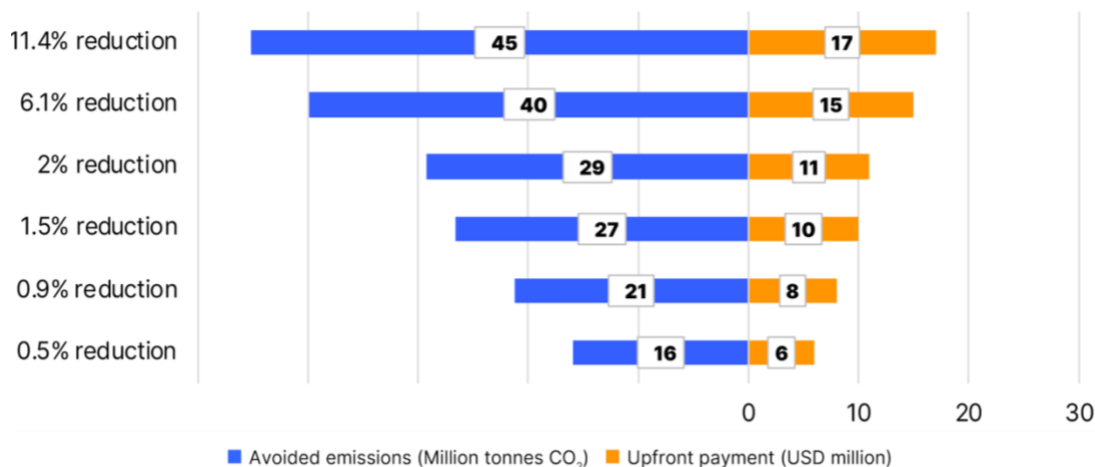
Source: Author analysis.

Figure 19: Scenario 2A: Avoided emissions under upfront compensation retirement mechanism at 50% plant utilization



Source: Author analysis.

Figure 20: Scenario 2B: Avoided emissions under downward ROE renegotiation at 50% plant utilization



Source: Author analysis.

Generally, higher utilization rates and longer plant lifetime reductions lead to higher avoided emissions. Subsequently, additional revenue through transition credits may be impacted depending on the volume of avoided emissions and the price of transition credits. According to this analysis, avoided emissions under these various early retirement scenarios could range between 13–65 million tonnes (Mt) of CO₂.

Analysis

This report establishes a comprehensive valuation framework with multiple scenarios to support bankable early retirement transactions. Under the BAU scenario with a 50% utilization rate, a ceiling for equity value negotiations with sponsors has been determined. Since the selected plant has less than three years of remaining debt from its original 10-year tenor, equity value was chosen instead of the EV as the decision benchmark. For younger plants with longer debt maturities, refinancing at lower rates could accelerate achievement of pre-transaction EV, effectively reducing the required operational lifespan.

Based on 2023 cash flows from credit rating reports, the secondary valuation establishes the floor.⁶⁹

The secondary valuation model yields significantly lower results — approximately half of the primary model's valuation. This reduction reflects 2023 as the baseline year, which proved particularly

⁶⁹ This figure aligns closely with equity values derived from an independent study "China coal exit: Opportunities for China-led financing of early phase down of coal-fired power plants in Pakistan and Vietnam" conducted by the Griffith Asia Institute in collaboration with the Green Finance & Development Center and Climate Smart Ventures, supported by the Coal Asset Transition Accelerator (CATA).

challenging for CFPPs due to unpaid dues from CPPA-G, regulatory uncertainty, and fuel supply disruptions. Record-high global and local interest rates further compressed cash flows, making this scenario an effective stress test for retirement transactions.

An alternative scenario mapping allocated returns under existing tariff regimes produces even lower equity values, highlighting abnormal earnings by CFPPs and other IPPs. These elevated returns stem from payment frequency discrepancies. Actual CPPA-G payments occur more frequently than those assumed in the original tariff calculations, creating an Internal Rate of Return (IRR) disparity that benefits IPPs. Operational savings during plant lifecycles, including efficiency gains, fuel cost reductions, Operations and Maintenance (O&M) savings, and late payment surcharge earned on invoices past due date, further contribute to return enhancement.

Early retirement offers notable advantages by avoiding future costs associated with maintaining 85% availability and mitigating downside risks from sectoral and sovereign challenges that could materialize during the plant's remaining life.

The government also stands to gain significantly from the early plant retirement. Most critically, this decision would conserve foreign exchange reserves depleted by substantial fuel import costs. According to this analysis, a high utilization can result in an annual fuel import bill of more than USD200mn. In addition to the fuel costs, maintaining these facilities throughout their full PPA terms would impose considerable capacity charges. For its remaining 22-year PPA commitment, the Sahiwal CFPP incurs cumulative capacity charges exceeding USD5bn, a substantial long-term fiscal obligation that early retirement could eliminate.

This analysis reveals multiple strategies for executing coal plant retirement transactions, presenting distinct advantages, limitations, and varying appeal to investors and government stakeholders:

Upfront payment strategy

Immediate lump-sum compensation provides the most direct path to investor agreement while eliminating execution risk for plant operators. This approach offers maximum certainty and political expedience with minimal administrative oversight requirements. However, there are significant drawbacks, including immediate fiscal constraints that would require the government to borrow several billion dollars if replicated across the entire coal fleet, the elimination of future government leverage over investor behavior, and missed opportunities to incentivize environmental compliance or prevent continued fossil fuel investments.

Staggered payment approach

A phased payment structure better balances stakeholder interests and policy objectives. This approach creates essential accountability mechanisms by linking compensation to verifiable environmental benchmarks and non-fossil fuel investment pledges. The government can spread costs over time while accessing diverse financing sources, including green bonds and multilateral facilities. Dedicated reserve accounts earning market returns could substantially offset the higher

nominal costs of extended payment schedules, while creating space for performance monitoring and course corrections throughout the retirement process.

Renewable reinvestment framework

Integrating renewable energy reinvestment provisions transforms what would otherwise be a fiscal burden into a strategic catalyst for clean energy deployment. This approach maintains investor engagement in Pakistan's evolving energy sector while providing substantial revenue potential through transition credit monetization. These credits could accelerate retirement timelines and improve overall project economics. However, significant execution challenges remain, including securing reliable PPAs and managing grid integration complexities.

ROE renegotiation assessment

Although renegotiating ROE rates may seem fiscally attractive, it presents fundamental challenges. Investor appetite for voluntary reductions remains minimal, particularly given substantial existing arrears. Legal risks are prohibitive — forced renegotiation would likely trigger international arbitration with potentially larger compensation awards. This approach also fails to address core grid oversupply issues while perpetuating reliance on underutilized fossil fuel infrastructure.

System-level considerations

Retirement must dovetail with grid planning. Pakistan currently faces surplus capacity. Simply removing the Sahiwal CFPP will not create immediate headroom for utility-scale renewables unless parallel measures, such as industrial demand revival, time-of-day tariffs, storage procurement, and distribution loss reduction, are implemented.

The coal-to-clean model targets industrial off-takers or island microgrids, avoiding further strain on the national dispatch merit order.

Alternatively, the strategic reuse of the plant site, especially the grid substation and land used for coal stockpiles, could create space for battery storage and solar PV. Regulatory amendments will also be required to ensure replacement projects secure priority connection and streamlined approvals.

Table 8: Feasibility index for Pakistan's coal retirement scenarios

Retirement scenario 1: Cash buyout/ Upfront compensation	
Staggered payments across remaining plant lifetime	
Opportunities	1. Prevents moral hazard by holding investors accountable to non-investment in new fossil fuel projects 2. Investors forced to meet performance/environmental compliance benchmarks to get next tranche of payment 3. Provides government with more time to arrange financing
Challenges	1. Staggered payments annually for the remaining project lifetime might cumulatively be higher in absolute value than a lump sum payment upfront 2. Plant owners will require guarantees for timely payments
Access to finance	This type of a cash buy out is more suited to the government where financing can be made available through low-cost sovereign borrowing through green/transition bonds, Islamic financing (sukuk), policy lending by MDBs, or budgetary allocations under the Public Sector Development Programme (PDSP). Dedicated funds/reserve accounts could be set up by the government for this purpose which earn interest. The interest payments could go towards annual installments to be paid to the coal plant owners.
Investor likelihood to agree to deal	Medium - Investor appetite for a deal might be present given the large volume of arrears that are owed to these plants
Government inclination for deal	Medium - Avoided fixed capacity payments and high energy tariffs for unutilized plant capacity to the plant is a motivational factor for the government. However, political and legal hurdles may be challenging to navigate.

Retirement scenario 2: Lowering of cost capital to create margins for early retirement	
Remaining investor equity or upfront payout is invested as equity in a new distributed or utility scale renewable energy/storage project with fresh (additional) debt	
Opportunities	1. Earmarks proceeds of the transition towards clean energy projects 2. Allows monetization of avoided emissions through transition credits to accelerate retirement timeline 3. Provides incumbent investors/plant owners with the possibility of steady returns after the coal power plant shuts down
Challenges	1. A power off-take agreement would need to be secured from the industrial sector if a distributed model is to be pursued 2. Load forecasting and demand projection studies will be needed to settle on the best technology for a utility-scale project keeping in mind demand constraints and the grid's surplus capacity condition at present 3. Payment guarantees needed by the government requiring setting up of reserve/escrow accounts
Access to finance	1. Credit enhancement support and guarantee facilities from MDBs under a JETP/ETM style deal which packages grants, concessional loans and private capital together 2. Transition credits 3. Possibility of CFPP parent company, China Huaneng Group, establishing a clean energy SPV under its renewable energy arm - Huaneng Renewables
Investor likelihood to agree to deal	High - Steady equity returns and cash flows guaranteed over a long-term
Government inclination for deal	High - Allows the government to pursue climate/transition finance, meet clean energy targets, and reduce surplus grid capacity, while avoiding payments to expensive imported coal-fired plants

Source: IEEFA.

Balancing multiple variables with layered project financing structures and geostrategic considerations between Pakistan and China would require expert planning and comprehensive discussions, with mediation and guarantees from development institutions. A prerequisite for any approach is the immediate resolution of existing financial arrears owed to Chinese IPPs.

Combining staggered payment structures with renewable reinvestment provisions best aligns Pakistan's fiscal constraints with climate objectives while providing sufficient investor incentives for voluntary participation by Chinese plant sponsors.

Pakistan's access to climate finance through MDBs could enable sophisticated retirement packages combining grants, concessional loans, and private capital. Complementary cash flow generation through transition credits could create a mutually beneficial situation, providing space for clearing existing financial arrears and paying off the principal and interest on new borrowing, while advancing Pakistan's renewable energy and grid enhancement goals. Engaging established renewable energy players, including China Huaneng's clean energy subsidiaries, could provide technical credibility and political facilitation for these complex transition arrangements.

Conclusion and the way forward

As demonstrated by the modeling results, there is a clear financial case for early retirement. Several factors need to be considered before an agreement can be reached between the political leadership in Pakistan and China regarding the early retirement of CFPPs. The Chinese government may be reluctant to approve for multiple reasons. Existing Chinese businesses in Pakistan are facing the challenge of inadequate financial settlements, and any attempts to reconfigure existing coal-fired plants (retrofitting, revising energy tariffs, and restructuring debt) could present a significant roadblock.

Mounting arrears create pressure to reach a solution and guarantees of future timely payments would need to be built into the new arrangement. The impetus for a coal phaseout should come from the Government of Pakistan, as it hosts these IPPs. This needs to be a renegotiation exercise rather than a unilateral termination from Pakistan's end, as it could trigger clauses requiring international arbitration. Instead, a dialogue should be initiated between the two countries to achieve mutually acceptable outcomes and cement their position on climate leadership. While a Western-backed model, which aims to retire Chinese-sponsored assets, is rare, a recent statement by China and the EU during a joint summit indicates potential cooperation on climate change matters, including a push for green technology and green financing.

The two parties agreed to demonstrate leadership in driving a global just transition and promoting ambitious, equitable, balanced, and inclusive outcomes at the 30th annual United Nations Climate Change Conference (COP30). The statement also highlighted an agreement to "facilitate access to

quality green technologies and products, so that they can be available, affordable and beneficial for all countries, including the developing countries".⁷⁰

The GIFP enables China to take a leadership role in global energy transition finance. By choosing a pilot project, such as retiring a coal plant in Pakistan under CPEC, China can be a proof of concept for accelerated and scalable coal retirement. Pakistan would benefit from reducing coal dependence and financial strain, while China would signal its readiness to bring financial resources back to the table for meaningful green development. While Western-backed models continue to prove their effectiveness, a successful Chinese-led coal transition project would be a notable global addition in the transition from coal to clean energy. Such a step could mark a new chapter in international cooperation for sustainable energy finance.

The GIFP could also be instrumental in spearheading an Asian-led model for phasing out coal in the region, provided the USD100bn earmarked for this purpose is mobilized. China's widespread adoption and manufacturing of renewable energy could easily lead to a pilot where Chinese clean energy technologies could displace Chinese coal-fired power plants in the developing world.⁷¹ The political push would need to come from Pakistan, along with the development of robust standards and policies that commit to broader economic decarbonization and establish the technical criteria for shifting to clean energy.

⁷⁰ Carbon Brief. [China Briefing 24 July 2025: EU-China climate statement; World's largest megadam; Clean-tech exports](#). 24 July 2025.

⁷¹ Renewables First. [Leader of One or Leader of None - China's choice for clean over coal in Pakistan](#). 2025.

Appendix A: Coal retirement schemes around the world – JETPs/ETMs

Advanced economies such as Germany and the United Kingdom (UK) have been able to leverage stringent environmental regulations and market-based mechanisms to phase out coal. The UK was the first group of seven (G-7) economies to completely shut down its decades-old coal fleet. The country's transition was marked by effective policies that penalized polluting coal power plants, robust carbon pricing mechanisms that rendered coal power plants economically uncompetitive, and emissions intensity standards that meant that coal plants would either have to invest in cost-inhibitive technologies such as carbon capture and storage (CCS) or shut down entirely. In parallel, investments in the grid and incentives for renewable energy have spurred solar and wind energy installations, while grid-forming technologies, such as battery energy storage, are also being encouraged. The last operational coal plant shut down in October 2024 under the country's 2015 coal phaseout plan.⁷²

Germany has also been pursuing a complete coal phaseout by 2038. Seven successive rounds of reverse auctions between 2020 and 2023 will lead to the closure of 10 gigawatts (GW) of coal-fired capacity by 2026, with the plants receiving over EUR700 million (mn) in compensation.⁷³

While these countries pursued ambitious plans for a coal phaseout through legally binding targets and strong political leadership, many of Asia's developing economies lack these factors. Other reasons that hamper a shift away from a coal towards cleaner energy technologies include:

- 1) **A fossil fuel lock-in:** The region has a high dependence on coal and fossil fuel-based power, with fossil fuels serving more than 50% of power generation needs in countries such as Indonesia, Vietnam, and Pakistan. These power plants are often protected by long-term power purchase agreements spanning 25–30 years, insulating them against market forces and limiting the amount of renewable energy that central grids can absorb.⁷⁴
- 2) **Lack of clear coal phaseout targets:** While most Asia markets are party to the Paris Agreement, with defined renewable energy targets and greenhouse gas (GHG) emissions reduction goals or net-zero ambitions, these are voluntary commitments without legal binding. Markets also shy away from targeted coal-phaseout timelines, citing resource dependency, nationalism, and price concerns.⁷⁵
- 3) **Absent/weak carbon pricing signals:** Most Asian markets lack institutional mechanisms, such as environmental standards or emissions trading schemes, which put a price on carbon-based pollution. In instances where a carbon price is in place, such as in Indonesia,

⁷² Carbon brief. [Q&A: How the UK became the first G7 country to phase out coal power](#). 27 September 2024.

⁷³ Agora Energiewende. [What's the timeline for Germany's coal phaseout. What are Germany's nuclear, coal and fossil gas phase-out strategies?](#). Accessed on May 05, 2025.

⁷⁴ IEEFA. [Coal Lock-in in Southeast Asia](#). December 2021.

⁷⁵ EY. [Understanding barriers to financing solar and wind energy projects in Asia](#). November 2023.

the price signal is insufficient to fully internalize the true cost of externalities imposed by coal-fired power plants. Carbon exchange platforms are not fully developed or lack capping mechanisms that impose limits on how much entities can pollute.⁷⁶

- 4) **Lack of financial resources:** Coal retirement is costly, considering the scale of the phaseout needed. While coal phaseouts in Western economies are supported by budgetary allocations and the possibility of buying out power plants, many developing economies lack the fiscal resources to support these initiatives. In addition, new investments in grid modifications and renewable energy resources are hampered by a lack of foreign direct investment (FDI), high capital costs, and entrenched subsidies for fossil fuel-based generation.

Under such circumstances, the availability of blended or concessional finance through schemes such as the Energy Transition Mechanism (ETM) or the Just Energy Transition Partnership (JETP) becomes fundamental to accelerate coal retirement in developing economies.

The Asian Development Bank (ADB) pioneered the ETM concept as a market-based model that uses low-cost, long-term funding to compensate coal plant owners for shortening the plant's lifespan while channeling new investment into clean energy replacement capacity. An ETM raises capital from public sources (concessional loans, climate funds, or government contributions) and private investors to purchase or refinance a coal plant's remaining equity/debt. By doing so, it can renegotiate the plant's power purchase agreement (PPA) and "shut [the plant] as much as a decade earlier than planned," with minimal financial loss to the owners. The freed generation capacity is intended to be replaced by renewable energy and storage, often as part of the ETM transaction. Key to ETM implementation is creating a financing structure that is attractive enough to "crowd in" private capital (for example, by mixing concessional funds that lower overall risk and yield) and ensuring a just transition for workers and communities affected by the coal plant closure. ADB's role has been to convene funding partners (multilateral banks, green funds, philanthropies) and local stakeholders to operationalize ETMs in coal-dependent countries.

JETPs are bilateral or multilateral financing partnerships in which a coalition of developed countries and international institutions (an International Partners Group [IPG]) pledges financial support to a coal-dependent emerging economy to facilitate its clean energy transition in a "just" manner, and underpinning primary co-financing from private sector lenders.⁷⁷ The emphasis is on pairing decarbonization with socioeconomic considerations — mitigating impacts on workers, communities, and energy affordability. In a JETP, the recipient country develops a comprehensive energy transition plan (including power sector reform, coal decommissioning schedules, renewable energy

⁷⁶ Climate Scorecard. [Indonesia's carbon trading system may not be able to deter companies from reducing emissions](#). 09 June 2024.

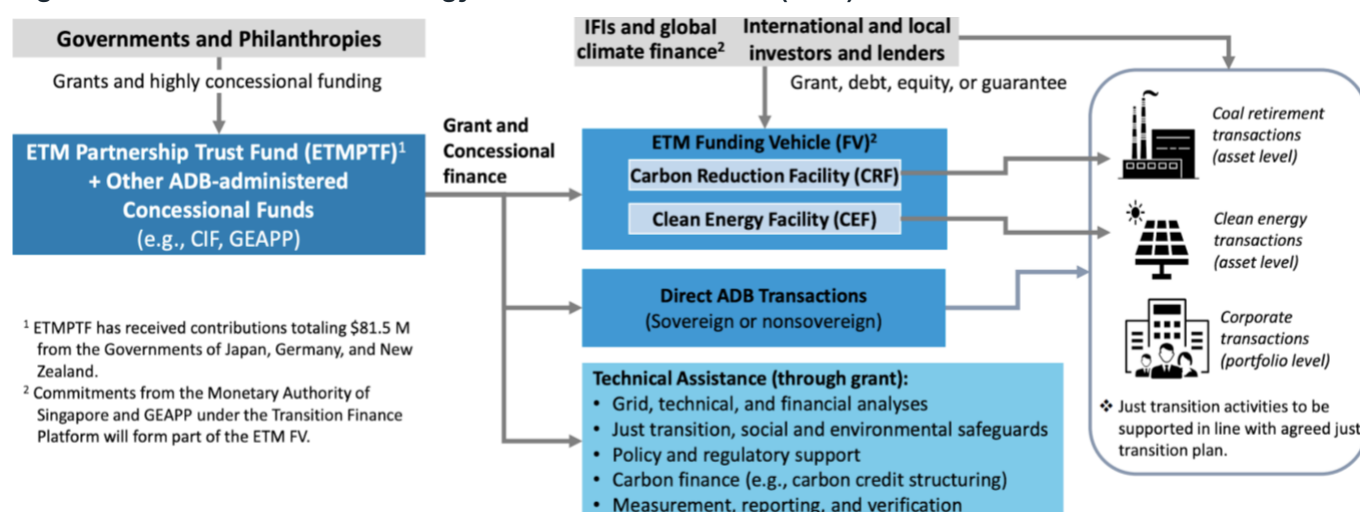
⁷⁷ Columbia SIPA. [Realizing the Potential of Just Energy Transition Partnerships in the Current Geopolitical Environment](#). 03 March 2025.

investments, and measures for workers' retraining), and the IPG commits a package of concessional loans, grants, and other financial instruments to support that plan.⁷⁸

Both ETMs and JETPs blend multiple funding sources to tackle the hurdle of coal transitions: the upfront cost of early retirement. ETMs tend to focus on specific assets or portfolios, assembling finance to compensate plant owners and invest in replacement generation. JETP is also allocated to specific projects identified by host countries.

Most projects are intended to be privately financed with complementary financing from development bank funds and the IPG, in the form of sovereign loans, export credit, and limited grant funding at the national scale.

Figure 21: Schematic of the Energy Transition Mechanism (ETM)



Source: Asian Development Bank⁷⁹.

Note: ADB = Asian Development Bank, CIF = Climate Investment Funds, GEAPP = Global Energy Alliance for People and Planet, ETM = Energy Transition Mechanism, IFI = International Financial Institution.

Although ADB has initiated ETM programs in Indonesia, the Philippines, and Kazakhstan with government support, a full transaction has yet to materialize because of complex and lengthy negotiation processes. Pre-feasibility studies were also conducted for potential early coal retirement in Pakistan and Vietnam. However, evolving political conditions and a lack of government initiative have prevented any progress beyond initial studies.

Indonesia's ETM program - Accelerating Cirebon 1's retirement

Indonesia is a critical test case for the ETM approach, given its heavy reliance on coal (over 60% of the electricity mix) and sizable fleet of relatively young coal power plants. The country, in partnership

⁷⁸ Columbia SIPA. [Realizing the Potential of Just Energy Transition Partnerships in the Current Geopolitical Environment](#). 03 March 2025.

⁷⁹ Asian Development Bank. [Energy Transition Mechanism \(ETM\)](#). 30 April 2025.

with ADB, launched an ETM Country Platform in November 2022 during the G20 Bali Summit.⁸⁰ This platform is essentially a coalition of the Indonesian government, ADB, the World Bank, and other partners to identify candidate coal plants for early retirement and marshal the needed funds. The inaugural target is the 660-megawatt (MW) Cirebon-1 coal-fired power plant in West Java, which was selected as the first ETM pilot project.⁸¹

Cirebon-1 began operating in 2012 under a 25-year PPA, which would normally keep it running until around 2040. Through the ETM, stakeholders aim to cut about seven years off its remaining life, retiring the plant by 2033 instead of 2040.⁸² An initial Memorandum of Understanding (MOU) to pursue this transaction was signed in 2022 (at the G20, COP27, and COP28). By 2023, an agreement in principle was reached to proceed with the early retirement plan for Cirebon-1, pending full financing arrangements. The ETM structure here involves refinancing the plant's debt and purchasing equity so that the plant can cease operations once its shortened PPA term ends, while investors are compensated through the new financing vehicle. ADB has reported that legal documentation for the Cirebon deal is ongoing, indicating that as of early 2025, the transaction has not yet closed.⁸³

To fund Indonesia's ETM plans, the ADB and its partners are assembling a blend of concessional and commercial resources. Notably, the Climate Investment Funds (CIF) – a multilateral climate finance trust – approved a dedicated USD500mn concessional financing package in mid-2023 to support Indonesia's coal transition efforts.⁸⁴ This USD500mn (part of CIF's Accelerating Coal Transition program) is expected to leverage up to USD4.5 billion (bn) in co-financing, including from ADB and private sector players, for projects like Cirebon's buyout. In addition, bilateral donors have contributed to ADB's ETM facilitation fund (for example, Germany provided EUR30mn and New Zealand gave USD25mn toward technical assistance and preparatory work). There is also collaboration with philanthropic and industry initiatives – a 2023 MOU was signed with Singapore's government and the Global Energy Alliance for People and Planet (GEAPP) on establishing a USD2bn "Transition Finance Platform" to attract private capital for Indonesia's ETM investments. This indicates a multi-layered financing plan: some money to reduce the cost of capital (concessional loans and grants), and some to directly invest in or lend to the refinancing vehicle that will own the retired plant.

Indonesia's ETM program is still in its nascent stage. By early 2025, no coal plant has yet been retired under the scheme, though Cirebon-1 is on track to be the first. The lengthy negotiations highlight the complexity of balancing interests – the plant's owners, the off-taker (PLN, the state utility), regulators, and financiers must all agree on the financial terms for an early shutdown. ADB's climate envoy Warren Evans noted that being the first such deal "there are a lot of challenges and

⁸⁰ IEEFA. [ADB's Energy Transition Mechanism \(ETM\) and Partnerships](#). September 2024.

⁸¹ IEEFA. [ADB's Energy Transition Mechanism \(ETM\) and Partnerships](#). September 2024.

⁸² IEEFA. [ADB's Energy Transition Mechanism \(ETM\) and Partnerships](#). September 2024.

⁸³ IEEFA. [ADB's Energy Transition Mechanism \(ETM\) and Partnerships](#). September 2024.

⁸⁴ IEEFA. [ADB's Energy Transition Mechanism \(ETM\) and Partnerships](#). September 2024.

uncertainties to be resolved,” but expressed confidence that it will go forward.⁸⁵ Key issues include agreeing on a payout value that satisfies the current owners, structuring the refinancing so that it does not overly burden Indonesia's public finances, and aligning the timeline with replacement renewable capacity. The target is for ETM to shorten coal plant lifetimes by up to a decade. If Cirebon-1 succeeds, Indonesia has a pipeline of 5–7 more plants envisioned for ETM retirement in the coming years.⁸⁶

It should be noted that Indonesia is also benefiting from a related initiative — a USD20bn JETP⁸⁷ — but the ETM is more narrowly focused on direct coal plant buyouts. The interplay between Indonesia's ETM and its JETP will require careful coordination, especially to ensure that international funds (whether from ADB or bilateral partners) are used efficiently.

South Africa's JETP

South Africa was the first country to embark on a JETP, announced at COP26 in November 2021 with an initial USD8.5bn pledge from France, Germany, the UK, the US, and the EU.⁸⁸ This JETP was framed as a pioneering model to support South Africa — which gets about 80% of its electricity from coal — in retiring coal power, expanding renewables, and cushioning the socioeconomic impacts. South Africa's government subsequently developed a detailed Just Energy Transition Investment Plan (JET-IP) in 2022, estimating that around USD98.5bn would be needed over the next five years to put the power sector on a Paris Agreement-aligned path and invest in electric vehicles and green hydrogen as new industries. The USD8.5bn from the JETP is therefore only a first tranche of what is required.⁸⁹

South Africa's JETP program largely consists of concessional loans and export credit, with a small grant component. According to public disclosures, only 3% of the USD8.5bn was set to be delivered as grants, the rest being loans on relatively soft terms.⁹⁰ The contributions were divided among the IPG members. For example, France and Germany each offered around USD600mn in loans (through their development banks)⁹¹, the US initially indicated loans and investment through the Development Finance Corporation (DFC) totaling a few hundred million dollars, the UK and EU provided smaller amounts including some grants and technical assistance.⁹² In late 2023, additional pledges and re-valuations were announced — bringing the total *potential* support to USD11.6bn (as of COP28) if all partners follow through.⁹³

⁸⁵ Climate Home News. [ADB set to launch first coal early retirement scheme in Indonesia](#). 29 September 2023.

⁸⁶ Oxford Economics. [Case Study: Energy Transition Mechanism](#). 2023.

⁸⁷ The Diplomat. [Indonesia Submits Plan on How it Will Spend \\$20 Billion on Clean Energy Transition](#). 17 August 2023.

⁸⁸ Columbia SIPA. [Realizing the Potential of Just Energy Transition Partnerships in the Current Geopolitical Environment](#). 03 March 2025.

⁸⁹ Columbia SIPA. [Realizing the Potential of Just Energy Transition Partnerships in the Current Geopolitical Environment](#). 03 March 2025.

⁹⁰ Climate Home News. [Why rich countries are “reluctant” on additional JETP coal-to-clean deals](#). 06 December 2024.

⁹¹ European Commission. [Joint Statement: South Africa Just Energy Transition Investment Plan](#). 07 November 2022.

⁹² UK Pact. [UK PACT supports South Africa's just energy transition with four new projects](#). 07 March 2024.

⁹³ Columbia SIPA. [Realizing the Potential of Just Energy Transition Partnerships in the Current Geopolitical Environment](#). 03 March 2025.

Importantly, the financing is not delivered into a single pool. Instead, each partner will fund specific projects or programs in line with South Africa's JET-IP. Proposed uses of funds include repurposing or decommissioning parts of Eskom's coal fleet⁹⁴ (the state utility has aging plants like Komati, which was shut down in 2022⁹⁵), strengthening the transmission grid to enable more renewables, investment in new solar and wind farms, and support for coal-dependent regions (such as Mpumalanga) to diversify their economies.

Despite the publicity, by early 2025, South Africa's JETP funds had been slow to flow. In fact, not a single major loan or grant from the USD8.5bn package has been fully disbursed to the country yet, more than three years after the initial announcement. A significant bottleneck has been the negotiation of financing terms and projects. South Africa presented its investment plan, but the initial JETP pledges were made without an established pipeline of projects. When investment plans were presented later, some partners had reservations about financing the proposed projects, leading to protracted discussions on how the money should be allocated. This misalignment resulted in delays, as donors and the South African government needed to agree on priority projects that both meet South Africa's needs and the donors' criteria.

Domestic and geopolitical shifts have complicated matters. By 2023–2024, South Africa experienced political and economic hurdles (e.g., a power crisis with rolling blackouts and changes in energy ministers), which slowed down transition efforts. On the donor side, the US, a key partner, has encountered internal political differences affecting its climate finance commitments. In March 2025, it was reported that the US was delaying the disbursement of USD2.6bn of its climate finance pledge to South Africa, raising concerns that the funds could be withheld.⁹⁶ Specifically, US representatives blocked a planned USD500mn funding approval from the Climate Investment Funds to South Africa — money that was expected to unlock an additional USD2.1bn from other sources.⁹⁷ This move, tied to a change in US administration policy, underscores how fragile the JETP pledges can be if political support wanes.

On the ground, South Africa has made some initial progress using alternative funding. For example, Eskom secured a separate USD497mn loan from the World Bank to decommission and repurpose the Komati coal plant, converting it into a renewable energy and skills training facility (this World Bank project runs parallel to the JETP).⁹⁸ However, the larger coal plant retirement plans (e.g., for several units of Medupi or Kusile power stations) envisioned under the JETP have not commenced yet, largely due to financing delays. Implementing renewable energy projects under the JETP umbrella also needs clearer funding allocation.

⁹⁴ World Bank Group. [Factsheet: Eskom Just Energy Transition Project in South Africa](#). 05 June 2023.

⁹⁵ Daily Maverick. [Komati Power Station — the cautionary tale of the Just Energy Transition and lessons to be learnt](#). 26 March 2024.

⁹⁶ Bloomberg. [US Stalls \\$2.6 Billion Climate Finance Package for S. Africa](#). 20 March 2025.

⁹⁷ US News and World Report. [US Delays \\$2.6 Billion Climate Finance Package to South Africa](#). 20 March 2025. |

⁹⁸ World Bank Group. [World Bank Approves \\$497 Million in Financing to Lower South Africa's Greenhouse Gas Emissions and Support a Just Transition](#). 03 November 2022.

South Africa's JETP illustrates both the potential and pitfalls of the Western-backed model. On the one hand, a USD8.5bn commitment has galvanized detailed transition planning and institution-building — South Africa has established a Presidential Climate Finance Task Team and integrated the JETP goals into its energy policy. On the other hand, the slow disbursement and predominantly loan-based financing have drawn criticism. South African stakeholders worry that taking on substantial new debts, even concessional ones, is difficult amid already strained finances and an energy utility in economic distress. The “just” component also requires significant grant funding for worker retraining and social support, which has not yet materialized at scale. Therefore, the South African JETP remains at a formative stage, where the framework and plans are in place, but funds are lagging. As of early 2025, the partnership has yet to retire any coal capacity or build any notable new renewables from the pledged funds. The next steps (once funds start flowing) will involve converting portions of Eskom's coal fleet and expanding renewable investments, which will demonstrate whether the JETP model can overcome its early hurdles.

ACEN's ETM deal in the Philippines

Unlike Indonesia and South Africa, the Philippines has moved rapidly with a pilot coal retirement transaction, largely driven by the private sector in collaboration with ADB. In November 2022, the Philippines achieved the world's first completed ETM deal — the early retirement of the 246MW South Luzon Thermal Energy Corporation (SLTEC) coal plant in Batangas.

This deal, spearheaded by ACEN (Ayala Corporation's energy arm), provides a concrete example of how an ETM can be executed in practice.

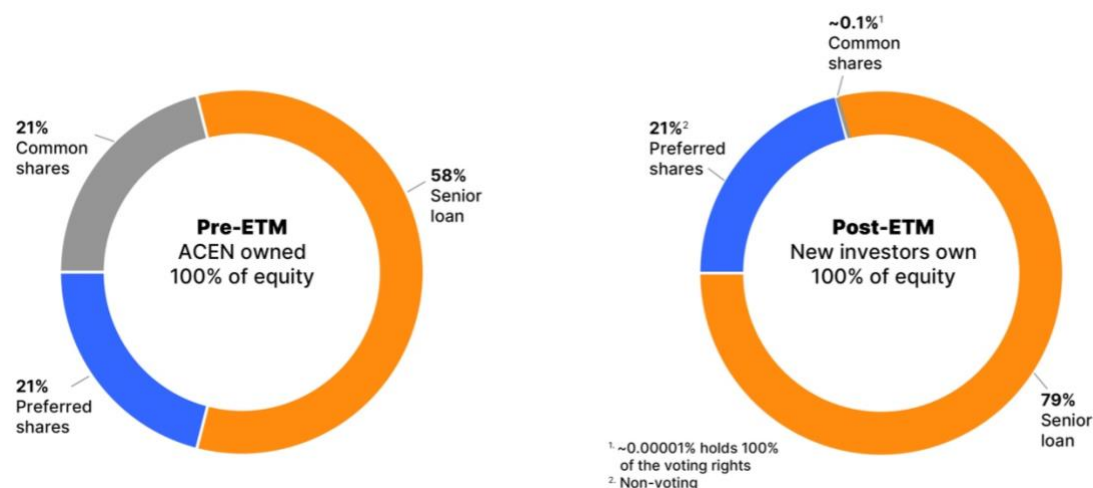
The SLTEC plant was commissioned in 2015 with an expected operating life of up to 50 years. Under the ETM structure devised, ACEN committed to retire the plant by 2040 —reducing its potential lifespan in half. To enable this, ACEN fully divested its equity stake in the coal plant and raised financing that allowed new investors to take over the plant's operation for a shortened period. The transaction was valued at PHP17.4bn (USD312mn), comprising PHP13.7bn (USD245mn) in debt from two local banks and PHP3.7bn (USD66mn) in new equity from a consortium of Philippine investors. Notably, the new equity investors included government and private financial institutions, including the Philippine Government Service Insurance System (GSIS) pension fund and the Insular Life Assurance Company, Ltd. (InLife), as well as a special purpose vehicle called ETM Philippines Holdings Inc. ADB acted as an advisor that helped structure the deal. ACEN was able to sell all its shares in the coal power plant to ETM Philippines Holdings Inc. In exchange for its divestment, ACEN received USD129mn from the transaction for reinvestment into renewable energy projects. The remainder or balance of proceeds was used for refinancing debt and paying off transaction fees.⁹⁹

The funding came primarily from domestic sources, a sign that local capital can be mobilized for coal transition given the right incentives. Optimizing SLTEC's capital structure also played a key role in

⁹⁹ PR Newswire. [ACEN completes the world's first Energy Transition Mechanism \(ETM\) transaction for the 246-MW SLTEC coal plant](#). 07 November 2022.

enabling the transaction. SLTEC's debt was upsized and lengthened through refinancing of the project loan. This allowed a partial return of capital to ACEN, while equity investors took up the remainder. Optimizing the capital structure with the use of leverage also lowered SLTEC's de facto cost of capital to under 8%.^{100, 101}

Figure 22: Optimization of SLTEC's capital structure



Source: World Economic Forum¹⁰².

From ACEN's perspective, the ETM allowed it to monetize its coal asset immediately (receiving PHP7.2bn in proceeds) and redeployed that capital into renewable energy projects. For the new owners, the deal was suitable because the financing was arranged such that returns were locked in over the next 15 years of the plant's remaining operation, and they plan to recover additional value by repurposing the site for cleaner technology after 2040. Crucially, the early retirement will avoid an estimated 50MtCO_{2e} that would have been produced had the plant run for 50 years.¹⁰³ This SLTEC deal has been hailed as a "market-based ETM" success, demonstrating that with the right mix of long-term debt and equity, private actors can profitably accelerate coal phaseout.

Building on this momentum, the Philippine government has embraced coal transition mechanisms as part of its energy policy. In 2023, the country formulated an Accelerating Coal Transition (ACT) Investment Plan with support from the CIF. In June 2024, the CIF endorsed a USD500mn financing package (comprising nearly USD25mn in grants and USD475mn in concessional loans) to help implement this plan. The ACT investment plan aims to decommission up to 900MW of existing coal capacity by 2027—an ambitious goal representing roughly a fifth of the Philippines' coal fleet. The

¹⁰⁰ World Economic Forum. [World's first Energy Transition Mechanism \(ETM\) transaction for early retirement of a Coal Plant](#). 06 December 2023.

¹⁰¹ Just Transition Finance Lab. [Case study: ACEN Renewables – using transition credits to accelerate coal closure](#). December 2024.

¹⁰² World Economic Forum. [World's first Energy Transition Mechanism \(ETM\) transaction for early retirement of a Coal Plant](#). 06 December 2023.

¹⁰³ World Economic Forum. [World's first Energy Transition Mechanism \(ETM\) transaction for early retirement of a Coal Plant](#). 06 December 2023.

USD500mn from CIF is expected to attract additional co-financing, with total funding exceeding USD2.3bn, in partnership with ADB, the World Bank, and private sector contributions. According to the plan, the focus will be on retiring or repurposing specific facilities, including the large government-owned Mindanao coal plant and several privately-owned plants, while simultaneously investing in about 1,500MW of new renewable capacity over the next six years.¹⁰⁴

The Philippines benefits from having relatively smaller and more manageable coal assets, and a strong policy push towards renewables (the government has set a target of 50% renewables by 2040).¹⁰⁵ The ETM approach has proven viable in the SLTEC case, attributable in part to domestic financiers seeing the opportunity to support green transition and earn returns. However, broader implementation will require navigating regulatory approvals and ensuring that replacement power is available to maintain grid reliability once coal units shut down. The presence of concessional climate funds (through CIF and possibly ADB) will help reduce the cost of these transitions. The Philippines has also signaled interest in entering a JETP with international partners, which could further augment financing for its clean energy shift.

The use of transition credits is also being explored to generate additional cash flows for the investors in the SLTEC early coal retirement transaction and accelerate the timeline for the plant closure, bringing it forward to 2030. In August 2024, ACEN signed a deal with investment firm GenZero and infrastructure company Keppel Ltd. to explore the use of transition credits for retiring SLTEC's coal plant and replacing it with clean energy by 2030.¹⁰⁶

Clean energy may be in the form of a hybrid, mid-merit renewable energy plant. ACEN estimates a replacement capacity of 1,000MW of solar capacity, combined with 250MW of wind, and battery storage delivering 4,800MWh of power. To make this proposed generation mix viable, a subsidy of around USD300–450mn would also be required. This amounts to transition credits being valued at USD18–27/tCO₂.¹⁰⁷

¹⁰⁴ Climate Investment Funds. [Climate Investment Funds Endorses \\$500m Philippines' Coal Transition Plan](#). 04 June 2024.

¹⁰⁵ Climate Tracker Asia. [Powering the future: The Philippines' crossroads in energy transition](#). 17 January 2025.

¹⁰⁶ ACEN. [ACEN, GenZero and Keppel join hands to catalyse retirement of coal-fired plants in Southeast Asia](#). 16 August 2024.

¹⁰⁷ Just Transition Finance Lab (2024). [Case study: ACEN Renewables – using transition credits to accelerate coal closure](#). December 2024.

Appendix B: China's views on early coal retirement in Pakistan and Chinese investor concerns

Disclaimer: This section's findings are based on interviews with various government, non-government, and academic institutions. All interviewees wish to remain anonymous. Therefore, their names, designations, and organizational affiliations have not been disclosed.

Limited precedence of in-country coal retirement in China

China's role as a leader in adopting clean energy is recognized globally. However, it is still in a transitional period regarding coal. The country has pledged to peak carbon emissions in 2025, following which a coal phaseout could begin. Some older plants have been retired, but there is a disparity between clean energy commitments and sustaining coal-fired generation in the country's energy mix. Record-breaking annual solar and wind energy additions have occurred, while new CFPPs are being constructed simultaneously. According to a joint report by the Centre for Research on Energy and Clean Air (CREA) and Global Energy Monitor (GEM), China started constructing 94.5GW of new coal-fired power plants in 2024. In addition, 3.3GW of suspended projects were also resumed.¹⁰⁸

According to consultations with Chinese academic experts, the continued addition of CFPPs is purportedly for growing energy needs and ensuring security. To prevent energy and fuel shortages, China has adopted a 'flexible' approach where new coal capacity is added alongside renewable energy projects. The speed and scale of renewable energy additions, such as solar and wind power, are meant to outpace that of coal-fired additions. This will ultimately lead to a decarbonized energy sector, as the share of renewable power generation surpasses fossil fuel-based generation. The primary role of CFPPs will be to serve as backup for renewable energy.

In 2024, China significantly expanded its renewable energy capacity, exceeding its pre-set targets and leading global growth. It added a record 373GW of renewable energy, boosting its total renewable capacity to 1,889GW. This included a surge in solar and wind power, with 277GW of solar and 80GW of wind capacity added.¹⁰⁹

Simultaneously, coal plants have been offered guaranteed payments for making their capacity available to the grid, regardless of actual power generation. This is to ensure that in times of renewable supply shortages, coal-based generation can provide backup.¹¹⁰

This also supports the construction of larger new coal power plants (especially in coal-rich provinces), which are replacing small older coal-fired units, such as those in Shaanxi province, where

¹⁰⁸ Carbon Brief. [China's construction of new coal-power plants 'reached 10-year high' in 2024](#). 13 February 2025.

¹⁰⁹ Energy Asia. [China's Ascendancy in the Global Energy Revolution](#). 2025. Accessed on 06 May 2025.

¹¹⁰ Reuters. [China to guarantee payments to coal power producers based on capacity](#). 11 November 2023.

a new hybrid coal-renewable cogeneration model is emerging. The Yushen Yuheng 2x350MW plant aims to replace 702MW of smaller, less-efficient coal plants, with the complex containing 60MW of wind power, 260MW of solar, and 100,000 tonnes of annual carbon capture capacity.¹¹¹

Need for strong technical criteria for coal retirement

In China, coal plants are likely to remain idle or be acquired by the government until they retire naturally. The retirement criteria need to be designed with technical parameters and thresholds acceptable to power plants (e.g., plant age, coal consumption, environmental standards, plant emissions, and whether the return on investment for the plant has been met). Shandong, China's largest coal-consuming province, established a threshold for retiring its old thermal fleet. In 2019, it was announced that *"except for the only and irreplaceable heat source for people's livelihood in the region, Shandong Province strives to shut down coal-fired units with a unit capacity of less than 300,000 kilowatts and supporting boilers in about three years"*.¹¹²

Academic experts suggest a similar approach for Pakistan, where new renewable energy could outcompete coal-fired generation in the energy mix on economic grounds. However, coal could still provide flexibility to the system by staying idle. This view was corroborated by Chinese policymaking bodies as well, which argued that retiring coal plants immediately may affect Pakistan's energy security, since some plants were located near heavy load centers.

Higher margins of return on investment in coal-fired capacity

According to experts consulted, Chinese investments in Pakistan have been driven by a combination of pricing and convenience. The Government of Pakistan invited coal IPPs, viewing them as a faster solution to address the energy shortfall issue. Investments in coal offered higher chances of profits through premiums and lucrative upfront tariffs. Imported CFPPs under CPEC received an ROE of up to 27.2%, while for Thar coal power plants, the ROEs were as high as 34.5%. At the same time, Chinese-sponsored wind and solar power projects received ROEs between 15% and 17%.¹¹³

As a result, Chinese investors preferred coal over solar and wind energy projects in Pakistan. The ease of adopting conventional power generation also led to the addition of imported coal-fired generation in Pakistan.

¹¹¹ The Asahi Shimbun, [In China's coal country, full steam ahead with new power plants despite climate pledges](#), 03 November 2023.

¹¹² [Huodian.bjx.com.cn](#), Shutdown | In addition to these units, Shandong Province's coal-fired units below 300,000 kilowatts will be shut down within three years (Translated from Chinese), 30 July 2019.

¹¹³ Bhandary et. al, [What drives Pakistan's coal-fired power plant construction boom? Understanding the China-Pakistan Economic Corridor's energy portfolio](#), March 2022. Accessed on 30 June 2025.

Pakistan's boom-and-bust economic cycles

Although utilization rates for imported CFPPs have declined significantly since their commissioning, Chinese stakeholders believe this can be attributed to the boom-and-bust cycles faced by Pakistan's economy. As the country emerges from its current economic challenges, demand is expected to increase again.

Interviewees strongly felt that a grid based on renewable energy alone would not be able to match strong economic growth, especially since BESS were not competitive with conventional dispatchable generation sources at the utility scale. The respondents thought that coal retirement could be an option 10 years later if renewable energy could meet Gross Domestic Product (GDP) growth targets. However, at present, it is important to have a diverse supply portfolio to ensure dispatchable electricity sources are available when renewable generation is absent due to low wind speeds or cloud cover.

Pakistan's remarkable adoption rate of distributed solar was also discussed as a reason for the consistent decline in electricity demand over the past two years. Although the Chinese entities were aware of this, it was still suggested that demand creation would be a more effective solution. This could be achieved by boosting industrial output or electrifying the country's transportation fleet.

Appendix C: Discounted Cash Flow (DCF) analysis

A comprehensive DCF model demonstrates how financial incentives can align stakeholder interests to accelerate the transition from coal-fired generation while protecting investor returns.

Methodology and data foundation

The valuation approach treats the Sahiwal CFPP as a standalone entity consistent with Pakistan's typical SPV financing structure. The analysis draws from multiple authoritative sources:

- PPAs for revenue projections and contractual terms
- Operational reports providing capacity factors, O&M costs, and performance metrics
- Credit assessments informing risk profiles and other financial metrics
- Market projections supplemented by historical compound annual growth rates where forward-looking data is unavailable

DCF analysis is used to determine the enterprise value (total business value, including debt and equity) and equity value (value for shareholders) of CFPPs and their potential renewable energy replacements. Each CFPP is treated as an independent entity, similar to how these facilities typically operate as SPVs with dedicated project financing.

Our valuation relies on the weighted average cost of capital (WACC) as the discount rate, which reflects the cost of financing for the coal plant. The WACC incorporates two distinct components: the cost of debt (interest rates) and the minimum required return for equity investors. Since these costs differ, the WACC evolves over time as the debt-to-equity ratio shifts due to scheduled debt repayments.

The cash flow projections encompass operating expenses, working capital requirements, revenue streams, debt service costs, and capital expenditures (capex). Based on these projections, baseline enterprise and equity valuations were established. Various scenarios were then tested to assess different outcomes and sensitivities.

Table 9: Financial and technical overview of Sahiwal CFPP

Financial Overview	USD/kWh
Fuel Cost	0.047
Variable O&M - Foreign	0.0007
Variable O&M - Local	0.0005
Fixed O&M - Foreign	0.0015
Fixed O&M - Local	0.0015
Insurance	0.0009
Working capital	0.0015
Debt service	0.0173
Return on equity	0.009
Technical Overview	
Total gross capacity - MW	1,320
Project cost – USD million	1,782
Equity – USD million	362
Foreign debt – USD million	1,420
PPA life - Years	30
Coal operations	2017
End of coal plant life	2046
Net dependable capacity - MW	1,244
Plant availability	85%

Source: NEPRA¹¹⁴.

The valuation incorporates several key cash flow components:

- **Revenue:** Calculated based on energy and capacity charges indexed to the United States Consumer Price Index (US-CPI) and Secured Overnight Financing Rate (SOFR) fluctuations for the debt service component. Plant utilization is projected at 35%, reflecting the average performance from FY2022–2024. A 90% revenue collection rate from the CPPA-G is assumed, with the remainder treated as bad debt. In a parallel scenario, plant utilization is assumed at the 50% guaranteed off-take by CPPA-G.
- **Operating Expenses:** Fuel costs are based on consumption rates adjusted for plant utilization, with historical fuel prices extrapolated using a constant growth rate. O&M costs follow regulatory

¹¹⁴ NEPRA. [Decision of the authority in the matter of tariff adjustment at commercial operation date \(cod\) of Huaneng Shandong Ruyi \(Pakistan\) energy private limited \(HSRPEL\)](#). 17 January 2019.

determinations, while insurance expenses are calculated using the United States Producer Price Index (US PPI) measures for steel and electrical machinery.

- **Capital Structure and Depreciation:** The plant uses straight-line depreciation over 30 years. The initial debt-to-equity ratio of 80:20 gradually changes as debt amortizes through fixed repayments with a variable SOFR (forecast based on the most recent figures).
- **Working Capital:** Assumptions include 225 receivable days (based on recent credit rating reports), inventory as determined by regulatory requirements, and 30-day payment terms.
- **Financing Costs:** The sponsors' cost of equity is 27.2% based on regulatory requirements, while debt carries the SOFR/London Interbank Offered Rate (LIBOR) plus a 4.5% spread. A short-term credit facility at Karachi Interbank Offered Rate (KIBOR) plus 2% is available to address cash flow shortfalls.

Alternate project valuations

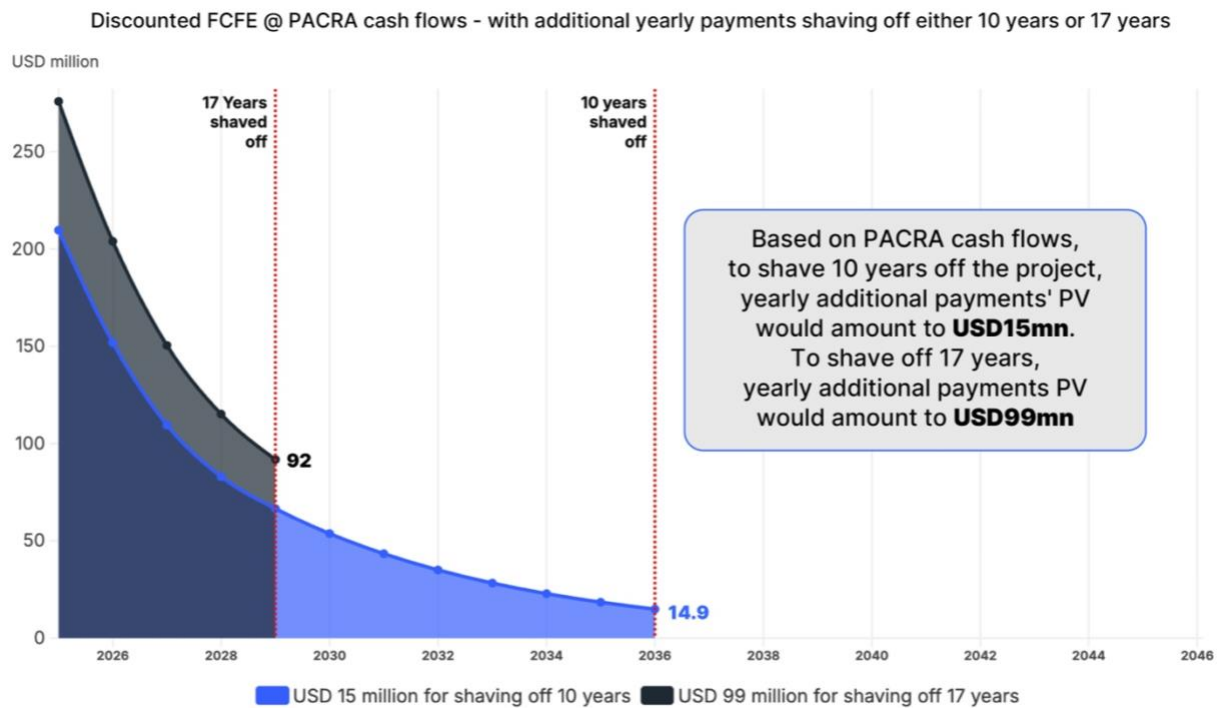
An alternative valuation is also explored based on the plant's cash flows reported by the Pakistan Credit Rating Agency (PACRA) for FY2023. The figure was adjusted for indexation to facilitate forecasting and to account for changes in cash flow after the debt servicing period.

Additionally, an exit valuation methodology is explored to establish equitable exit pricing for sponsors and to provide the government with negotiating room during discussions. This approach extrapolates cash flows from the tariff's Return on Equity (ROE) component across the plant's remaining operational life of 22 years (as of 2025), yielding a derived equity value of USD389 million. The methodology's foundation rests on the principle that the ROE component represents the sanctioned and accountable returns for equity investors under an upfront tariff structure. Any returns exceeding this threshold constitute windfall gains beyond the regulated compensation framework.

Table 10: Plant valuation under alternate scenarios

Reduced Timeframe	PACRA Evaluation	Exit Valuation
17 years shaved	255	115
15 years shaved	165	70
10 years shaved	52	20
7 years shaved	24	9
5 years shaved	13	5

Source: Author analysis.

Figure 23: Free cash flows to equity under retirement scenario according to PACRA cash flows

Source: Author analysis.

Note: FCFE = Free Cash Flow to Equity, PV = Present Value.

About IEEFA

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