

Making the Energy Transition Mechanism Meaningful

A case study from Pakistan

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Key Findings

Pakistan's tough political-economic circumstances and constrained transmission network present challenges for an early coal phaseout, but LNG or diesel power plants can be more suited to an energy transition mechanism (ETM) facility.

Medium-sized, middle-aged thermal plants like Halmore, Saif and Sapphire are potentially viable candidates for an ETM in the near future.

For the young coal fleet, IEEFA's analysis suggests waiting until these plants have fully paid up their loans and are at least 10 years of age.

Ultimately, an ETM retirement facility would have to reach a balance of criteria from the government, potential investors and plant owners to arrive at optimal candidates which meet the needs of all stakeholders, for it is only then that the mechanism could fulfill its true goals – ensuring a timely phaseout of high-carbon assets and, at the same time, the adoption of cleaner energy.



Executive Summary

Pakistan's potential candidature for an Energy Transition Mechanism (ETM) facility under the backing of the Asian Development Bank (ADB) became apparent when the nation expressed its desire to be a part of the scheme at the 2021 United Nations Climate Change Conference. While Southeast Asian economies such as Indonesia have been deep in negotiations for an ETM, and the Philippines has seen a successful coal retirement transaction led by the private sector, it is recognized that each country has unique conditions which contribute to making an effective ETM deal.

Pakistan is going through an economic crisis, the scale of which it has never seen before. Under such circumstances, an ETM deal could face a host of challenges that may need to be overcome first, given the government's competing priorities to ensure political and economic stability.



Ideal power assets would be plants that offered a good balance of incentives to all stakeholders while avoiding significant CO₂ emissions if they were shut before their economic lifetime ended.

An ETM transaction as conceived under the ADB's approach would seek an arrangement between incumbent plant owners, the government and ETM investors. Ideal power assets would be plants that offered a good balance of incentives to all stakeholders while avoiding significant CO₂ emissions if they were shut before their economic lifetime ended. Furthermore, while each stakeholder may come to the table for its own interests, the ultimate beneficiaries of the mechanism have to be the local citizens of Pakistan, therefore any savings, health or other benefits should be passed down to consumers.

From a public-sector perspective, a good ETM transaction asset would be one for which the government is willing to pay the least but from which it would benefit the most – financially, operationally and environmentally – through the asset's removal from the grid.

From an asset seller's perspective, the asset would be one for which the status quo ownership offers little prospective upside or has seen its market value diminish due to low dispatch or large upcoming capital expenditure, such that an early exit through participation in an ETM transaction would allow the highest potential valuation to be achieved.

From an incoming ETM investor's perspective, a good asset is one that allows the investor to pay the least but from which they would earn the most in the shortest operating period.

This report by the Institute for Energy Economics and Financial Analysis (IEEFA) analyzes Pakistan's thermal and coal fleet to come up with a list of potential candidates for an ETM facility using a discounted cash flow analysis (DCF) and associated carbon emission assessment.

The thermal power plants that came out as top contenders for an ETM retirement facility using IEEFA's methodology included medium-sized gas or diesel-based power plants of 220-230 megawatts (MW), such as Saif Power Limited, Halmore Power Generation Co Ltd and Sapphire Electric Company Limited. Since these power plants have almost reached the midpoint of the contracted terms in their 30-year power purchase agreements (PPAs), an immediate retirement would put a price cap of US\$47 million to US\$51 million each on their valuation. On the other hand, letting them operate for a few more years and shaving off the last 10 years of their economic lifetime in a premature termination would reduce the valuation to just US\$17.5 million to US\$18.6 million per plant. The impact from an avoided emissions angle would be a total of 10Mt to 18Mt for all three plants.

By comparison, Pakistan's coal fleet is very young, so IEEFA's DCF analysis of an immediate retirement scenario for selected plants yields an economic valuation of US\$1.1 billion to US\$1.6 billion. On the other hand, if retirement takes place later, letting the power plants complete their debt servicing obligations significantly changes the situation as the DCF values for foregone profits are reduced to US\$398 million to US\$628 million. Further delaying retirement results in an even lower valuation, dropping to between US\$111 million and US\$174.8 million if the PPAs are terminated 10 years before the 30-year contract is over.

The environmental case for shuttering these plants is also very strong. IEEFA estimates that an immediate retirement could lead to an avoidance of up to 250Mt of carbon dioxide emissions per plant.

However, these power plants operate under intergovernmental agreements and sovereign guarantees, so any premature closure may hinge on high-level discussions being able to reach consensus. The challenge is for the authorities on both sides of a PPA to be fully on board with phasing out coal assets. This may require much time and effort, so depending on the priorities of the government, negotiations for an early closure may need to be started sooner rather later.

Whether Pakistan seeks support for near-term retirement of middle-aged thermal power plants, tries to reach a compromise on an early shutdown of Chinese-funded coal power plants, or looks to do both, it appears there are the makings of reasonable prospective deals drawing on ETM principles. With the right conditions bringing together willing parties, the transactions seem reasonable, where asset owners, ETM investors and the government all stand to benefit. More importantly, progress on the ETM will bring both fiscal and environmental relief to the people of Pakistan.

Energy Transition Mechanism in Pakistan

Introduction

Pakistan became a potential candidate for the Asian Development Bank's (ADB) Energy Transition Mechanism (ETM) in 2021, when the national government approached ADB during the United Nations Climate Change Conference that year and expressed an interest to participate in the mechanism. ADB agreed to carry out a pre-feasibility assessment of the potential of retiring high-carbon-emitting assets in the country earlier than their contractually agreed-upon termination dates. Speculation is high as to what it will recommend.¹

The ETM is a concept first visualized by Donald Kanak, chief executive of Prudential Insurance Growth Markets, and later formally adopted by ADB.² At its foundation, the mechanism envisions developing a facility which leverages long-term concessional finance to accelerate the retirement of high-carbon, mainly coal-fired power assets and the funneling of proceeds from the transactions to investments in low-cost renewable energy projects.

The facility mainly targets developing countries which have high carbon lock-in, yet lack the resources and access to concessional capital necessary for a transition toward low-carbon energy.

In the Philippines, the availability of commercial capital and the local private sector's ambition for clean energy have made it possible to retire in advance the 246 megawatt (MW) South Luzon Thermal Energy Corporation (SLTEC) coal plant formerly owned by ACEN Corporation in Batangas. The ETM deal will halve the 50-year operating life of the plant, avoiding the emission of more than 50 million tonnes (Mt) of carbon dioxide (CO₂). The P17.4 billion (US\$308 million) purchase and refinancing facility included a mix of debt financing from the Bank of the Philippine Islands and Rizal Commercial Banking Corporation, and a P3.7 billion equity injection by the Philippine Government Service Insurance System, The Insular Life Assurance Company Ltd and ETM Philippines Holdings Inc. ACEN received P7.2 billion for reinvestment in renewable energy projects.³ It is important to note that this initiative was completely led by the private sector; neither the Philippine government nor its climate policies were involved in the transaction.

For Indonesia, a regulated electricity market with high involvement from the state's sole electricity utility Perusahaan Listrik Negara (PLN), an initial "acquire and retire model" was modified to a simple refinancing deal that would compensate the owner of the 12-year-old 660MW Cirebon-1 coal power plant for the present value of profits foregone due to the plant retiring early, through a low-interest concessional loan. The plant owner, Cirebon Electric Power (CEP), has signed a memorandum of

¹ ADB. [Update on ADB's Energy Transition Mechanism – April 2023](#).

² ADB. [ADB, Indonesia, the Philippines launch partnership to set up Energy Transition Mechanism](#). November 3, 2021.

³ Cision PR Newswire. [ACEN completes the world's first Energy Transition Mechanism \(ETM\) transaction for the 246-MW SLTEC coal plant](#). November 7, 2022.

understanding (MOU) with ADB to explore the possibility of premature termination of a 30-year power purchase agreement (PPA) it holds with PLN. If an agreement is reached, the refinancing of the plant is estimated at US\$250 million to US\$300 million, which may draw on Indonesia's US\$500 million allocation from the Climate Investment Fund.^{4,5,6}

While market-based mechanisms in the Philippines, coupled with CEP and ACEN's own desire to move to cleaner fuels, have worked in the favor of piloting successful deals or, in the case of Indonesia, facilitated what could be a successful deal, it is public knowledge that Pakistan has neither of these elements to its benefit. The country is going through an economic crisis, the scale of which it has never seen before. Participating in an International Monetary Fund aid program to build up financial credibility, combined with heavy reliance on imported fuels, has left the country with extremely high and unaffordable electricity prices. Inflation has been rampant, leading to public unrest and opposition to the government. High-cost energy imports and U.S. dollar-indexed power markets further exacerbate these conditions.

It is thus recognized that under such circumstances, an ETM deal could face a host of challenges that may need to be overcome first, given the government's competing priorities to ensure political and economic stability.

Nevertheless, Pakistan has an opportunity to stay ahead of the curve if it is prepared to phase out certain fossil fuel assets which are an economic burden on the country due to their extremely high and contractually bound U.S. dollar-denominated payments and impracticability from a techno-economic standpoint. A holistic system approach will be needed to properly identify these power plants and secure a timely buy-in from all stakeholders involved.

In this report, the Institute for Energy Economics and Financial Analysis (IEEFA) identifies potential assets which could be candidates to take up an ETM retirement facility in the future.

Finding Optimal ETM Candidates

If the goal is to find a portfolio of realistic potential candidates for ETM participation, it becomes imperative to strike a balance among the parties sitting around the negotiating table. While each stakeholder may come to the table for its own interests, the ultimate beneficiaries of the mechanism have to be the local citizens of Pakistan, therefore any savings, health or other benefits should be passed down to consumers.

⁴ ADB. [ADB and Indonesia partners sign landmark MOU on early retirement plan for first coal power plant under Energy Transition Mechanism](#). November 14, 2022.

⁵ ADB. [Energy Transition Mechanism](#).

⁶ Al Jazeera. [Indonesia, ADB launch first coal power plant retirement deal](#). November 14, 2022.

Pakistan's power market follows a single-buyer model in which a state-owned company, Central Power Purchasing Agency (CPPA-G), is the sole off-taker of electricity. Almost 53% of the installed generation capacity is owned by independent power producers (IPPs), which sell it to CPPA-G through long-term "take-or-pay" (ToP)⁷ PPAs. The power generation mix is 60% thermal in nature, including imported residual furnace oil, natural gas, domestic and imported liquefied natural gas (LNG), high-speed diesel (HSD), imported coal and local Thar coal.

Understandably, the high reliance on imported fuels for energy production has led to the worsening of foreign exchange shortages Pakistan has been facing of late. The forex shortages have in turn spurred fuel unavailability, leading to plants going temporarily offline or reducing power output. Under such circumstances, it could be worth exploring if there is a possibility of retiring high carbon power plants that are costly, have low energy security value and are exacerbating the current economic crisis.

It then begs the question: What are the characteristics of a power asset such that all parties involved would be willing to enter into a deal and that such a deal would be good for each of them?

- **ETM considerations from a government perspective.** Take-or-pay contracts like those in place for IPPs in Pakistan can be a burden on the economy if utilization rates are low. Pakistan follows a two-part tariff system: a capacity charge which covers fixed expenses such as debt servicing and return on equity; and an energy charge which is pegged to variable factors such as fuel consumption and operational and maintenance costs. While the energy charge is directly proportional to the amount of energy produced and off-taken by the utility, the capacity charge is paid to guarantee the IPP's full availability. So even if the plant is not being asked to supply electricity to the grid, but is available to do so, it will receive capacity payments regardless of the low offtake.

The take-or-pay arrangement has become a massive issue of late as a significant portion of Pakistan's thermal fleet faced forced outages due to the unavailability of regasified LNG and imported coal. According to the Ministry of Energy (MoE), the government paid Rs. 1.3 trillion (US\$4.2 billion) to IPPs as capacity payments alone – and yet the power shutdowns occurred. Since the capacity payments are U.S. dollar-indexed, they are projected to increase in local currency terms as the rupee depreciates and loses economic value.⁸

From a government's perspective, it would thus be ideal to retire assets which are getting U.S. dollar-denominated capacity payments despite having low utilization factors. For candidate plants that operate at high dispatch rates, fuel price volatility and technical efficiency would also be deciding factors in shortlisting potential assets.

⁷ Take-or-pay (ToP) clauses are usually added to PPAs to ensure a fixed revenue stream for the energy producer regardless of the actual off-take. Under a ToP arrangement, the utility is obligated to accept the contracted amount of power generation to be delivered by the power producer, or to pay for it, regardless of the circumstances.

⁸ The News International. [Senate body asks govt to stop capacity payments to IPPs](#). August 29, 2023.

- **ETM considerations from an asset owner's perspective.** Utilization rates and merit-order dispatch⁹ are important to an asset owner. Although capacity payments ensure a base level of revenue generation, low economic dispatch can cut into the company's margins and market valuation. From a technical point of view, a plant that is midway through its PPA term may be approaching time for a maintenance overhaul due to operational wear and tear. Such circumstances would require near-term capital investment in order to continue operations reliably, as well as potentially being necessary to meet the requirements of the plant's contract.

Further, plants with a low utilization rate and low capacity factors will also likely experience low operating efficiencies, consuming more fuel for a given level of output, which could compromise compliance with local and international emission standards.

In Pakistan's case, its economic crisis and CPPA-G's inability to fully pay off IPPs due to low or partial recovery of consumer bills by distribution companies has resulted in the IPPs being owed massive arrears. A plant on the receiving end of these dues may consider early retirement a good option if there is a threat of the arrears increasing in the future. Potentially, participating in an ETM facility allows the plant to achieve its highest economic valuation while mitigating the risk of government non-payment.

- **ETM considerations from a transition investor's perspective.** From a potential private-sector ETM investor's point of view, it is critical that the investor has a commitment to a cleaner energy transition and supports ventures that prioritize environmental, social and governance factors in their investment decisions. The investor should have a view toward participating in the green growth of the market, ideally through onward participation in new renewable energy projects. Acquisition and retirement of a polluting asset would be seen as an environmental service and/or as part of a new, green opportunity.

From a financial viewpoint, an investor considering fossil assets targeted for retirement would be looking for the lowest asset valuation while still wanting the plant's power tariff to be high enough to cover all financial and operational obligations. In addition, if the plant is able to maintain the minimum efficiency and environmental compliance standards stipulated by the PPA, that would be an added bonus.

Given a combination of these factors, the asset transaction should be able to pass the appraisal of an equity investment committee and a lenders' credit committee to yield a transaction on reasonable terms with an acceptable cost of capital. More importantly from a transition perspective, if green factors are of paramount concern to the investor, the time horizon to reaching a successful plant closure should be near enough to have a material impact on emission reductions.

⁹ A merit-order dispatch defines the operating order of all IPPs in the country, based on the marginal cost of their operations. In Pakistan's case, the marginal cost comprises the sum of the variable operations and maintenance costs and fuel costs.

A balancing of the three perspectives would result in the following criteria:

- From a public perspective, a good asset would be one for which the government would be willing to pay the least but from which it would benefit the most from the asset's removal from the grid – financially, operationally and environmentally.
- From an asset seller's perspective, the asset would be one for which their status quo ownership offers little prospective upside or has seen its market value start to diminish, but for which participation in an ETM transaction would allow the highest potential valuation to be achieved.
- From a transition investor's perspective, the asset is one that allows the investor to pay the least but from which they would earn the most while achieving the earliest possible plant closure.

Putting the Three Perspectives Together

Thus, once the criterion of a “willingness to bargain” between the private-sector owner's perspective and the government's perspective is set, it becomes easier to identify candidate assets that meet in the middle ground. It should be noted that it is possible for the “seller” and the “investor” to be one and the same entity under an ETM. The parameters for asset consideration would still apply, however, and would be part of a broader deal to onward investment in new green assets.

Figure 1: IEEFA’s Proposed Framework for Pakistan ETM



Potential ETM Candidates: Results and Discussion

Thermal Power Plants

In the context of Pakistan, it is widely accepted that the aging thermal fleet is the root cause of many of the power sector’s problems. A lot of these plants are now past their prime with reduced efficiencies and low utilization rates, but are still earning a return on their assets through capacity payments ensured by long-term PPAs. These plants are a huge drain on forex reserves due to their capacity payments alone, which are denominated in U.S. dollars. Added to this forex bill are any operations that rely upon imported fuel, such as residual fuel oil and LNG.

Furnace oil power plants usually have take-or-pay supply agreements with local oil refineries, which then schedule refinery operations and contract volumes based on the projected demand from these power plants. Hence, sometimes it becomes necessary to run the furnace oil plants regardless of their marginal cost in order to continue regularly accepting fuel oil and refined petroleum products from these refineries.¹⁰

The Pakistan Bureau of Statistics reports that the country's oil import bill for refined petroleum products such as furnace oil and HSD rose by 133.9% in economic value to clock in at US\$12.1 billion during the 2022 fiscal year,¹¹ compared with US\$5.2 billion in FY2021. This was mainly due to increasing oil price volatility in global markets and sustained domestic demand for oil products in the power and transport sectors despite the highly depreciating rupee.¹² The country's LNG import bill also rose from US\$2.6 billion in FY2021 to US\$5 billion in FY2022, due to extremely high spot prices and a decrease in the rupee's value against the dollar.¹³

Against the backdrop of these tough economic challenges and rising import bills, IEEFA has applied an ETM framework to the country's thermal fleet. Plants were short-listed based on the following technical and operational parameters:

- Plants having a high marginal cost: greater than Rs. 25 per kilowatt-hour (kWh)
- Plants with low utilization rates: less than 40%
- Plants with low capacity factors: less than 40%
- Plants with low-moderate efficiencies: between 35% and 50%
- Plants which are not already scheduled for retirement under the government's Indicative Capacity Generation Expansion Plan (IGCEP) 2022-2031, which is prepared by the National Transmission and Despatch Company (NTDC).

The application of these criteria initially resulted in the selection of 10 plants which operated on residual fuel oil (RFO), LNG or a mix of LNG and HSD. The ages of the plants ranged from 12 to 26 years.

While the LNG/HSD-based plants were still young and almost midway through their PPAs, many of the RFO-based outfits were already near the end of their PPAs, hence decommissioning them may not result in any net environmental or economic benefits. Based on this premise, the list of potential candidates was narrowed down further according to two more characteristics:

- Plants which are not already scheduled for retirement under the IGCEP 2022-2031
- Plants aged greater than 10 but less than 25 years, to ensure they have settled their debt but still hold equity in the form of capacity payments

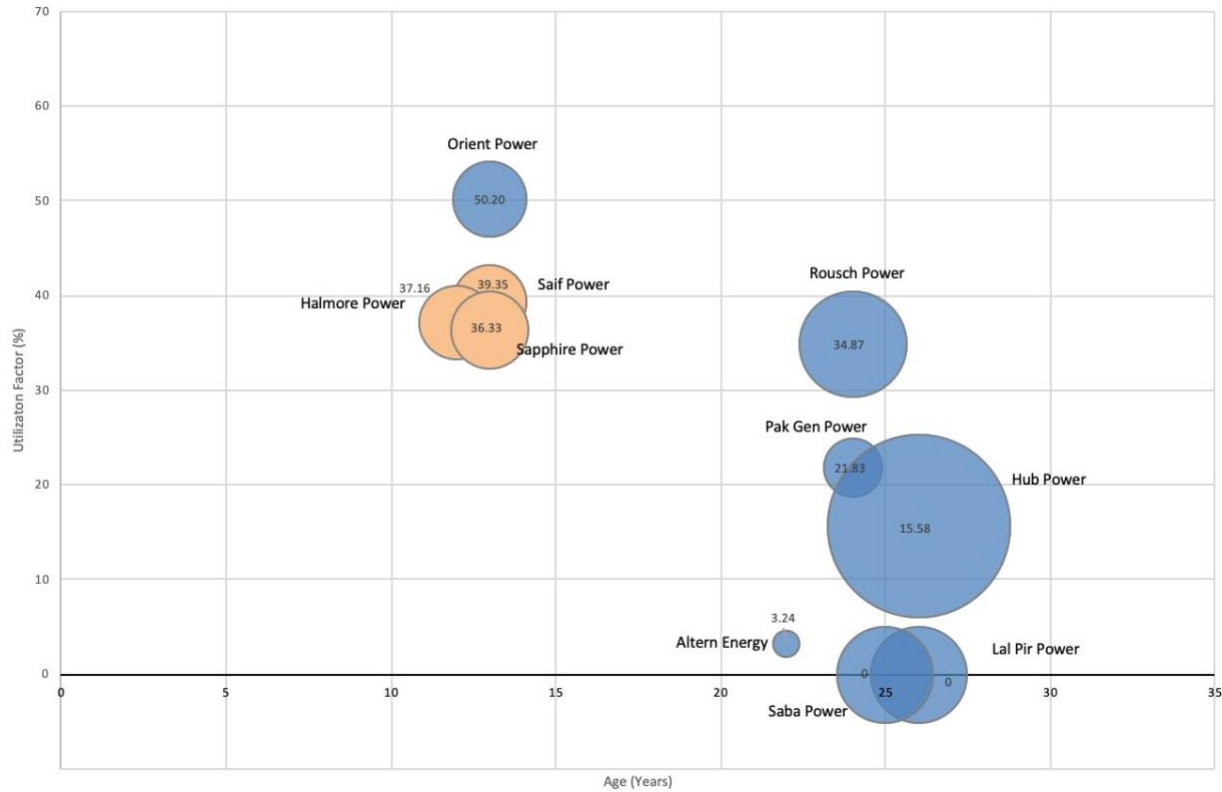
¹⁰ Profit, Pakistan Today. [QCAC requests DG Oil to resolve furnace oil overload issue at refineries](#). December 3, 2021.

¹¹ In Pakistan, the fiscal year runs from July 1 to June 30.

¹² Pakistan Bureau of Statistics. [Annual Analytical Report on External Trade Statistics of Pakistan FY 2021-22](#). January 2023.

¹³ Ibid.

Figure 2: Plants Selected for Further Analysis



Source: IEEFA analysis

Note: The size of each bubble reflects the plant capacity (MW).

After filtering the short list using the two criteria, three thermal IPPs, namely Saif Power Limited, Halmore Power Generation Co Ltd and Sapphire Electric Company Limited, were considered for further valuation under a discounted cash flow (DCF) analysis to assess how much it would cost to retire their plants early under different scenarios.

Table 1: DCF Analysis of Selected Thermal IPPs under IEEFA's ETM Framework

Plant Name	Capacity (MW)	Fuel Type	Average Efficiency (2017-2022, %)	Average Utilization Rate (2017-2022, %)	Average Capacity Factor (2017-2022, %)	Start of Commercial Operations	Age (years)	Latest Marginal Cost* (Rs./kWh)
Saif	225	LNG/HSD	51.20	39.35	38.19	2010	13	5.12
Halmore	225	LNG/HSD	51.18	37.16	35.66	2011	12	26.6-55.96
Sapphire	235	LNG/HSD	51.20	36.33	35.22	2010	13	26.14-55.0

IEEFA

Source: National Electric Power Regulatory Authority (NEPRA) State of Industry Report 2022

*Note: The latest marginal costs were procured from the National Transmission and Despatch Company's [merit order list](#) for the month of August 2023.

Associated carbon emissions were also calculated to see what the environmental impact of an accelerated phaseout would look like for these plants. The results are listed in Table 2.

Table 2: Valuation of Potential ETM Candidates (Thermal Plants) Using DCF Analysis



IEEFA

Source: IEEFA analysis

Note: MtCO₂ = million tonnes of carbon dioxide

The three thermal power plants shortlisted under IEEFA’s methodology, Saif Power Limited, Halmore Power Generation Co Ltd and Sapphire Electric Company Limited, are medium-sized (220MW-230MW) gas or diesel-based power plants. Mostly operating on LNG, these plants sometimes switch

to HSD for operations. Due to low utilization rates and capacity factors, they have been earning excess capacity payments of up to US\$11.64 million¹⁴ per plant annually. Multiply this figure by the remainder of the PPA term, and Halmore is set to reap US\$205 million, Saif US\$197 million, and Sapphire US\$210 million.



Due to low utilization rates and capacity factors, the Halmore, Saif and Sapphire power plants have each been earning excess capacity payments of up to US\$11.64 million annually.

Since these power plants have almost reached the midpoint of their contracted PPA terms, an immediate retirement would put a price cap of US\$47 million to US\$51 million each on their valuation. On the other hand, letting them operate for a few more years and shaving off the last 10 years of their economic lifetime in a premature termination would reduce it to just US\$17.5 million to US\$18.6 million per plant. Due to the small to medium size of these plants, their currently low dispatch rates and their LNG-based operation, the impact from an avoided emissions angle would be a total of 10Mt-18Mt for the three plants under all three retirement scenarios, and up to 5Mt of CO₂ per plant if they are retired immediately.

The early retirement of these thermal power plants may also make sense due to several other factors. From an energy security point of view, these plants combined produced less than 2% of the total power generated by the country from FY2018 to FY2022. The non-availability of gas and LNG in the past few years has severely affected the efficiency and availability of these plants for supply of power to the grid. The State of Industry Report, an annual publication by NEPRA, stated that all three plants faced several force majeure events in FY2022 due to unavailability of gas supply. The report said that Halmore was out of operation for 243 days, while Sapphire and Saif underwent forced outages of 53 and 43 days, respectively.¹⁵

Conversely, due to transmission constraints and aggregate technical and commercial losses, CPPA-G may not be able to offtake power from plants despite their availability. Thermal plants running on a partial load are less efficient and thus result in higher fuel charges per kWh generated, which are eventually passed on to consumers. In the absence of an offtake due to CPPA-G's inability to absorb more power, IPPs are allowed under their respective PPAs to claim partial load adjustment charges (PLACs) for operating on partial loads, on top of the guaranteed capacity charges.

Figure 3 shows how these charges have been increasing over the years, standing at a cumulative Rs. 3.4 billion in FY2022,¹⁶ an added economic burden to the already hefty capacity charges being paid to these plants.

¹⁴ In nominal terms.

¹⁵ NEPRA. [State of Industry Report 2022](#).

¹⁶ Ibid.

All three plants are in the vicinity of the Sahiwal and Sheikhpura areas. Their aim is mainly to meet the power demands of Lahore city, which, with a population of 11.3 million, is one of the biggest load centers in the country. The trio had been serving as baseload plants before 2017, when the country was facing a severe power shortfall. After cheaper generation was commissioned, Halmore, Saif and Sapphire lost their spots on the merit order. Now, the plants mostly remain idle except during the high-demand months of June to September, when they get dispatched to provide local voltage support. The voltage support becomes necessary when high demand strains the transmission grid; it is achieved by drawing on idle plants to carry out reactive power compensation.¹⁷

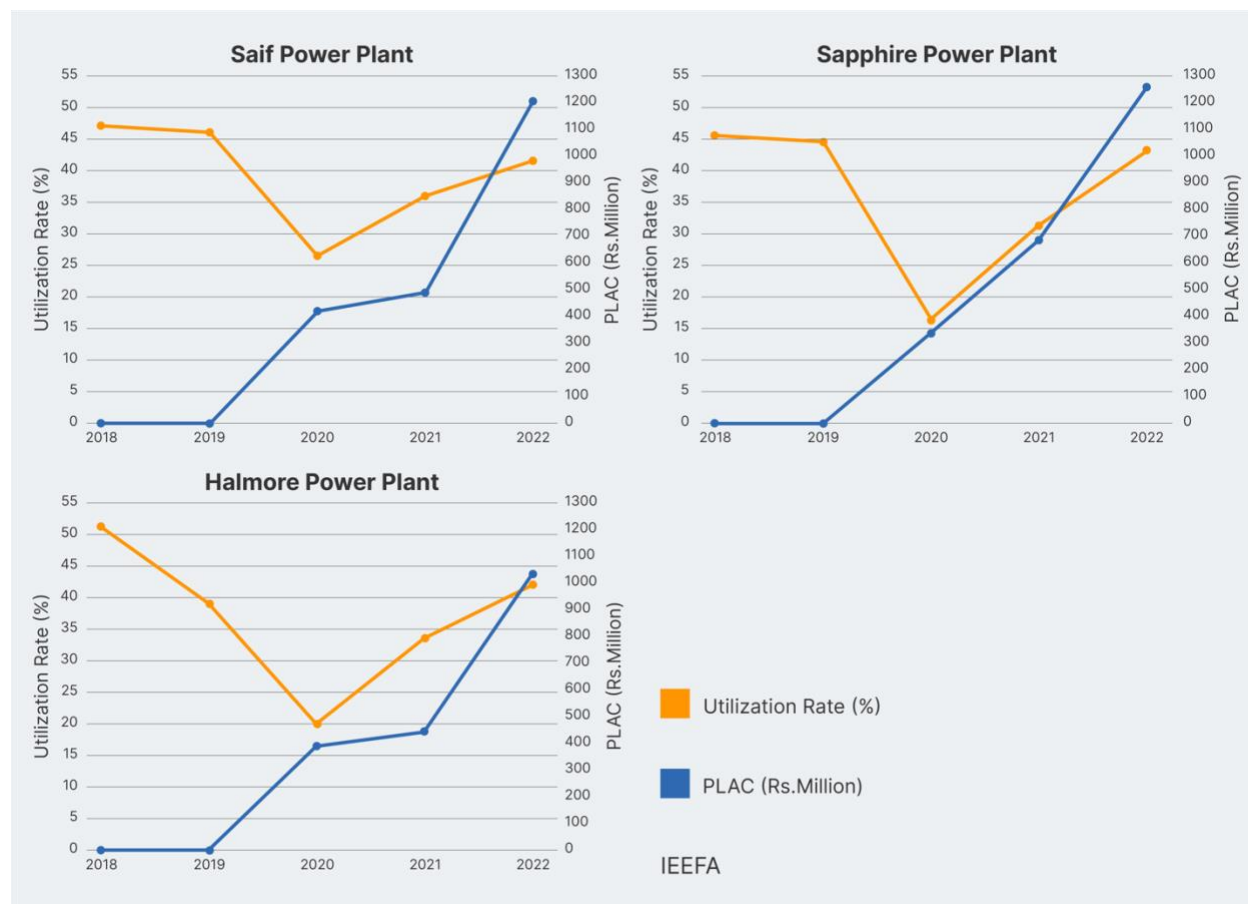
The State of Industry Report corroborates the information above, stating that these plants are the most utilized during June and July.

Pakistan's National Transmission and Despatch Company has been working on its Transmission System Expansion Plan (TSEP), which aims to remove transmission constraints around Lahore by 2025-2026. Under the TSEP, the government has planned several ventures for transmission system expansion and for reactive power compensation around the Lahore grid area. Once these projects are completed, the three power plants will highly likely be not needed anymore.

The transmission expansion plans under the TSEP strengthen the case for possible retirement of the trio by 2025-2026, otherwise, as of now, the cost of letting even one of these plants sit idle and operate at low utilization rates is turning out to be much more than the total cost of retiring all three under all scenarios.

¹⁷ Umer Farooq. Senior energy analyst, LUMS Energy Institute.

Figure 3: PLACs Paid to Halmore, Sapphire and Saif (2019-2022)



Source: State of Industry Report 2022

Note: The year 2020 had an unusually low utilization rate for all three power plants, which may be attributed to subdued demand for power due to the COVID-19 pandemic.

Coal Power Plants

Coal is a relatively new entrant to the Pakistani power market, the oldest plant on the grid being only six years old. Nevertheless, the fuel already forms more than 14% (7.3GW) of the country’s total installed capacity, supplying nearly 20% of the total power generated in FY2022. All of the operating coal plants are run by Chinese IPPs. More than 60% of the present coal-based installed capacity operates on imported coal; however, these power plants are still cheaper to run compared with those on furnace oil or LNG. Hence, they have high utilization factors and rank high on the merit order.

Coal power plants are therefore important for energy security, and yet because of the use of low-grade sub-bituminous or lignite coal, they are highly polluting in nature.

Since the coal fleet is very young, IEEFA has to be practical when selecting potential candidates for an ETM facility. The ETM typically focuses on plants which have been operating for a period sufficient to pay down a portion of their debt while earning some returns on the investment, making the owner of these plants more amenable to negotiating an early phaseout.

In the present circumstances, however, an early retirement deal may offer the Chinese-backed IPPs a way out of the mounting dues owed by CPPA-G. The overdue receivables have reportedly reached US\$1.5 billion, of which US\$263.5 million is owed to Port Qasim Electric Power Company and US\$214.4 million to Engro Powergen Thar.¹⁸

Overdue receivables, especially of this magnitude, can severely cut into the working capital of a power company and affect liquidity. In fact, as recently as March 2023, Port Qasim Electric Power Company was reported to be facing extreme financial difficulty as it had not received payment of energy and capacity charges. This resulted in Port Qasim's failure to pay its coal supplier, which, in turn, discontinued shipments. Both companies were forced to shut down due to fuel non-availability.¹⁹ Later on, in May, Port Qasim had to serve the government a notice of payment default for missing the month-end deadline for settling a principal payment worth US\$73.6 million.²⁰ The incident is a case in point for how capital-intensive coal power plants can be, requiring a steady flow of forex to sustain day-to-day operations.

For economic valuation and assessment of avoided carbon emissions, IEEFA has selected four of the oldest coal-fired power plants, namely, Engro Powergen Thar, Huaneng Shandong Ruyi Sahiwal Coal Power Plant, Port Qasim Electric Power Plant and China Power Hub Generation. Table 3 lists some characteristics of these plants.

¹⁸ Dawn. [Chinese IPP serves notice of payment default on CPPA](#). May 31, 2023.

¹⁹ Profit, Pakistan Today. [Chinese insurers unwilling to insure new financing for CPEC power projects](#). March 7, 2023.

²⁰ Dawn. [Chinese IPP serves notice of payment default on CPPA](#). May 31, 2023.

Table 3: DCF Analysis of Selected Coal-fired IPPs Under IEEFA's ETM Framework

Plant Name	Capacity (MW)	Fuel Type	Average Efficiency (2017-2022, %)	Average Utilization Rate (2017-2022, %)	Average Capacity Factor (2017-2022, %)	Start of Commercial Operations	Age (years)	Latest Marginal Cost* (Rs./kWh)
Huaneng Shandong Ruyi Sahiwal Coal Power Plant	1320	Imported coal	39	91.07	62	2017	6	31.1
Port Qasim Electric Power	1320	Imported coal	40.76	94.16	70	2018	5	23.3
China Power Hub	1320	Imported coal	41.6	90.52	64	2018	5	22.05
Engro Power Gen Thar	660	Domestic (Thar) coal	37	93.24	85	2019	4	5.1

Source: NEPRA State of Industry Report 2022; NTDC.

IEEFA's DCF analysis of an immediate retirement scenario for the selected coal fleet yields an economic valuation of US\$1.1 billion to US\$1.6 billion, including debt servicing needs and contracted returns on equity as stipulated in the plants' tariff agreements. This high valuation can be attributed to the young age of the facilities, and to high returns on equity granted by the Pakistani government to spur investment in the domestic coal sector.²¹

On the other hand, if retirement takes place later, letting the power plants complete their debt servicing obligations significantly changes the situation as the DCF values for foregone profits are reduced to US\$398 million to US\$628 million. Further delaying retirement results in an even lower valuation, dropping to between US\$111 million and US\$174.8 million if the PPAs are terminated 10 years before the 30-year contract is over.

The DCF analysis suggests that for newly built assets such as the Chinese-backed coal power plants in Pakistan, a phaseout near to or after the end of the debt servicing period might be more prudent from an economic and investment angle. From the Pakistani government's perspective, given the high equity returns being provided under IPP contracts, there is significant incentive to negotiate for early retirement.

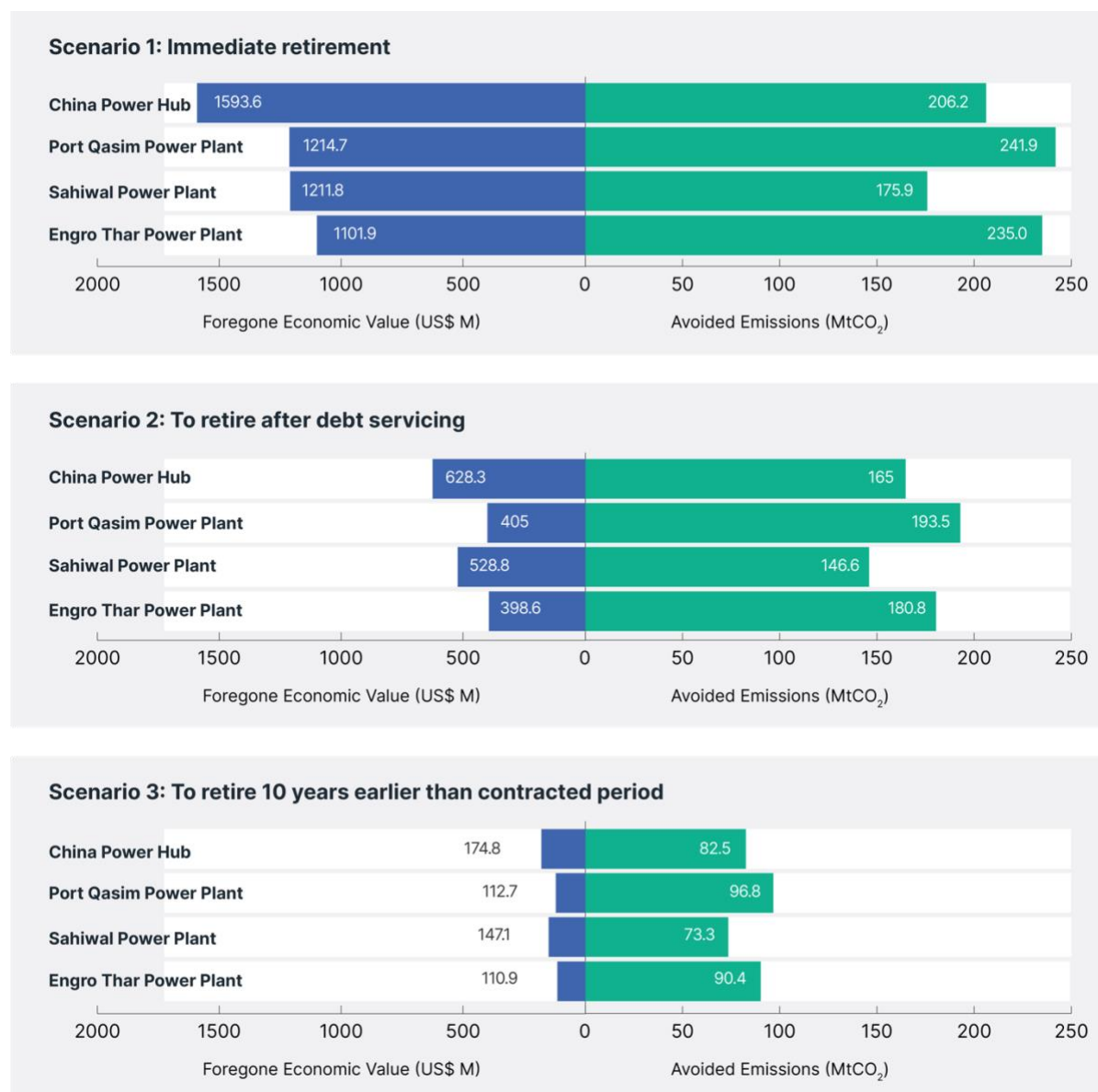
Furthermore, from an energy security point of view, retirement is possible only if the grid has enough backup power that could take the place of these assets. Alternatively, the phaseout could happen in

²¹ Bhandary and Gallagher. [What drives Pakistan's coal-fired power plant construction boom? Understanding the China-Pakistan Economic Corridor's energy portfolio](#). World Development Perspectives. Vol 25. March 2022.

a managed way, whereby the grid is injected with new and cheaper renewable energy coupled with storage as these coal-based assets are gradually retired.

The environmental case for shuttering these plants is very strong. IEEFA estimates that an immediate retirement could lead to an avoidance of up to 250Mt of CO₂ emissions per plant. Prolonging the retirement timelines would understandably reduce emission reduction potential, but it would still remain a significant 73Mt to 90Mt of CO₂ per plant if the PPA term is cut by 10 years.

Table 4: Valuation of Potential ETM Candidates (Coal-fired Plants) Using DCF Analysis



Source: IEEFA analysis

Recommendations

While an economic valuation helps put numbers on what it could cost to actually retire a polluting asset, an actual deal hinges on the availability of blended finance and/or guarantees on offer from multilateral development banks standing behind the Pakistani government to provide low-cost capital and to de-risk these transactions. The necessity of these conditions reinforces the fact that ETM plant closures cannot exist alone. A coal or thermal plant buyout will not be enough and may even be disadvantageous to the country if they are stand-alone transactions.

Instead, a plant closure should be coupled with an investment plan in renewables, storage and/or the grid. In a demand growth environment such as Pakistan, plant closures *per se* have little merit. The government cannot risk waiting for clean energy or grid improvements to come through external sources in serial fashion. Because of Pakistan's high-risk investment environment, coupled with growing industry procurement costs, well-intentioned plans such as a solar photovoltaic fast-track initiative have turned out to be a failure, as witnessed in the summer.²²

Under such circumstances, an ETM provides an opportunity for high-carbon asset closure to be packaged along with new investments in renewable energy. This can be done in two ways: getting the incumbent plant owner to agree to close the plant early AND to invest in a new renewable energy project; OR getting a new third party involved which will buy out the incumbent AND finance clean energy from the proceeds of the deal.

Incumbent asset owners have a distinct advantage over new developers or parties coming into the picture when it comes to familiarity with power market dynamics in Pakistan. They already know how to maximize operations. That knowledge can be parlayed and leveraged into development, financing and implementation of the clean energy investment portion of the ETM. With access to willing lending already present through the ETM, this process becomes less risky, less stressful and more certain. Networks of relationships with vendors and contractors can also help smooth new investment implementation. Moreover, such relationship networks could optimize resource usage – both time and money – from ETM financial participants and increase the feasibility of a deal.

Pakistan's young coal fleet may make retirement of any such assets challenging in the near future. These power plants are shielded by long-term government-to-government PPAs and sovereign guarantees, which means any initiative to accelerate their closure will have to come from the highest levels of authority. This is where stakeholder engagement and buy-in from the government become very important. Unless both the Chinese and Pakistani authorities are fully on board with phasing out coal assets, any retirement of coal-based power plants will only remain a pipe dream. However, mounting arrears create pressure to reach a solution. Perhaps a bundled approach between shorter-

²² Business Recorder. [600MWp solar project: AEDB holds Nepra responsible for lack of interest among investors](#). June 6, 2023.

term operations of coal facilities and construction of renewable energy facilities under a restructured and rebalanced PPA coupled with ETM financial relief might be an approach.

On the other hand, retirement of medium-sized, middle-aged thermal IPPs such as those discussed earlier in the report could be readily capitalized upon as low-hanging fruit. These plants require less capital for a buyout and could also save the government significant economic resources in the form of avoided capacity payments and PLACs.

The ETM process in Pakistan offers a multidimensional opportunity to improve overall sustainability of the power sector, both environmentally and fiscally. Indeed, quasi-commercial financial incentives are at the heart of the ETM concept. The foregoing case of coal-fired plants in Pakistan shows that in looking to strike a balance, sometimes financial stability is as important as environmental mitigation. By freeing up state monies caught in a fossil-fueled circular debt trap, more money may be made available to support cheaper, more sustainable green alternatives. There is a balance that can be struck among asset owners, ETM investors and lenders, and government to reach a more sustainable, cleaner, cost-effective future.

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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