Policy brief

Locked In and Priced Out: How Coal Power Contracts Fuel Debt and Delay the Energy Transition

Summary

- Power Purchase Agreements (PPAs) are seen as necessary to build power infrastructure, yet they lock in aging and uneconomic power plants beyond when they would retire due to market forces alone.
- PPAs in India, Indonesia, and Pakistan have led to severely mis-aligned incentives creating unsustainable debt, fossil fuel lock-in, and affordability crises.
- For instance, capacity payments made to keep coal running now exceed some countries' annual health budgets, while providing electricity to households that costs three times as much as renewables.
- We outline three policy approaches to 'break the coal contract trap':
    - Payouts compensating coal power producers for a contract's residual value, conditional on total closure;
    - Careful renegotiation of capacity payments to coal power plants alongside technology swaps to crowd in cheaper, clean technologies, and;
    - Where renegotiation fails, litigation to terminate a PPA.
- Finding ways to exit rigid PPAs, many of which were never sourced competitively, will create a pathway for a more just and equitable energy transition, to reduce greenhouse gas emissions, national debt and household electricity bills.

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Introduction

Renewable energy is now the cheapest source of electricity in the world on a levelised cost basis.[1] Yet its diffusion is hampered by institutional barriers. About 90% of coal-based electricity in the world is procured and sold through rigid, long-term bilateral contracts known as power purchase agreements (PPAs) instead of dynamic wholesale markets.[2] If markets were present, many fossil fuel assets would retire faster than rigid PPAs allow.

PPAs are seldom disclosed, making it difficult to systematically assess how costly they are and their implications for climate change.[3] To get around this challenge, we leverage case studies from the power sectors of India, Indonesia, and Pakistan, to elucidate how these contracts slow down the transition to cleaner and cheaper energy. In the absence of systematic and globally comprehensive data on PPAs, these case studies provide insight into the problems at play and can create the grounds for greater disclosure of PPAs. The nations we study serve a quarter of the planet's population and are responsible for approximately one-fifth of global coal demand.[4] These countries' fates are essential to global efforts to address climate change.

Before the economic liberalisation of the 1990s, electricity generation in developing countries was publicly owned. PPAs were used extensively to create stable and predictable returns for independent power producers (IPPs) and induce private sector investments and entry.[5] However, this required using contract features that insulated IPPs from market and policy forces, which led to a growing misalignment between the actions of IPPs and policy goals of making electricity affordable, accessible, and clean. Here, we will explore the contract features which have led to deteriorating economic and environmental outcomes and explore forward-looking options for reform.

The true economic costs of PPA contracts locking in fossil fuel infrastructure

Standard PPA contracts across India, Indonesia, and Pakistan offer IPPs an inflation-indexed tariff over 25-30 years, fixed monthly capacity payments irrespective of how much electricity is sold, and the ability to pass through 100% of the increases in input costs to the utility ("cost-plus" contracting), alongside a guaranteed return on equity. This implies little to no incentive for IPPs to reduce costs or phase out fossil-fuel infrastructure in line with economic incentives.

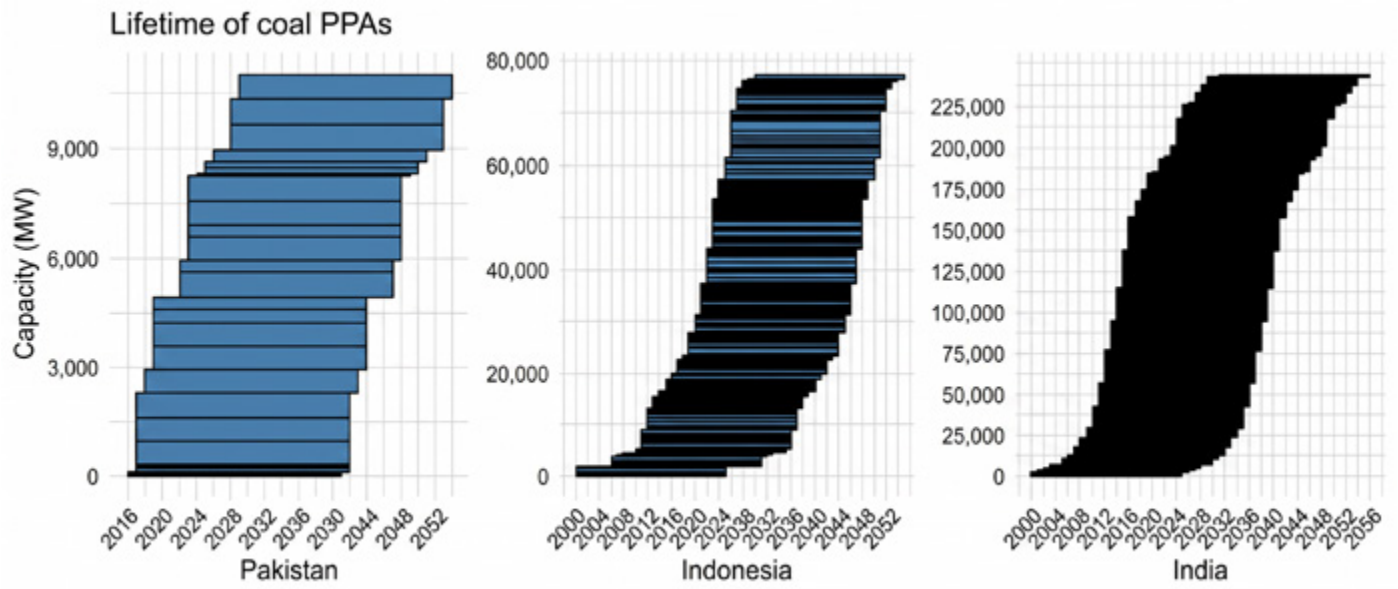
Long-duration PPAs are locking in coal for decades to come, even when renewables are cheaper

Since more than 50% of global coal is under long-term PPAs, unwinding these contracts before their term is over will be necessary to reach global net zero targets.[6] The pressure to shift away from fossil fuel PPAs is mounting due to both climate and pollution-related concerns,[7] alongside the falling costs of renewable energy.[8]

For example, Pakistan inaugurated a large amount of new coal capacity under the 2015 China Pakistan Economic Corridor (CPEC) (see Figure 1).[9] CPEC coal projects were not competitively procured,[10] raising questions on whether the most competitive energy generation technology was chosen. The economic costs of this coal lock-in are extremely high: China Power Hub Generation provides electricity at US cents (USc) 11.4 per kWh while solar-based electricity in Pakistan costs USc 3.7 per kWh (both in 2023 US cents) – therefore coal is nearly three times more expensive than solar-based electricity.[11]

Even putting climate considerations aside, the premature termination of coal PPAs in Pakistan will help avoid the foreign exchange risk that is associated with net imports of coal. This is because every time the Pakistani rupee depreciates, the real cost of coal-based electricity increases since payments must be made in US dollars (USD). Since the grid is so expensive, Pakistani households and firms are turning to self-generation by installing rooftop solar: over 2022-2024, grid-based power consumption shrunk by 10% while solar imports reached 14 GW.[12]

Figure 1



Note: Each bar represents a unique coal-fired power plant. We assume each PPA lasts 25 years although extensions are commonplace. Data is from Gem Wiki and may not be complete.

In Indonesia, the President in 2024 vowed to terminate all coal capacity in the next 15 years and replace it with 75 GW of renewable power.[13] This will mean retiring a large number of coal PPAs before their duration is over (Figure 1). The scale of the coal lock-in is an order of magnitude larger in India. The levelised cost of renewables in India is now around USc 2 per kWh while the tariff from coal plants ranges from USc 4-6 per kWh.[14] Even though renewable energy is cheaper; it cannot enter the system at the rate it ordinarily would because of the overhang of coal PPAs that are insulating these assets from market dynamics. In both India and Indonesia, local coal mining creates political-economy challenges associated with phase-downs or -outs.

Capacity payments made to keep coal running exceed some countries' annual health budgets

Another major feature of PPAs is capacity payments, typically justified by improved system reliability. In practice, overly generous capacity payments have led to excess entry and inefficiently low exit, creating large levels of indebtedness with USD billions being paid out to idle fossil fuel generation infrastructure. For example, consider that in 2023, Pakistan's capacity payments to IPPs totalled 4.5 billion USD, equalling 4% of the country's annual government budget, outstripping the annual health budget by 9 times.[15]

Capacity payments make up 70% of the average power purchase price in Pakistan[16] while supporting fossil fuel plants that are used less than 20% of the time but receive capacity charges for a 100% plant availability (for context, a standard assumption when calculating plant-level economics is 70-80% utilisation).[17] Without capacity payments, assets with such low utilisation rates would have left the market, thereby creating room for renewable energy.

Similarly, in Indonesia, the scale of the debt problem is large: over the next 25 years, an estimated USD 16.2 billion will be paid for idle coal capacity concentrated in the Java-Bali region, which is 40% of total capacity payments.[18] The resultant indebtedness is inhibiting the Indonesian utility from electrifying parts of the archipelago that still suffer from poor access. The excess capacity is not needed for system reliability—the main Java-Bali grid has 60% more capacity than peak demand, far above the regulated reserve margin of 25%.[19]

Finally, in India, an estimated 7 billion USD could be saved annually by exiting old coal PPAs.[20] The indebtedness of Indian utilities is preventing them from financing system upgrades, thereby exacerbating unreliability. While it is important for a country to have enough electricity generation capacity to meet its development needs, there is a real cost to building out too much, too fast, as these examples show. Capacity payments are imposing large financial burdens on the governments of India, Pakistan and Indonesia and this is ironically, making the power sector more fragile rather than robust.

Cost-plus contracting leads to inefficient operations and renders carbon pricing ineffective

Another feature of PPAs is cost-plus contracting, which allows IPPs to pass on fuel cost increases—whether these are market-driven or policy-driven, to the utility. This eliminates the incentive for IPPs to optimise fuel efficiency, seek cheaper suppliers, or switch to cleaner alternatives.[21] This also renders carbon pricing ineffective, as there is no tax incidence on the IPP. This rigidity is the main reason why, even when carbon pricing exists, it will have little to no effect on altering the incentives of polluting firms to not pollute. Even increases in coal price driven purely by market forces are unable to impact a coal powerplant's incentives. Far from coal-fired power plants paying for

their external costs (such as climate change and air pollution), they are not even paying for internal costs. In India, the result is a highly inefficient thermal fleet and crippling levels of air pollution.[22]

Another consequence of cost-plus contracting is "economic loadshedding": while IPPs can pass on all fuel cost increases, utilities are unable to charge higher tariffs to customers and consequently resort to electricity rationing to limit total losses.[23]

Cost-plus contracting is also leading to adverse selection, where IPPs choose suppliers based on patronage rather than value. In Pakistan, Sahiwal Power Plant CPEC project was found using coal priced at USD 265 per tonne when market rates were 40% lower.[24] It was also being reimbursed for high-quality coal when in reality, it was using cheaper low-quality coal, thereby not only hurting the public exchequer but also exacerbating air pollution.[25] The same was found to be occurring in India for Adani-operated coal-fired power plants which are similarly under cost-plus PPAs.[26]

Policy approaches

There are different approaches to dealing with the inefficiency of PPAs. Some of these strategies are relatively investor friendly, acknowledging that perhaps at the time of signing, these contracts were efficient with the information available then. Other strategies penalise investors for: taking on too much systemic risk even when the consequences of fossil fuel combustion were clear; [27] infringing upon right to life/clean environment; outright cheating; or, writing a contract 'in bad faith' from the outset because it put too much of the burden of future risks on the utility.[28] We consider some of these options here. What works largely depends on the institutional context and policymakers in question.

Pay-outs and technology swaps

In a managed transition, IPPs could be compensated for the contract's residual value plus an early termination fee, funded through climate or domestic finance. The pay-out should be conditional on total closure. If the residual value is clear, it can be paid out (as was done in Ontario);[29] if not, an auction can resolve information asymmetries if there is sufficient competition (as done in Germany).[30] In Pakistan, for example, 5 PPAs were terminated prematurely in exchange for a lump sum payment that would cover the plants' capacity payments for the remainder of the PPA.[31] Another approach is to maintain similar commercial terms in the PPA while providing subsidies to replace the underlying technology. This could involve retiring coal-fired power plants and replacing them with renewable energy, as seen in Chile,[32] or using certified biofuels that do not contribute to deforestation, as done in the UK.[33] This latter strategy may be particularly suitable for contexts where the coal fleet is relatively young,[34] making fuel replacement more politically feasible than complete asset closure. Provided there is financing available, pay-outs and technology swaps represent a relatively non-confrontational way of expediting the energy transition and resolving the lock-in created by coal contracts. The key barrier for developing countries is access to finance.

Renegotiation

Renegotiation is a critical aspect of long-term contracts. In Pakistan, the government halted capacity payments for 18 IPPs and terminated contracts with 5 other IPPs.[35] These IPPs had already paid off their debt and earned a high return on equity.[36] The rise of off-grid solar in Pakistan strengthens the case for renegotiating capacity payments, presenting an opportunity for a cheaper exit from coal. However, not all IPPs are willing to renegotiate. Those under CPEC agreement were offered high returns on equity (27% to 34%), along with uncapped dollar indexation and 100% pass-through of fuel costs and are not open to any type of renegotiation.[37] These terms have resulted in Chinese creditors holding one-fifth of the total Pakistani power sector debt[38] while being the largest financiers of coal in Pakistan. Despite growing calls for renegotiation, Beijing has remained recalcitrant till date (July 2026). This highlights a particularly challenging issue for developing countries – when the counterparty to a large coal PPA is a foreign nation, geopolitical forces can hinder renegotiation. Systematic international pressure is needed for large financiers of coal, such as China, to clean up their "financed emissions".

Litigation

Where renegotiation fails, litigation can be deployed to terminate a PPA. For example, a private utility in Delhi successfully exited a coal PPA, arguing that switching to solar would lower costs and provide cleaner energy. The court ruled in favour of the utility, noting that the 25-year-old coal plant was "fully depreciated."[39] This decision prompted similar terminations, including five fossil fuel PPAs totalling 250 MW in Rajasthan[40] and 832 MW of coal in Bihar.[41] Similar efforts also emerged in Odisha, Punjab, and West Bengal.[42] While some of these coal assets can participate in India's spot market, there they will have to perform entirely on a market basis, unlike under a PPA.

Furthermore, if a coal PPA is causing significant harm, human rights arguments related to the right to life or a clean environment could potentially be used to nullify the contract.[43] Evidence is already building against specific powerplants with studies showing, for example, that Indonesia's Banten-Suralaya coal complex, located close to Jakarta, imposes annual health costs of USD 1 billion.[44] The termination of asbestos contracts represents a historical parallel. Finally, explicit cheating, or bad-faith negotiations can also justify contract termination. Evidence that power plants have been artificially inflating costs can create the grounds for exit via litigation. However, the success of litigation depends on the independence of courts and strength of rule of law.

Conclusion

Several years post signing, it is clear fossil fuel PPAs have led to severely mis-aligned incentives, with IPPs failing to improve their efficiency, engaging in adverse selection on fuel suppliers, artificially inflating their costs to secure lucrative top-ups, and exiting far too late (relative to when they would exit in a market-based setting) - crowding out the space for cleaner and cheaper alternatives to enter. The consequences have been rising debt, unaffordability, unreliability, pollution and a delayed energy transition.

Why were these contracts signed, given the obvious misalignment in incentives that they would create? Plausible explanations include regulatory capture and asymmetric information. CPEC projects were not competitively procured and negotiated through bilateral deals. One Chinese coal plant recouped 70% of its investment in two years, while another recaptured a third in just one year,[45] contrasting sharply with the typical 9–15-year repayment period.[46] In Indonesia, coal mining is largely controlled by politically connected families, creating a strong case for rigid PPAs that support these mines.[47] A lawsuit against the first Indonesian IPP highlighted alleged corruption via excessive tariffs and the Indonesian utility's director was ousted for publicly signalling the difficulty of going against "power companies that had Indonesia's first family behind them."[48]

This work shows how there is an imminent climate and development win-win: finding ways to exit rigid PPAs', many of which were never sourced competitively, will create a pathway for a more just and equitable energy transition, one which will not only reduce greenhouse gas emissions but also, national debt and household electricity bills. This may also pave the way for more transparent and competitively sourced renewable energy PPAs which will likely to play an important role in the diffusion of clean power.[49]

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