10

Pricing Energy and Retiring Circular Debt

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Abstract

This paper examines the structural drivers of circular debt in Pakistan's power sector, focusing on energy pricing reforms and capacity payment obligations under privatized electricity generation contracts. Although the efficiency hypothesis implies that private sector involvement enhances cost recovery and decreases fiscal burdens, Pakistan's experience indicates the existence of chronic financial imbalances. Based on data for the period of 2006–2024, this paper examines circular debt accumulation trends, electricity tariffs, and the payables composition of public and private generation entities.

The results indicate that, even with significant tariff rates, circular debt has been increasing. More specifically, the increasing portion of capacity purchase payments within total power purchase costs is closely linked to debt accumulation. This suggests that circular debt is not solely the result of tariff under-recovery but reflects deeper structural rigidities embedded in fixed contractual obligations and institutional inefficiencies.

This paper posits that to implement sustainable reform, it is necessary to address capacity payment designs, subsidy management, and pricing changes to regain financial stability and ensure competitiveness.

Introduction

Pakistan's economic growth has remained volatile since the early 1990s, marked by declining investment and persistent fiscal imbalances. The deceleration of

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investment growth, especially in infrastructure and energy, has limited industrial growth and long-term productivity. Gross domestic product (GDP) growth dropped, on average, by 1.84 percentage points. This decline in growth aligns with a drop in investment growth, which fell by an average of 3.11 percentage points between 1973 and 2018 (Ikram & Mahmood, 2022). Pakistan adopted structural adjustment programs under the close supervision and guidance of the World Bank and International Monetary Fund in response to fiscal stress and external imbalances. The programs were intended to tackle economic strain, narrow current account deficits, stabilize exchange rates, and manage outstanding external debt.

While these programs aimed to improve efficiency and reduce fiscal pressure, they also reduced public investment in key sectors, particularly electricity generation. This led to Pakistan entering a repeated cycle of external borrowing and adjustment.

Since the early 1990s, recurrent electricity shortages and financial stress caused by the Water and Power Development Authority, a state-owned utility, led to major reforms in Pakistan's power sector. The energy policy of 1994 allowed private sector participation in the energy sector (see Government of Pakistan, 1994), which ultimately led to the establishment of independent power producers (IPPs) (Malik, 2007). This reform was guided by the efficiency hypothesis, which argues that private ownership improves cost recovery and operational efficiency. The 1998 energy policy, introduced amid a continuing energy supply deficit, reaffirmed the confidence of private power producers, leading to an increase in the number of IPPs from 18 to around 90 by 2021 (National Electric Power Regulatory Authority [NEPRA], 2021). While privatization expanded generation capacity, it also altered the financial structure of power purchase agreements, introducing fixed capacity obligations that have had long-term fiscal consequences.

In the years that followed, growing demand and persistent supply deficits led subsequent governments to increase private participation. This increase reflects the logic of the efficiency hypothesis, which argues that private ownership tends to deliver more efficient outcomes than state-run enterprises (Megginson & Netter, 2001). However, the evidence is mixed in the case of Pakistan. IPPs helped address electricity shortages and attract foreign investment, but their entry was accompanied by tariff inefficiencies, capacity

payments, and governance issues (Kessides, 2004; Malik & Qasim, 2018). In essence, IPPs *did* lead to an increase in capacity, but the target of efficiency was only partially fulfilled.

Recent evidence suggests that the shift from public to private generation has been associated with higher production costs and rising electricity tariffs (Ikram et al. 2024). These developments indicate that the financial structure of electricity generation has become increasingly costly, placing additional pressure on the power sector's payment system.

Therefore, despite increased generation capacity and recurring tariff changes, Pakistan's power sector has been experiencing chronic and growing circular debt. Instead of stabilizing the sector's financial situation, privatization and price increases have been accompanied by rising payment arrears along the electricity supply chain (Bacon, 2019; NEPRA, 2023).

This raises critical questions: if private involvement and higher electricity prices were expected to improve cost recovery and financial sustainability, why has circular debt continued to grow? Is the problem merely one of tariff under-recovery, or are there fundamental structural processes at work in the power purchase framework that accumulate debt?

This paper argues that the persistence of circular debt cannot be explained by pricing inefficiencies alone. Rather, the problem reflects the structural rigidity of contractual provisions, particularly the rising burden of capacity payment commitments under privatized generation contracts. By analyzing the composition of circular debt between 2006 and 2024, this paper demonstrates that fixed capacity payments have played a central role in debt accumulation.

To understand how privatization reshaped the power sector's financial dynamics, it is necessary to revisit the theoretical foundations of the efficiency hypothesis and assess its implications for pricing and cost recovery.

The next section explains the theoretical groundwork behind the efficiency hypothesis. This is followed by sections defining circular debt, identifying and analyzing the key financial and operational components contributing to circular debt, and an assessment of electricity tariff hikes' effectiveness in reducing circular debt. The paper goes on to examine the role of capacity payments as drivers of debt accumulation, compare Pakistan's electricity tariffs with regional

and global tariffs for comparative advantage and competitiveness, and present policy recommendations.

The Efficiency Hypothesis

The efficiency hypothesis proposes that improved efficiency in energy production and distribution can decrease unnecessary consumption, enhance productivity, and lower financial burden without requiring additional power generation capacity (Sorrell, 2015). In the context of privatization, the hypothesis argues that private ownership improves performance through stronger profit incentives, cost discipline, and reduced political interference in operational decision-making (Megginson & Netter, 2001). In contrast to state enterprises, private firms are expected to operate under strict budget constraints, align prices with underlying costs, and reduce inefficiencies arising from overstaffing, technical losses, and weak governance frameworks.

In electricity markets, this theory implies that private generation companies should improve cost recovery and financial sustainability by pricing electricity closer to its true production cost. In the long run, improved efficiency should reduce fiscal implications for the government, lower operational losses, and strengthen financial stability within the sector.

In Pakistan, however, the shift from public to private energy production has produced mixed outcomes. The growth rate of electricity generation has decelerated from eight percent to four percent after resource reallocation. In 2024, the private sector produced electricity at an average cost of PKR 30.7 per kilowatt-hour (kWh), compared to PKR 17/kWh in the public sector, representing a cost difference of approximately 75 percent (Ikram et al., 2024). This cost differential challenges the expectation that private participation decreases production costs.

Moreover, the share of capacity purchase price (CPP) has increased relative to the energy purchase price (EPP), accounting for 67 percent of the total power purchase price (PPP) in 2024. The resulting price burden has shifted to consumers, leading to higher overall tariffs and nullifying the efficiency theory (NEPRA, 2024; World Bank, 2020).

The divergence between theoretical expectations and actual outcomes suggests that financial imbalances may be embedded within the sector's cost

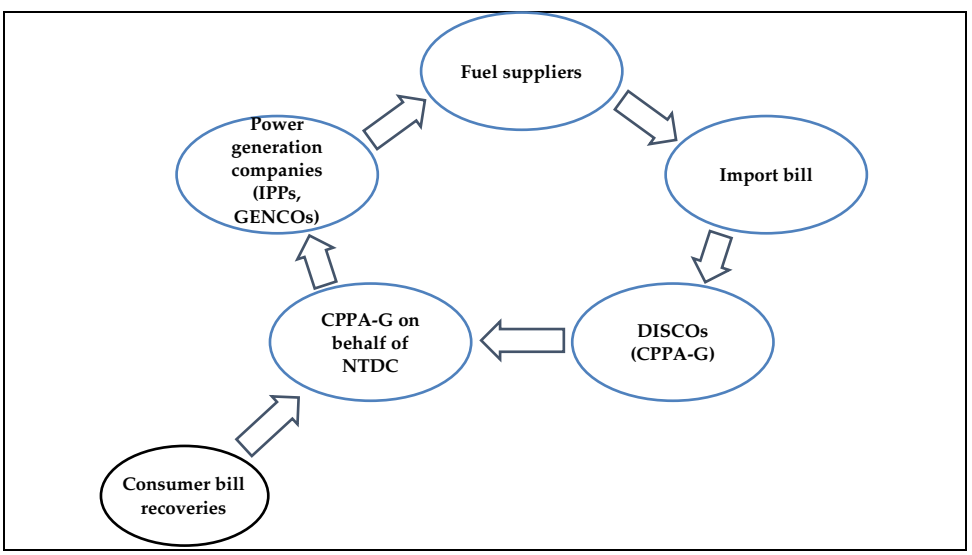
structure. This leads to the central issue examined in the next section: the emergence of circular debt. Rather than eliminating inefficiencies, privatization may have shifted the composition of costs from variable operational losses to fixed contractual obligations, particularly capacity payments.

What is Circular Debt?

Having examined the theoretical expectations of privatization, it is now necessary to define and contextualize the central financial problem of Pakistan's power sector: circular debt. The World Bank described circular debt as the sum of the cash gap within the Central Power Purchasing Agency-Guarantee (CPPA-G) that it cannot pay to power supply companies (Bacon, 2019). The reason for this deficit is the gap that results from the difference between the actual cost of electricity production and distribution and the revenue that distribution companies (DISCOs) collect from users.

Circular debt occurs when one entity facing cash flow problems holds back payments to suppliers and creditors (Figure 1). Thus, problems in the cash inflow of one entity cascade through other segments of the payment chain (Ali & Badar, 2010).

Figure 1: Circular debt



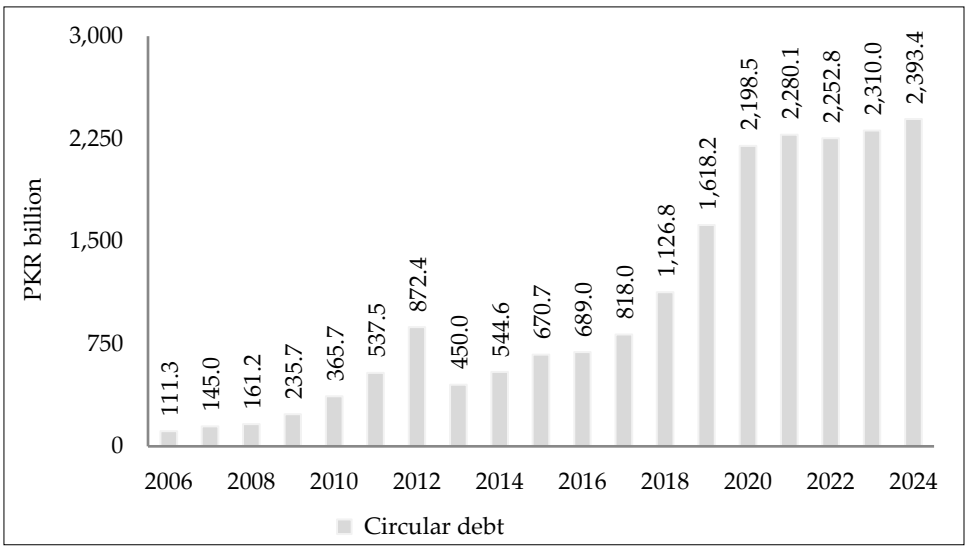
CPPA-G = Central Power Purchasing Agency-Guarantee, DISCO = distribution company, GENCO = generation company (public), IPP = independent power producer, NTDC = National Transmission and Despatch Company.

The magnitude of this issue can be observed in the historical trend of circular debt accumulation in Pakistan's power sector. Table 1 and Figure 2 illustrate the trend in circular debt accumulation from 2006 to 2024.

Table 1: Historical trends of circular debt accumulation (2006–2024)

Year	Circular debt (PKR billion)
2006	111
2007	145
2008	161
2009	236
2010	366
2011	538
2012	872
2013	450
2014	545
2015	671
2016	689
2017	818
2018	1,127
2019	1,618
2020	2,198
2021	2,280
2022	2,253
2023	2,310
2024	2,393

Figure 2: Circular debt (2006–2024)



Circular debt increased from PKR 111 billion in 2006 to PKR 870 billion by 2012. In 2013, the government of Pakistan injected approximately PKR 480 billion to settle outstanding liabilities, temporarily reducing the stock of circular debt to PKR 450 billion (Ministry of Finance, 2014; International Monetary Fund, 2014). However, the bailout proved to be a temporary fix, as circular debt had increased to PKR 2.4 trillion by 2024, representing 3.8 percent of GDP and 5.6 percent of total government debt. The average debt servicing surcharge paid by consumers became PKR 3.23/kWh (NEPRA, 2024; Ministry of Finance, 2025).

In Pakistan's case, this payment chain breakdown has evolved gradually due to several factors. Principally, it was due to government delays in paying producers or releasing subsidies. These delays resulted in policy implementation lags following official announcements (Bacon, 2019).

Beyond internal inefficiencies, external macroeconomic shocks also contributed to debt accumulation, particularly the sharp increase in global oil prices during 2005–2008. In 2006, Pakistan was heavily dependent on furnace oil for electricity production. To understand why fuel price volatility had such a substantial impact, it is important to examine the structure of Pakistan's energy generation mix. Table 2 shows source-wise energy generation in gigawatt hours (GWh) and demonstrates Pakistan's reliance on thermal energy generation through both public and private producers (Ikram et al., 2024).

Table 2: Source-wise energy generation (GWh)

Year	Public				Private					Total (public and pvt.)
	Hydro	Thermal	Nuclear	Total (public)	Hydro (IPPs)	Thermal	Solar	Wind	Total (pvt.)	
1981–82	9,526	4,660	0	14,186	0	0	0	0	0	14,186
1982–83	11,366	4,554	0	15,920	0	0	0	0	0	15,920
1983–84	12,822	4,737	0	17,559	0	0	0	0	0	17,559
1984–85	12,245	5,907	0	18,152	0	0	0	0	0	18,152
1985–86	13,804	6,661	0	20,465	0	0	0	0	0	20,465
1986–87	15,251	7,058	0	22,309	0	0	0	0	0	22,309
1987–88	16,689	9,015	0	25,704	0	0	0	0	0	25,704
1988–89	16,196	9,555	0	25,751	0	0	0	0	0	25,751
1989–90	16,925	12,153	0	29,078	0	0	0	0	0	29,078
1990–91	18,298	13,653	0	31,951	0	0	0	0	0	31,951
1991–92	18,647	16,010	0	34,657	0	0	0	0	0	34,657
1992–93	21,111	15,157	0	36,268	0	0	0	0	0	36,268
1993–94	19,436	17,494	0	36,930	0	0	0	0	0	36,930
1994–95	22,858	17,158	0	40,016	0	0	0	0	0	40,016
1995–96	23,206	18,457	0	41,663	0	161	0	0	161	41,824
1996–97	20,858	17,068	0	37,926	0	10,740	0	0	10,740	48,666
1997–98	22,060	15,200	0	37,260	0	13,580	0	0	13,580	50,840
1998–99	22,448	13,769	0	36,217	0	15,326	0	0	15,326	51,543
1999–00	19,288	19,064	0	38,352	0	17,418	0	0	17,418	55,770
2000–01	17,196	16,798	1,565	35,559	63	22,773	0	0	22,836	58,395
2001–02	18,941	18,620	1,662	39,223	115	21,458	0	0	21,573	60,796
2002–03	22,253	19,570	1,386	43,209	97	20,658	0	0	20,755	63,964
2003–04	27,372	21,012	1,559	49,943	105	18,931	0	0	19,036	68,979
2004–05	25,588	22,181	2,295	50,064	83	23,233	0	0	23,316	73,380
2005–06	30,751	22,479	2,170	55,400	104	26,535	0	0	26,639	82,039
2006–07	31,846	21,587	1,944	55,377	96	32,163	0	0	32,259	87,636
2007–08	28,536	20,497	2,455	51,488	131	34,439	0	0	34,570	86,058
2008–09	27,636	19,568	1,058	48,262	547	35,340	0	0	35,887	84,149
2009–10	27,927	565	2,095	30,587	19,632	38,452	0	0	58,084	88,671
2010–11	31,685	305	2,930	34,920	13,044	42,342	0	0	55,386	90,306
2011–12	28,166	436	4,413	33,015	12,652	43,711	0	6	56,369	89,384
2012–13	29,326	662	3,668	33,656	13,838	40,072	0	38	53,948	87,604
2013–14	31,084	989	4,431	36,504	14,248	43,721	28	230	58,227	94,731
2014–15	31,525	1,020	5,033	37,578	14,223	44,441	231	464	59,359	96,937
2015–16	33,151	1,132	3,885	38,168	17,294	44,650	657	780	63,381	101,549
2016–17	31,084	1,016	5,860	37,960	19,821	47,316	664	1,339	69,140	107,100
2017–18	27,431	1,137	8,800	37,368	17,087	62,487	665	2,118	82,357	119,725

Year	Public				Private					Total (public and pvt.)
	Hydro	Thermal	Nuclear	Total (public)	Hydro (IPPs)	Thermal	Solar	Wind	Total (pvt.)	
2018–19	31,146	1,432	9,038	41,616	13,590	62,571	657	3,166	79,984	121,600
2019–20	37,431	1,795	9,735	48,961	8,205	60,753	662	2,457	72,077	121,038
2020–21	37,144	1,922	10,936	50,002	7,079	68,896	727	2,550	79,252	129,254
2021–22	33,449	2,374	18,304	54,127	6,596	76,154	0	4,411	87,161	141,288

Sources: NEPRA and the National Transmission and Despatch Company.

Table 2 presents source-wise energy generation and highlights the structural shift in Pakistan's energy mix from predominantly public to private, and from hydro-based to thermal-based production. There was no private energy generation in the country before 1982. By 1997, private energy generation accounted for three-quarters of total energy generation.

This expensive generation mix and reliance on thermal power, particularly on imported furnace oil, along with the government's inability to manage price shocks, significantly increased electricity generation costs (Ali & Badar, 2010). As a result, circular debt became a major issue in Pakistan's policy discourse. While these structural and external factors explain the debt buildup, understanding circular debt requires more than defining the phenomenon; it requires identifying the components driving its growth. The following section identifies circular debt's primary financial components.

Components of Circular Debt

To identify the primary sources of debt accumulation, it is necessary to examine the composition of circular debt and the relative contributions of its financial components. These are:

- Payables to IPPs (private)
- Payables to public generation companies (GENCOs)
- Payables to the fuel suppliers of GENCOs
- Payables to Power Holding Private Limited (PHPL)

'Payables to IPPs' refer to payments owed to private generation companies operating under power purchase agreements. These obligations arise from contractual commitments between private sector power producers and the CPPA-G.

GENCOs are state-owned electricity generation companies. 'Payables to GENCOs' represent payments owed to these companies.

'Payables to the fuel suppliers of GENCOs' refer to payments owed to public sector fuel suppliers that provide fuel and other inputs for electricity generation to GENCOs. These include Pakistan State Oil, Pakistan Petroleum Limited, and other domestic or imported fuel providers. The fuel supplied typically includes furnace oil, natural gas, or coal used in thermal power generation.

PHPL is a government entity that was established by the Ministry of Energy (Power Division) to raise and manage the capital required to settle debts owed by DISCOs to GENCOs and IPPs. This could be done through government-guaranteed loans or bonds. Hence, PHPL acts as a financial intermediary. Accordingly, payables to PHPL represent accumulated liabilities incurred to retire circular debt.

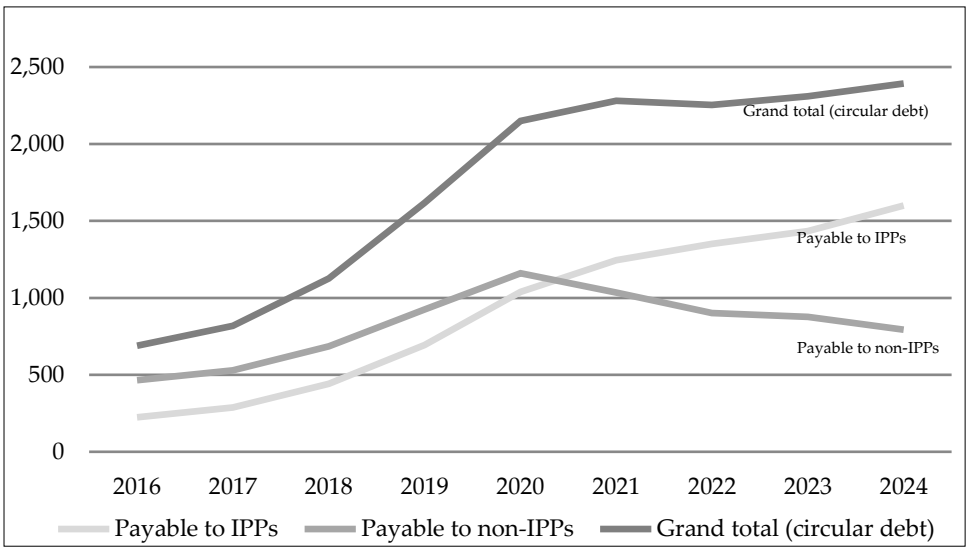
Table 3 and Figure 3 show components of circular debt in nominal values (PKR billion). Table 4 shows the percentage shares between fiscal years (FY) 2016 and 2024. The share of payables to IPPs increased from 33 percent in FY 2016 to 67 percent in FY 2024, indicating that IPPs account for the majority of circular debt. In contrast, payables to PHPL gradually declined from 53 percent in FY 2016 to 29 percent in FY 2024.

Table 3: Components of circular debt in nominal values (PKR billion)

	2016	2017	2018	2019	2020	2021	2022	2023	2024
Payables to IPPs	224	288	441	694	1,038	1,245	1,351	1,434	1,600
Payables to GENCOs	0	0	16	17	48	0	101	111	110
Payables to fuel suppliers of GENCOs	97	91	86	101	105	105	0	0	0
Payables to PHPL	368	439	583	806	1,007	930	800	765	683
Circular debt	689	818	1,127	1,618	2,150	2,280	2,253	2,310	2,393

Sources: Various NEPRA state of industry reports (2002–2024); Ministry of Energy (Power Division).

Figure 3: Components of circular debt in nominal values (PKR billion)



Sources: Various NEPRA state of industry reports (2002–2024); Ministry of Energy (Power Division).

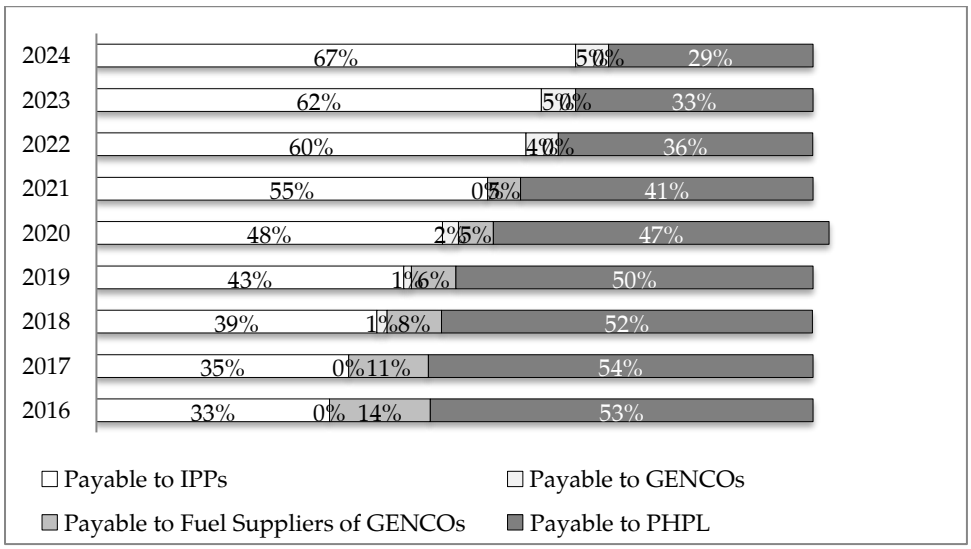
Table 4: Circular debt for FY 2016–2024 (percentage)

	2016	2017	2018	2019	2020	2021	2022	2023	2024
Payables to IPPs	33	35	39	43	48	55	60	62	67
Payables to GENCOs	0	0	1	1	2	0	4	5	5
Payables to fuel suppliers of GENCOs	14	11	8	6	5	5	0	0	0
Payables to PHPL	53	54	52	50	47	41	36	33	29
Circular debt	100	100	100	100	100	100	100	100	100

Source: Various NEPRA state of industry reports (2002–2024); Ministry of Energy (Power Division).

Figure 4 shows a shift in the composition of circular debt between 2016 and 2024. Payables to IPPs during this period increased from 33 percent to 67 percent, making them the primary contributor to circular debt. In contrast, the share of payables to PHPL declined steadily from around 53 percent in 2016 to 29 percent by 2024, indicating a reduced relative burden. Payables to the fuel suppliers of GENCOs also declined gradually, falling from 14 percent in 2016 to 0 percent by 2024, while payables to GENCOs increased from zero percent to five percent over the same period.

Figure 4: Major contributors to circular debt



Source: Various NEPRA state of industry reports (2002–2024); Ministry of Energy (Power Division).

Overall, the data highlights a structural shift in circular debt, with liabilities increasingly concentrated in IPP-related payments and diminishing contributions from PHPL and fuel suppliers. The rising concentration of circular debt within IPP-related payables suggests that contractual cost structures, particularly capacity payment obligations, may be central to debt persistence.

The increasing prominence of IPP-related liabilities poses an important analytical question regarding the relationship between these payables and the general accumulation of circular debt.

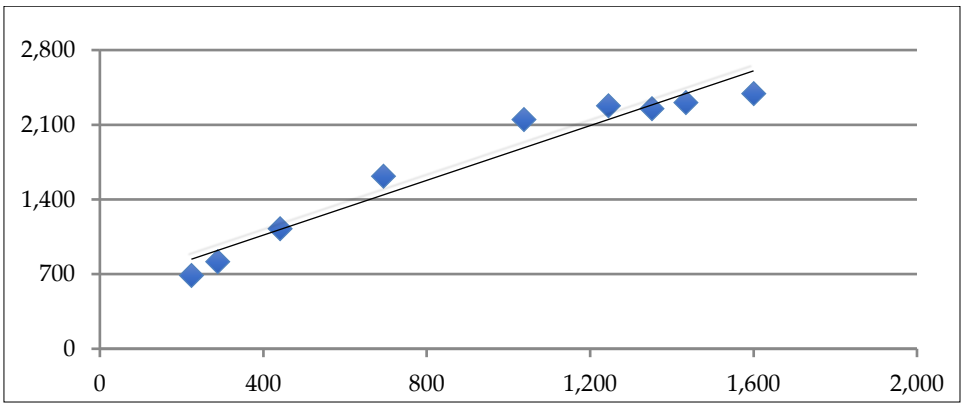
Table 5 and Figure 5 present the relationship between payables to IPPs and circular debt. The correlation coefficient of 0.97 indicates a strong positive relationship (highly significant) between IPPs' payables and total circular debt. This suggests that as circular debt in the power sector increases, the amount payable to IPPs also rises.

Table 5: Relationship between payables to IPPs and circular debt

	IPP payables vs. circular debt
Correlation coefficient	0.97***

Source: Authors' estimation using data from NEPRA and the Ministry of Energy (Power Division).
*** denotes significance at the one percent level.

Figure 5: Correlation - Payables to IPPs and circular debt (PKR billion)



The growing dominance of IPP-related liabilities raises an important question: if private generation was expected to improve efficiency, why is debt increasingly concentrated within these contractual obligations? Although the structure of circular debt demonstrates the increased role of IPP-related liabilities, another commonly cited explanation for debt accumulation is inadequate electricity pricing levels. Therefore, the following section evaluates whether electricity tariff increases have been effective in reducing circular debt.

Have Electricity Tariff Hikes Effectively Reduced Circular Debt?

In addition to the structural factors discussed above, policymakers often attribute circular debt accumulation to inadequate electricity pricing levels. One policy response has been repeated tariff increases intended to improve cost recovery. If this approach were effective, higher prices would reduce debt accumulation. Therefore, it is necessary to examine the relationship between electricity tariffs and circular debt over time.

The theoretical efficiency argument states that an increase in energy prices should reduce circular debt by improving cost recovery. However, repeated electricity tariff hikes (a 263 percent increase since 2013) have failed to reduce circular debt, which has increased by 340 percent over the same period. Table 6 shows that from 2013 to 2024, electricity prices rose from PKR 10.9/kWh to PKR 40.2/kWh, while circular debt increased from PKR 544.6 billion to PKR 2,393 billion. Higher electricity tariffs are, therefore, associated with continued growth in circular debt. This pattern suggests that tariff adjustments alone have not addressed the underlying structural drivers of debt accumulation.

Table 6: Electricity tariffs and circular debt (2013–2024)

	Price (PKR/kWh)	Circular debt (PKR billion)
2013	10.935	544.6
2014	12.430	670.7
2015	12.655	689.0
2016	12.72	689.0
2017	12.625	818.0
2018	12.890	1,127.0
2019	14.205	1,618.0
2020	17.935	2,150.0
2021	18.975	2,280.0
2022	23.165	2,253.0
2023	33.870	2,310.0
2024	40.225	2,393.0

This reinforces the notion that price increases alone are insufficient in addressing structural imbalances within the power sector, pointing to policy ineffectiveness and deeper systemic inefficiencies within the sector.

The persistence of circular debt despite significant tariff increases suggests that the problem may lie in the structure of power purchase costs, particularly capacity payment obligations.

Table 7 and Figure 6 present the relationship between electricity prices and circular debt. The correlation coefficient of 0.74 indicates a positive relationship (highly significant) between prices and circular debt. This implies that when electricity prices in Pakistan's power sector increase, the amount of circular debt also rises.

Table 7: Relationship between electricity prices and circular debt

	Prices vs. circular debt
Correlation coefficient	0.74**

** denotes significance at the five percent level.

Figure 6: Correlation - Circular debt (PKR billion) and electricity prices (PKR/kWh)

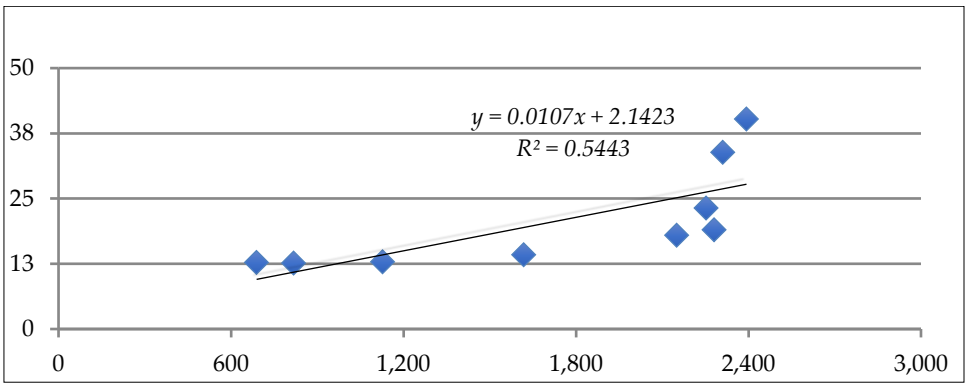
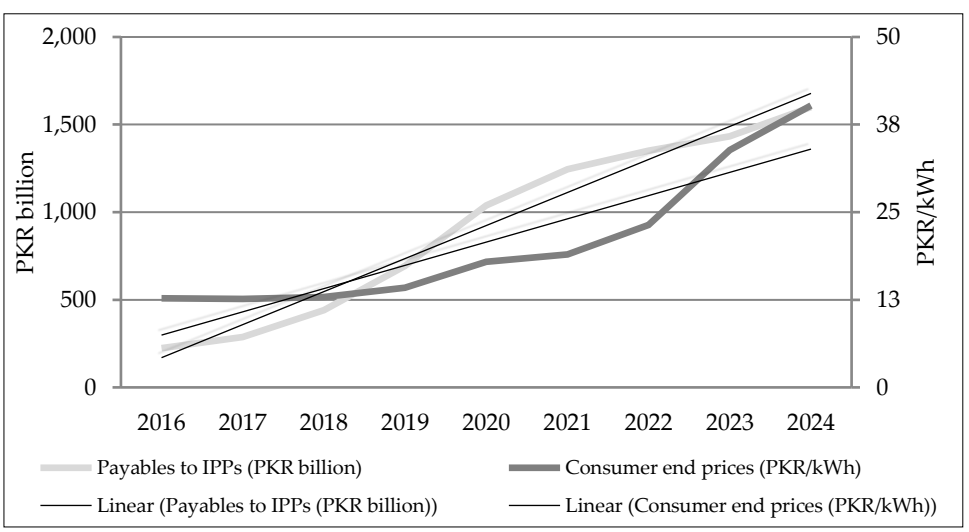


Figure 7 illustrates the relationship between payables to IPPs and electricity prices. The data shows that from 2016 to 2024, both the amounts payable to IPPs and electricity prices moved in the same direction, reflecting a positive relationship between the two variables. The fact that circular debt persists even with high tariff increases points to the possibility that the issue is not electricity pricing alone but also the structure of power purchase costs.

Figure 7: Payables to IPPs and electricity prices (PKR billion)



Sources: NEPRA and the Ministry of Energy (Power Division).

Are Capacity Payments the Hidden Engine of Circular Debt?

While tariff adjustments have been widely suggested as a policy response, data on the persistence of circular debt suggests that deeper structural mechanisms may be driving debt accumulation, such as capacity payments.

Capacity payments refer to fixed contractual obligations paid to power producers regardless of whether electricity is generated (Malik, 2020; Abbas, 2023). These fixed commitments contribute significantly to the persistent growth of Pakistan's circular debt in the power sector.

Ali and Badar (2010) highlighted that consumer tariffs are often insufficient to fully cover these fixed costs, resulting in fiscal pressure on the government to cover the difference. Box 1 breaks down the components of the CPP and EPP to better explain this cost structure.

Box 1: Components of CPP and EPP

The CPP comprises:

- Project debt payments (including interest and principal)
- Return on equity over project life
- Fixed elements of operating and maintenance costs
- Plant insurance costs
- Foreign exchange risk insurance cost, which is the cost of hedging loans against foreign exchange risk

The EPP comprises:

- Fuel cost, which is set by the government and is higher than world oil prices by the amount of a surcharge
- Variable elements of operating and maintenance costs

PPP = EPP + CPP

Note: Definition from PPP forecast, CPPA-G.

Given the significance of capacity payments within the overall power purchase structure, it is important to examine how the CPP has evolved relative to circular debt over time. Table 8 shows the relationship between circular debt and the CPP from 2013 to 2024.

Table 8: Relationship between circular debt and the CPP (2013–2024)

	Circular debt (PKR billion)	CPP (PKR billion)	CPP % of circular debt
2013	544.6	185	34.0
2014	670.7	212	31.6
2015	689.0	246	35.7
2016	689	275	39.9
2017	818	358	43.8
2018	1,127	468	41.5
2019	1,618	642	39.7
2020	2,150	859	40.0
2021	2,280	796	34.9
2022	2,253	971	43.1
2023	2,310	1,321	57.2
2024	2,393	2,010	84.0

Sources: Authors' estimation using data from NEPRA and the Ministry of Energy (Power Division).

The CPP as a percentage of circular debt increased from 34 percent in 2013 to 84 percent in 2024, indicating a substantial rise in the share of capacity payments within total circular debt.

This finding highlights a central concern—the CPP is the main driver behind the increase in circular debt. The capacity payments charged by IPPs are fueling circular debt and are, therefore, a significant concern for the broader economy.

The PPP is the sum of the EPP and CPP. An increase in CPP directly raises the overall PPP, thereby increasing the financial burden on the system.

The main components of the CPP include debt servicing obligations (interest and principal payments), returns on equity to IPPs or state-owned companies, and fixed operating and maintenance costs. It also incorporates plant insurance and the cost of hedging foreign loans against exchange rate variations (foreign exchange risk insurance).

Containing CPP, therefore, requires reforms aimed at improving contractual efficiency and reducing structural reliance on high fixed-cost generation agreements.

In addition to capacity payment obligations, several other factors contribute to the persistence of circular debt. These include subsidies and tariff differentials. While subsidies decrease the price of electricity for some consumers, delays in government reimbursement create a funding gap, i.e., tariff differentials. As a result, power companies do not recover their full costs.

Subsequently, power sector entities experience cash flow constraints when the government delays reimbursements. In turn, these entities find it difficult to make payments to generators and fuel suppliers, ultimately triggering delays across the entire supply chain.

DISCOs fail to collect sufficient funds on the consumer end because of payment delays or poor bill recovery. Furthermore, system losses, theft, and weak administration reduce revenue collection. Together, these factors contribute to the accumulation of circular debt. While capacity obligations explain the structural buildup of debt, their consequences extend beyond fiscal imbalance. Elevated cost structures ultimately shape electricity pricing and economic competitiveness.

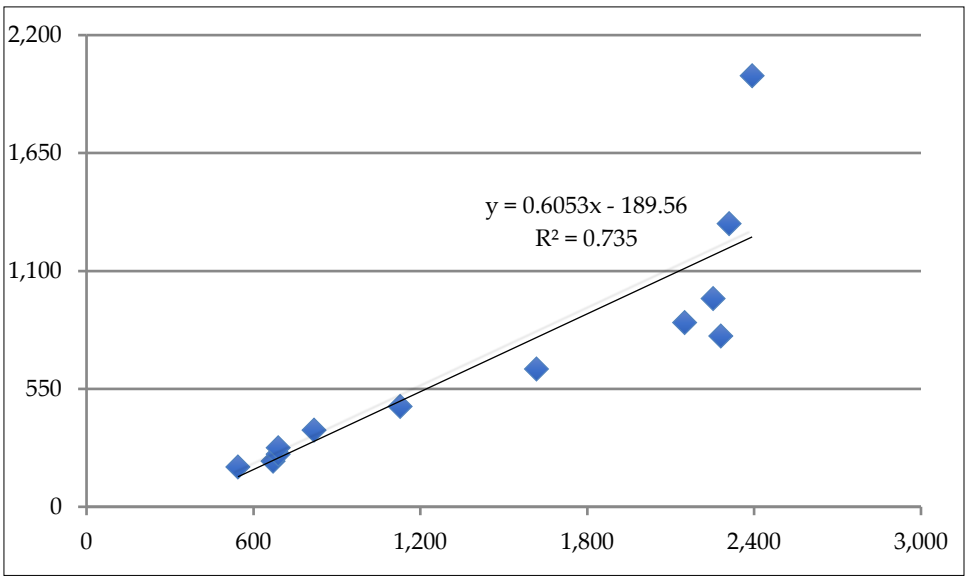
Table 9 and Figure 8 present the relationship between CPP and circular debt. The correlation coefficient of 0.86 indicates a strong positive relationship between CPP and circular debt, supporting this paper's argument that rising capacity obligations are closely linked to debt accumulation.

Table 9: Relationship between CPP and circular debt

	CPP vs. circular debt
Correlation coefficient	0.86***

*** denotes significance at the one percent level.

Figure 8: Correlation - CPP (PKR billion) vs. circular debt (PKR billion)



Sources: NEPRA and the Ministry of Energy (Power Division).

How Does Pakistan Rank in Electricity Prices Regionally and Globally?

The cost structure of Pakistan's power sector not only contributes to circular debt but also influences the level of electricity tariffs faced by consumers and industries. Pakistan's population in 2025 is estimated at 255.22 million, making it the fifth most populous country in the world and ranking 33rd globally by area, according to worldmeters.info.

Figure 9 presents average electricity prices for households and industry in South Asia and beyond for the period of 2023–2025 (USD/kWh). Among three South Asian nations, electricity prices for households are highest in India (USD 0.077/kWh), followed by Pakistan (USD 0.065/kWh) and Bangladesh (USD 0.062/kWh).

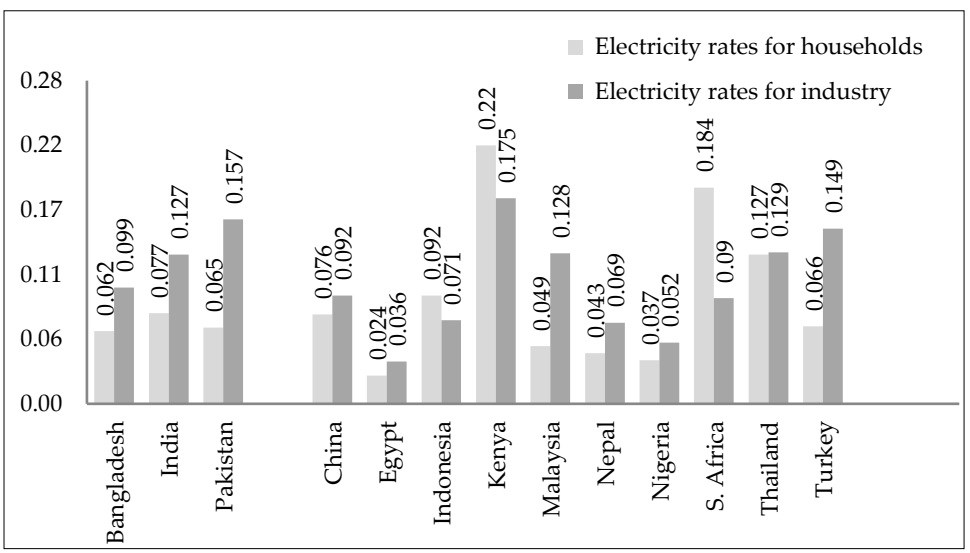
Pakistan's average industrial electricity price is USD 0.157/kWh, the highest among the three South Asian countries considered, followed by India and Bangladesh.

Figure 9 also shows these averages for households and industry in other countries, highlighting significant variation in tariffs. The highest household rate

was recorded by Kenya at USD 0.220/kWh, followed by South Africa at USD 0.184/kWh, and Thailand at USD 0.127/kWh. Egypt and Nigeria fall on the opposite side of the spectrum with the lowest rates of USD 0.024/kWh and USD 0.037/kWh, respectively.

The highest industry tariff rate was recorded by Kenya at USD 0.175/kWh, closely followed by Pakistan at USD 0.157/kWh. Industrial electricity rates are higher than household rates in most of the countries shown, which places pressure on local manufacturers and the industrial sector alike.

Figure 9: Household and industry electricity rates (USD/kWh) - Average for 2023–2025



Source: GlobalPetrolPrices.com.

Pakistan's electricity prices, particularly for industrial consumers, are much higher than those in neighboring countries, placing it at a competitive disadvantage in regional trade and industrial production. Higher industrial tariffs increase production costs, which are often passed on to consumers in the form of higher product prices. Higher electricity prices further add to production costs. As a result, Pakistan's manufacturing sector faces reduced competitiveness in major industrial sectors relative to regional peers (Rehman et al., 2025). Excessive price increases make it difficult for consumers to afford electricity, and elevated tariffs raise operating costs for key industries, thereby dampening economic activity (Jamil, 2012). Since electricity constitutes a major input cost for

heavy industry operations, higher tariffs weaken export competitiveness in comparison to India and Vietnam in textile manufacturing. Using time-series data from 2005 to 2015, Junejo and Khoso (2018) found that Pakistan's electricity crisis significantly hampered industrial growth, reducing both industrial output growth and electricity consumption across industries.

Global electricity price benchmarks for 2022 indicate that Pakistan's residential electricity tariffs were 46.16 percent of the world average and 83.21 percent of the Asia average. In contrast, Pakistan's industrial tariffs surpassed global and regional averages, standing at 106.93 percent of the world average and 146.89 percent of the Asia average. Comparatively, India's residential tariffs were 51.28 percent of the world average and 92.45 percent of the Asia average, while its industrial tariffs were 85.99 percent and 118.12 percent, respectively. Bangladesh's industrial tariffs, at 73.20 percent of the world average and 100.55 percent of the Asia average, were comparatively lower than those of both Pakistan and India (Table 10).

Table 10: Global and regional electricity price comparison (2022)

	Residential (%)		**Industrial (%)**	
	World avg. electricity price	**Asia avg. electricity price**	**World avg. electricity price**	**Asia avg. electricity price**
Pakistan	46.16	83.21	106.93	146.89
India	51.28	92.45	85.99	118.12
Bangladesh	45.03	81.17	73.20	100.55

Source: GlobalPetrolPrices.com.

These comparisons substantiate and reinforce the validity of this paper's theoretical framework, providing clear evidence that aligns with the predictions and assumptions outlined earlier: that Pakistan's industrial electricity costs are significantly higher in regional terms, while residential electricity prices in South Asia remain below global averages. This puts Pakistan at a competitive disadvantage and a comparative trade disadvantage.

Given these structural inefficiencies and their macroeconomic implications, comprehensive sectoral reform becomes imperative.

Recommendations

Pakistan's power sector remains structurally constrained by persistent circular debt accumulation, accentuating the need for comprehensive reforms.

A primary reform priority is enhancing transparency in power purchase agreements. The government should mandate greater disclosure of contract terms, financial obligations, and performance metrics associated with IPPs. Improved transparency would strengthen accountability and ensure that stakeholders understand the financial commitments and operational performance of IPPs.

A second area of reform involves taking a strategic exit from costly contracts by reassessing high-cost contractual commitments. Policymakers may consider renegotiating or terminating agreements with inefficient thermal plants categorized by high capacity (e.g., above 50 percent capacity charges) and low utilization rates (below 30 percent load factor). Such measures would reduce the structural fixed cost burden.

Furthermore, Pakistan should begin shifting to cost-effective power sources by focusing on electricity from power plants that deliver higher output at lower capacity obligations. This strategy will optimize resource allocation and help reduce the overall financial strain on the energy sector.

Additionally, Pakistan should aim to improve the utilization of existing high-cost plants and prioritize purchasing electricity from plants incurring significant capacity payments to ensure that already committed funds result in tangible energy output, thus maximizing the value derived from these agreements.

The next step should be expanding renewable energy capacity to present a medium-to-long-term structural solution. Future IPP investments should increasingly shift to renewable fuel and replace retired capacity with solar or wind IPPs (no fuel cost volatility), or hydropower expansions should be carried out (base load stability) to reduce exposure to fuel price volatility and lower long-run obligations, thereby contributing to greater financial sustainability.

Conclusion

This paper examined the structural drivers of circular debt in Pakistan's power sector, particularly the impact of electricity prices and capacity payment

requirements. Although policymakers have often attributed the persistence of circular debt to inadequate electricity tariffs, this paper indicates that price changes have not been enough to eliminate them. Irrespective of the fact that tariffs have significantly increased in the last ten years, circular debt has increased substantially, indicating that deeper structural factors are at work within the power sector.

The analysis reveals that the role of capacity payments in privatized power generation contracts has emerged as a dominant component of circular debt. The proportion of CPP relative to total circular debt has increased drastically over the years, which underlines the increasing financial liabilities associated with fixed contractual obligations to IPPs. Correlation analysis further confirms the close relationship between capacity payments and circular debt accumulation, indicating that the issue may be embedded in the design of power purchase agreements and the overall costs of the electricity market.

Addressing circular debt, therefore, requires more than tariff adjustments. Sustainable reforms should aim at increasing the efficiency of power purchase agreements, reducing dependence on high fixed-cost capacity payments, and increasing financial transparency throughout the power industry. Without structural reform, Pakistan's energy system will continue to face financial instability, escalating electricity prices, and decreasing industrial competitiveness.

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