

## Governance Factors and the Role of Independent Power Producers in the Power Sector's Performance Outcomes: International Evidence

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### Abstract

*Independent power producers (IPPs) are major sources of power generation around the world. Countries faced with severe energy shortages and limited public resources have turned to private investors to ameliorate the situation. However, IPPs in Pakistan have suffered from corruption allegations and doubts over contract fairness, operating performance, and their ability to decrease energy disparities. There is a need for broader reforms, especially a regulatory and governance environment that is conducive to leveraging private investment to bolster energy infrastructure. This paper's key objective is to explore the links between a country's governance and regulatory environment and the performance of IPPs in terms of access, price, quality, and technical and financial performance. The analysis is based on data from 50 countries over the period 2017–2019 and assesses six dimensions of governance. The initial results confirm the hypothesis that regulatory and governance factors significantly affect IPP performance. The results underscore the importance of improving government effectiveness, the rule of law, and regulatory quality, and controlling corruption so that IPPs can better fulfill their potential.*

### Introduction

Independent power producers (IPPs) have become a major source of power generation around the world. Countries faced with severe energy shortages and limited public resources have turned to private investors to ameliorate the situation. However, the promise of such public-private partnership (PPP) structures has not been evenly realized by different countries (Hoskote, 1995; Mayer & Trück, 2018; Tahir et al., 2024). We focus on the quality of governance across countries to understand why.

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PPPs suffer from an agency problem, i.e., the two parties, agents (IPPs) and principals (governments or public regulatory authorities), have divergent economic interests. It has long been recognized that electricity generation firms, much like public utilities, exhibit characteristics of natural monopolies and, therefore, require regulation (Sabin, 2023). While the interests of private investors could be said to be driven by profit maximization (a single-bottom line), the public sector's goals may extend beyond simply ensuring project viability and sustainability to include wider public welfare and developmental goals (a double-bottom line). The latter's goals could include universal access to electricity, eliminating power access gaps across regions and social strata, and ameliorating energy poverty and inequity. Thus, the PPP model's success relies on efficient solutions to the agency problem and, at minimum, agency costs. However, when public sector governance is weak and corrupt, monitoring and enforcing PPP contracts is difficult, and private sector players can use that to their advantage. In extreme cases, the private sector can work to the detriment of public interest through lobbying, corruption, oligopolistic practices, and 'regulatory capture,' where regulatory authorities act as cohorts rather than watchdogs.

There is also an agency problem between governments (agents) and the public (principals). At this level, autocratic or unresponsive governments exacerbate the first-level agency problem. Considering these agency issues, how IPPs participate in the power sector depends on the strength of public governance, its responsiveness to the public's demands, and on private parties' political influence.

Various authors have drawn attention to the power sector's performance-governance nexus. Vagliasindi's (2012) study on power market structures and performance speaks of the need 'to implement broader reforms, particularly introducing a sound regulatory framework [and] reducing the degree of concentration of the generation and distribution segments of the market.' Tabash et al. (2025) acknowledge that PPP investments in energy significantly reduce poverty and unemployment in the long run but suggest that improved governance and strategic public spending enhance such socioeconomic benefits. Othman and Khallaf (2023) show that the main barriers to renewable energy PPPs in Egypt are regulatory and political, while well-prepared contract documents and skilled and efficient parties are primary success factors. Kanyamyoga (2020) suggests that the quality of political, economic, and social institutions, both formal and informal, affects PPP projects' functionality and their economic outcomes.

Other scholars have also underscored the importance of conducive regulatory and governance environments in leveraging private investment to bolster energy infrastructure. They include Advanced Engineering Associates International, Inc. and Deloitte Touche Tohmatsu (2003), Akcura and Mutambatsere (2024), Hayakawa et al. (2000), Ndlovu and Telukdarie (2020), Woolf and Halpern (2001), Kashi (2015), Steelyana and Aulia (2024), Chowdhury et al. (2012), Aulia and Steelyana (2023), and Othman and Khallaf (2022).

This paper's primary objective is to explore the links between a country's governance and regulatory environment and the performance of IPPs in terms of access, price, quality, and technical and financial performance. The analysis is based on a data panel of 50 countries over the period 2017–2019 from the International Finance Corporation (2021). It is combined with the World Bank's (2025) worldwide governance indicators, which describe broad patterns in perceptions of the quality of governance across countries and over time. These indicators capture six dimensions of governance: (i) voice and accountability, (ii) political stability and the absence of violence/terrorism, (iii) government effectiveness, (iv) regulatory quality, (v) the rule of law, and (vi) control of corruption.

The study's results confirm the hypothesis that regulatory and governance strength positively affect IPP performance. On the other hand, a larger share of IPPs in power sectors appears to negatively impact performance outcomes. These results are useful for helping shape public policy as they underscore the role of improving government effectiveness, the rule of law, and regulatory quality, and controlling corruption in fulfilling IPPs' potential.

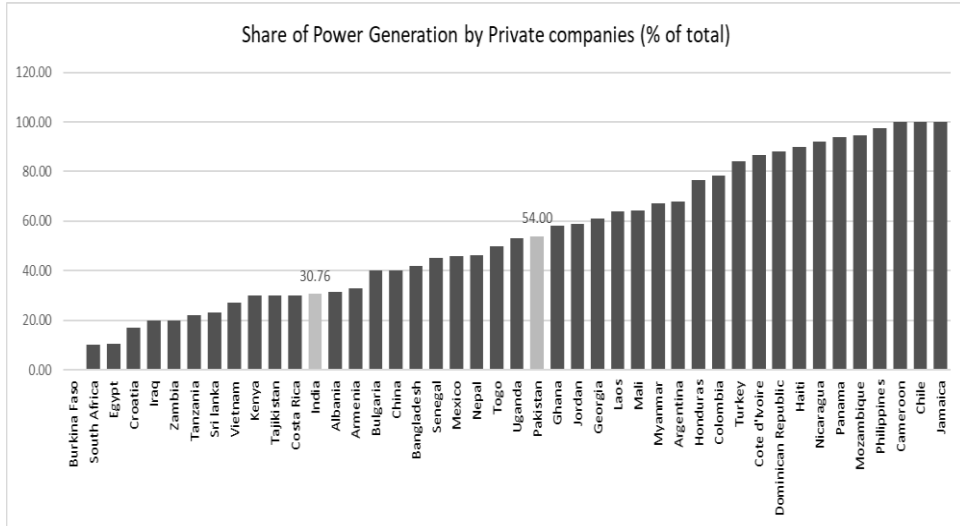
### **IPPs: A Major Source of Power**

IPPs hold a considerable share of power generation capacity around the world. Countries have sought to ameliorate energy shortages by inviting private investment in the energy sector to supplement limited public resources. As Figure 1 shows, there is a wide spread in IPPs' share of power generation across countries. It ranges from 100 percent (Cameroon, Chile, Jamaica) to 0.15 percent (Burkina Faso). In the case of Pakistan, IPPs' share is 54 percent, compared to about 31 percent in India.

The reasons for this spread include individual countries' supply-demand conditions and their orientation toward the role of the public and private sectors in their economies. The expectation of IPPs is the amelioration of energy

shortages, reductions in energy poverty, increased operational efficiency, and equitable access to reliable energy.

**Figure 1: IPP share of power generation by country (percentage of total)**



## **Pakistan's Experience**

Pakistan was among the first countries to induct IPPs into its power sector to attract private investment and rapidly close the supply-demand gap in electric power. The Hub Power Project was a landmark project in infrastructure finance, hailed as a PPP showpiece, and considered an important precedent for the viability of private financing of energy projects in developing countries.

Pakistan's private power policy was adopted in 1994, under which 19 IPPs were launched. However, the initiative faced a setback in 1998 due to corruption allegations, leading to the renegotiation of contracts (Fraser, 2005). Since then, IPPs have come to account for over half of Pakistan's installed electricity generation capacity. However, their actual contribution varies due to power demand and other power system constraints.

IPP performance has been under critical scrutiny, both in the popular press and in professional circles, since 1994. There have been allegations of corruption and doubts over contract fairness, operational performance, and whether they increase or decrease energy access disparities (Khan, 2014; Siddiqui, 1998; Arafat et al., 2019; Ullah & Wazir, 2023).

A key criticism has been the 'take-or-pay' feature of IPP contracts, under which the government makes 'capacity payments,' minimum amounts for maintaining power generation capacity. This puts a considerable burden on the federal government, straining the budget without corresponding benefits. A second criticism is the government's commitment to supply IPPs with fuel.

Limited budget space and associated foreign exchange constraints are major factors contributing to why IPPs run below full capacity. The strategy relied heavily on imported fossil fuels like oil, coal, and liquefied natural gas due to limited domestic energy sources. This meant that the power supply was vulnerable to fluctuations in international energy prices, thereby affecting electricity costs for consumers. In response, the government has recently pursued alternative arrangements by renegotiating with some IPPs to alleviate capacity payment and circular debt concerns.

Pakistan has been characterized as having a weak governance environment; it scores toward the bottom of all governance indicators, particularly in the rule of law, government effectiveness, and regulatory quality.

Endemic corruption and weaknesses in the areas of voice and accountability create an enabling environment for elite and regulatory capture by private producers. Therefore, a case study of Pakistan's power sector lends support to our hypotheses on the linkages between IPPs' share of power generation, the quality of governance, and the power sector's performance outcome measures.

## **Study Objectives**

Several studies indicate that the promise of such PPP structures has not been evenly realized in various countries. The objective of this study is to investigate the role that governance factors play in enhancing or hindering the power sector's performance. Several scholars underscore the importance of institutional factors in fulfilling the PPP promise, including:

1. A sound regulatory framework
2. The degree of concentration of the generation and distribution segments of the market
3. A conducive environment for private sector investment and participation

4. A conducive regulatory and governance environment for leveraging private investment to bolster energy infrastructure

This study explores the nexus between a country's governance and regulatory environment, the share of IPPs, and the performance of its power sector in terms of the following indicators included in the International Finance Corporation's (2021) data panel of 50 countries:

1. Electricity access (percentage of population)
2. Urban-rural access gap (percentage of population)
3. System average interruption frequency index (SAIFI)
4. System average interruption duration index (SAIDI)
5. Electricity losses (percentage of output)
6. Non-technical losses (percentage of output)
7. Bill collection rate (percentage)
8. Average industrial tariff (USD/kWh)
9. Average generation cost (USD 1,000/GWh)

The governance indicators are from the World Bank (2025) and consist of the following:

1. Voice and accountability
2. Political stability and absence of violence/terrorism
3. Government effectiveness
4. Regulatory quality
5. Rule of law
6. Control of corruption

### **An Exploratory Econometric Model**

A multiple regression model was utilized where the nine power sector performance indicators ( $P_i$ ,  $i = 1-9$ ) (country,  $k = 1-50$ ) were regressed using the following independent variables:

1. IPP share in a country's power sector ( $S_k$ )
2. Governance indicators ( $G_{j,k}$ ,  $j = 1-6$ ,  $k = 1-50$ ), including one indicator for each regression run
3. A control variable, a country's gross domestic product (GDP) per capita ( $I_k$ )

Thus, the model can be expressed as follows:

$$P_{i,j,k} = \alpha_{i,j} + \beta_{i,j}S_k + \gamma_{i,j}G_{j,k} + \delta_{i,j}I_k + \varepsilon_{i,j,k}$$

This study is best regarded as exploratory since data is limited to a single timeframe. There could be a variety of omitted variables that would limit the model's applicability. Appendix 1 presents summary statistics of the variables used in the model.

## **Results**

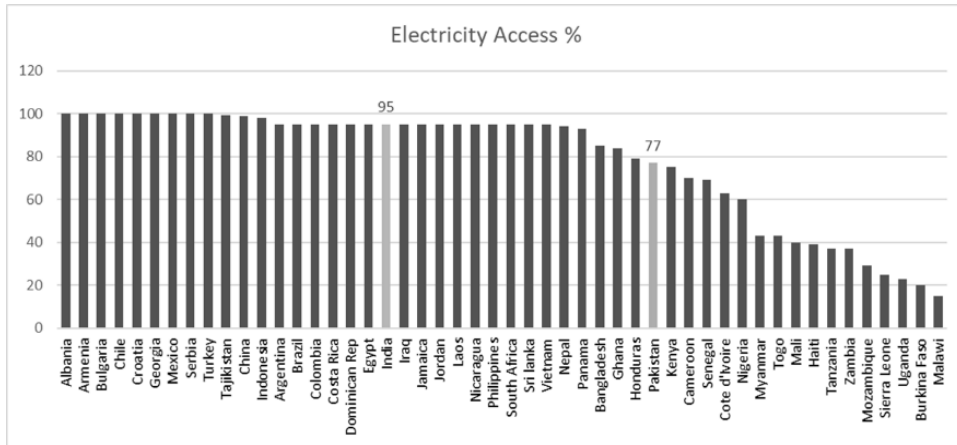
The econometric estimation was run for 54 models: one equation for each of the nine performance indicators, including one of the six governance indicators in each equation. The results are shown in Appendices 2–10. Each appendix table shows regression analysis results, including the governance indices, in six columns. The results of each performance indicator are discussed below.

### *Electricity Access*

A basic indicator of the power sector's performance is the electricity access rate, i.e., the percentage share of the population with access to electricity. Figure 2 shows that 30 of 50 countries in the sample have a 90 percent or higher electricity access rate. On the other hand, 11 countries have an electricity access rate of less than 50 percent. Pakistan and India's rates are 77 percent and 95 percent, respectively.

The results show that the share of IPPs' total power generation capacity is not statistically significantly related to the percentage access to electricity; a higher IPP share does not appear to increase electricity access. However, two of the governance indicators have positive significant coefficients. These are government effectiveness and regulatory quality, and they appear to help increase access (Appendix 2).

Figure 2: Electricity access (percentage)

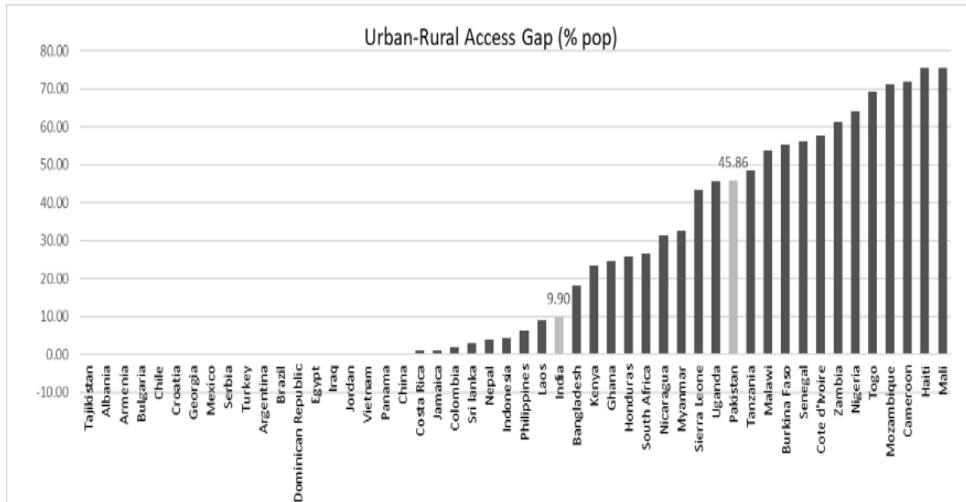


### Urban-Rural Access Gap

The urban-rural access gap is an indicator of inclusiveness and equity in electricity access, i.e., the percentage point difference between the share of people with access to electricity in urban versus rural areas. The urban-rural access gap is five percent or less for half of the sample (25 countries). On the other hand, the gap exceeds 50 percent in 11 countries. The figures for Pakistan and India are 45.9 percent (rank 38/50) and 9.9 percent (rank 28/50), respectively (Figure 3).

The results of the regression model (Appendix 3) show that while the coefficient for the IPP share is insignificant in all six models, three governance variables are statistically significant. These are government effectiveness (p-value = 0.001), rule of law (p-value = 0.10), and regulatory quality (p-value = 0.001).

**Figure 3: Urban-rural access gap (percentage of population)**

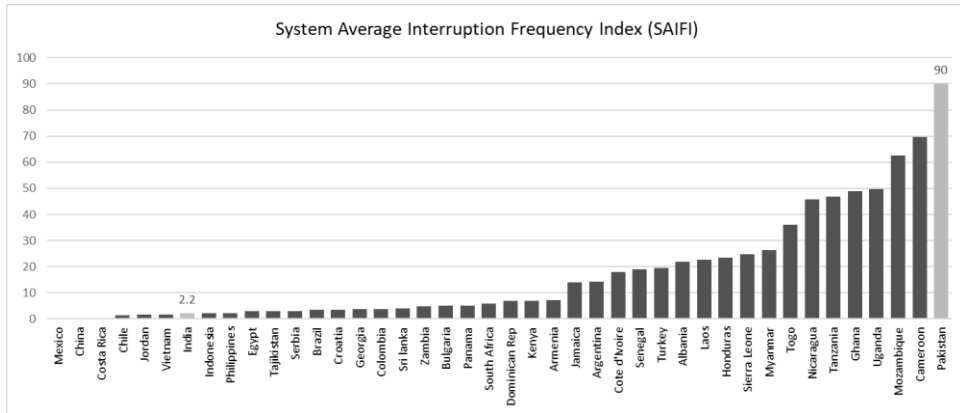


***Power Interruptions: System Average Interruption Frequency Index***

SAIFI is a key measure of operational efficiency and the quality of power supply. Pakistan stands out with the highest frequency of power interruptions (90). Eighteen countries have SAIFI values of 5 or less. India's index is 2.2 (Figure 4).

The regression results in Appendix 4 show that the IPP share is positively related to SAIFI and statistically significant. The coefficients are significant in five of the six governance models. On the other hand, the governance indicators are negatively related to the SAIFI index; the coefficients are significant for four of the six governance indicators, i.e., control of corruption, government effectiveness, rule of law, and regulatory quality.

**Figure 4: Frequency of system interruptions (SAIFI)**



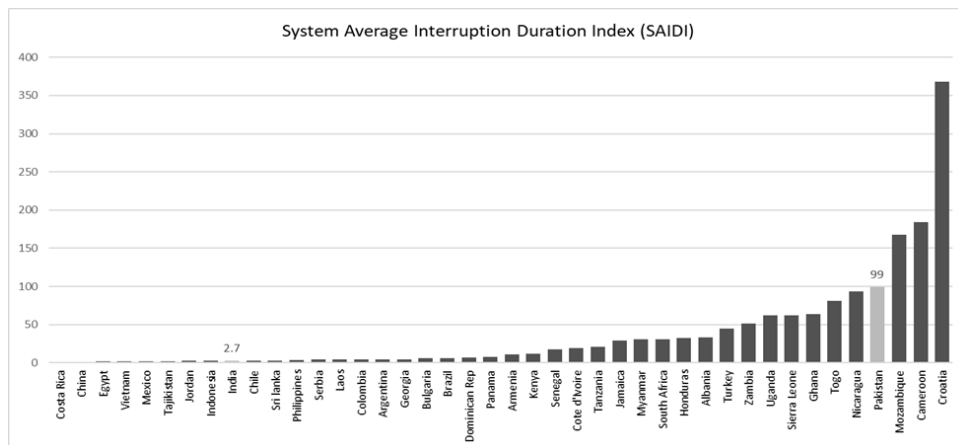
The results in Appendix 4 support our hypothesis that a larger share of IPPs is associated with a lower quality of power supply, as indicated by SAIFI, while better governance exerts pressure on IPPs and the power sector to improve delivery quality.

***Power Interruptions: System Average Interruption Duration Index***

SAIDI is another useful measure of the quality of delivered power. Once again, Pakistan’s power sector stands out with an index value of 99—its rank is fourth from the worst in the sample. Figure 5 shows that 21 of 42 countries have SAIDI values of less than 10. India’s value is 2.7.

The results in Appendix 5 show that neither the regression coefficients of the IPPs’ share nor any of the governance indicators are statistically significant. Thus, we are unable to reject the null hypothesis of there being no relationship between IPP share or the governance indicators and the average duration of interruptions.

**Figure 5: Duration of system interruptions (SAIDI)**

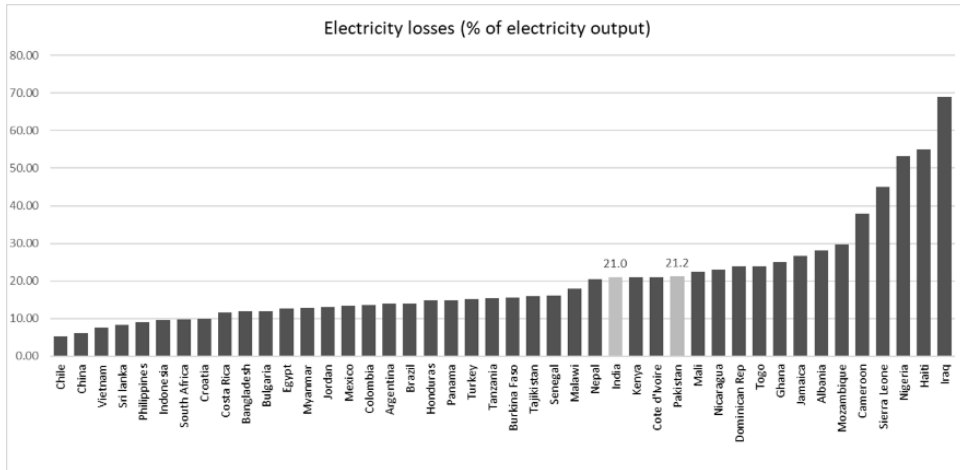


### *Electricity losses*

Electricity losses (as a percentage of electricity output) are electric power transmission and distribution losses, including losses in transmission between sources of supply and points of distribution and in distribution to consumers, including pilferage. Figure 6 shows a broad spread in electricity losses across the sample, ranging from 5 percent (Chile) to 69 percent (Iraq). Pakistan (21 percent) and India (20 percent) stand close to the center of the distribution, with ranks of 31/44 and 26/44, respectively.

The question is: to what extent are electricity losses affected by the share of IPPs and the state of governance in a country? The regression results in Appendix 6 show that while the IPP share is not a statistically significant determinant of electricity losses, governance does play a role in curbing losses. Four of six governance indicators carry negative coefficients with statistical significance. These include control of corruption, government effectiveness, the rule of law, and regulatory quality, suggesting that better governance tends to ameliorate electricity losses.

**Figure 6: Electricity losses (percentage of electricity output)**



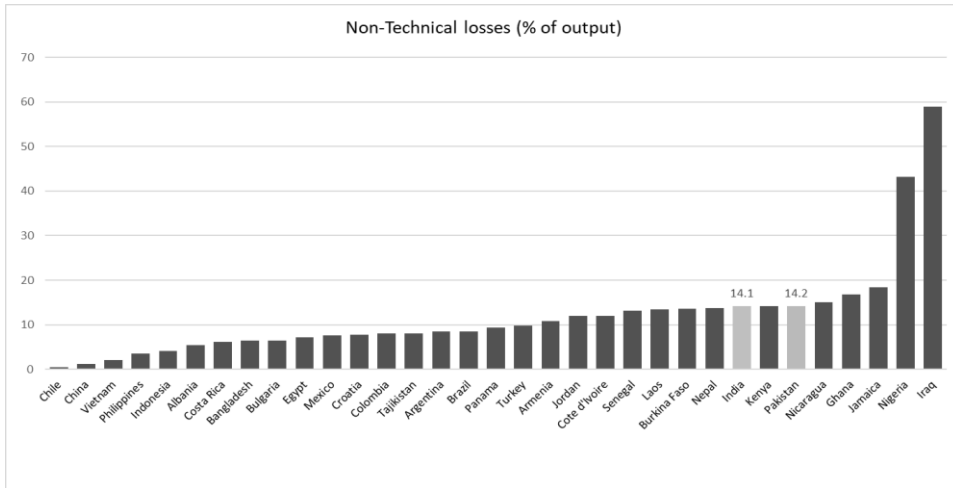
***Non-Technical Power Losses***

Non-technical losses, also known as commercial losses (as a percentage of electricity output), measure the percentage share of total electricity output lost due to factors such as theft, unmetered supplies, and conveyance errors. Apart from Iraq (59 percent) and Nigeria (43.2 percent), which are outliers in the sample, there is an even gradation of losses ranging from 0.5 percent to almost 20 percent. Pakistan and India appear towards the higher end of the loss spectrum, with values of 14.2 percent and 14.1 percent, respectively. Pakistan ranks 28/33, while India ranks 26/33 (Figure 7).

The regression output in Appendix 7 shows that none of the coefficients of IPP share are statistically significant, implying that the data does not reject the null hypothesis of there being no linkage between the share of IPPs and non-technical electricity losses. On the other hand, two of the governance indicators have significant coefficients, albeit at only the ten percent level of significance.

We note that this study does not focus on electricity losses due to energy dissipated in conductors, equipment used for transmission lines, transformers, sub-transmission lines, and distribution lines, or magnetic losses in transformers.

**Figure 7: Non-technical losses (percentage of output)**

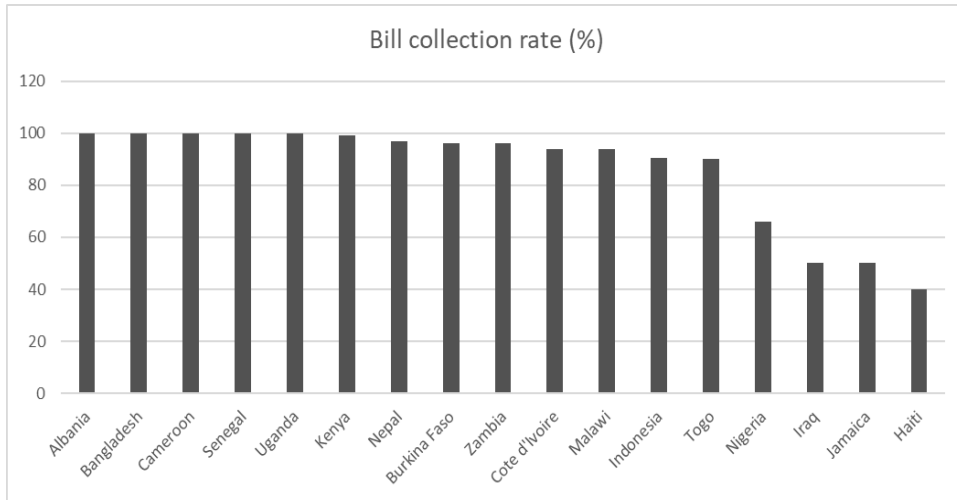


**Bill Collection Rate**

The bill collection rate is an indicator of financial resilience. It is the share of issued electricity bills that are paid (collected). Many countries face hurdles in bill collection, but most in our sample have high collection rates, although country data for this indicator was limited. As Figure 8 shows, 5 of 17 countries have collection rates of 100 percent. The next eight countries have rates above 90 percent. However, four countries have poor rates: Nigeria (66 percent), Iraq (50 percent), Jamaica (50 percent), and Haiti (40 percent).

The econometric exercise for this variable may not be as robust due to data limitations (Appendix 8). Nonetheless, the independent variable, IPP share, does not have a significant coefficient in all six models. However, two of the governance indicators, government effectiveness and regulatory quality, have statistically significant positive coefficients (p-value = 0.05). Thus, even for bill collection, governance appears to matter (with the noted reservations).

**Figure 8: Bill collection rate (percentage)**

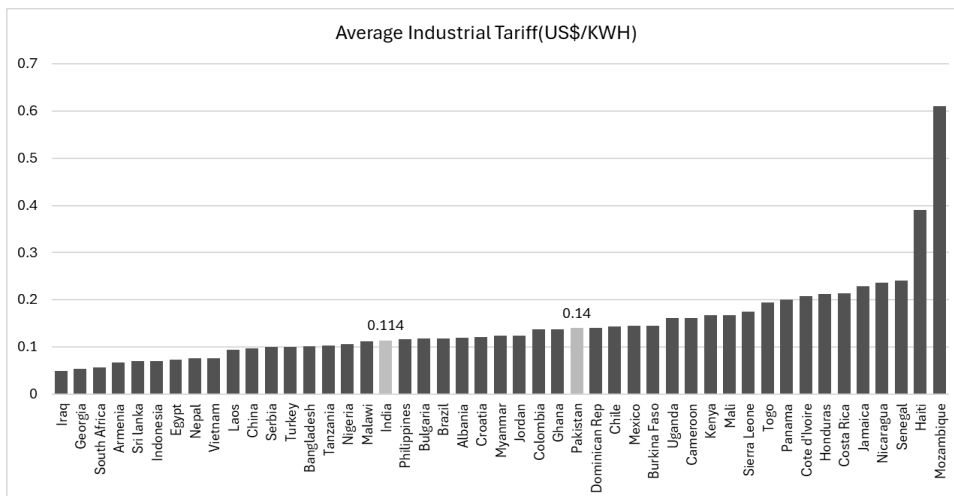


### ***Average Industrial Tariff***

Industrial consumer tariff (USD per kWh), or the average electricity tariff charged to industrial users, is a key indicator of power sector performance. Two countries, Haiti and Mozambique, have relatively high tariffs that stand out. The remaining countries' tariffs vary across the sample in an even fashion. Pakistan's industrial tariff average is USD 0.140 per kWh, while India's is USD 0.114 per kWh (Figure 9).

The results of the regression analysis in Appendix 9 show that IPP share is positively related to the tariff rate, as indicated by statistically significant coefficients in all six governance models. This implies that the higher the share of IPPs, the higher the tariff rate, suggesting that IPPs may be exerting some sort of market power or influence on power regulators. On the other hand, three governance variables, i.e., government effectiveness, the rule of law, and regulatory quality, have significant coefficients with negative signs. This aligns with the hypothesis that better governance leads to effective control over tariff charges to customers.

**Figure 9: Average industrial tariff (USD/kWh)**

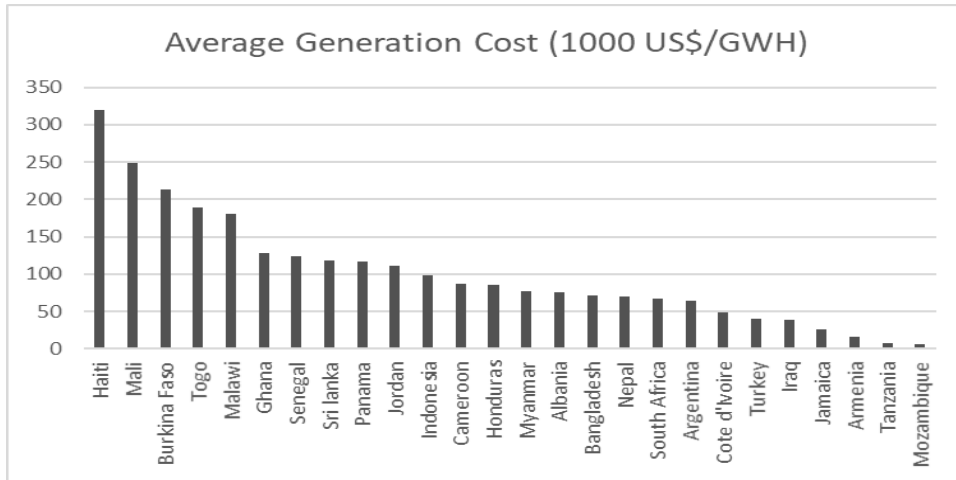


**Average Generation Cost**

Another measure of resilience is the average cost of generation (measured in thousands of US dollars per GWh of power generation). It refers to the per-unit cost of generating electricity. The cost varies between USD 6.2 and USD 320 and should be a function of the energy source mix, e.g., hydropower vs. fossil fuels (Figure 10). Nevertheless, one expected benefit of partnerships with IPPs is economic efficiency resulting in lower generation costs.

However, our regression analysis results in Appendix 10 show statistically significant negative coefficients for the IPP share in all six models. This suggests that IPP participation in the power sector may be resulting in lower generation costs, thus supporting the initial expectation from the PPP model. For governance indicators, we find that government effectiveness and regulatory quality have negative and significant coefficients (p-value = 5 percent).

Figure 10: Average generation cost (USD 1,000/GWh)



## Conclusion

This paper sought to examine how governance quality and the increased share of IPPs in power generation might impact power sector performance, which, in turn, was examined in terms of access, equity, technical efficiency, and cost. As a country's reliance on IPPs increases, IPP groups may acquire greater influence and economic power and be able to resist government efforts to redirect their [IPPs'] efforts toward serving the wider public interest and developmental goals. On the other hand, the PPP model was conceived with a view to bringing more private investment to the sector and greater operational efficiency through private management.

However, an agency problem is inherent in the PPP models. Private operators are likely to pursue private profits to the neglect and detriment of the wider public interest. IPPs also tend to form cartels and follow quasi-oligopolistic practices if not prevented by law. They also tend to form special interest groups and exert political pressure on governments. For these reasons, the power sectors in all countries have been heavily regulated through special bodies, e.g., utilities commissions, which work to mitigate agency conflict and ensure private producers do not ignore the development dimension of energy policy. Therefore, the key to successful outcomes from power sector PPP models is public governance—the rule of law, government effectiveness, quality of regulation, and control of corruption.

Thus, it is expected that countries with stronger governance environments will see relatively better power sector outcomes. On the other hand, greater IPP reliance is likely to be accompanied by poorer outcomes in social and developmental goals, but with better outcomes in operational areas.

The results from this cross-country study support the hypotheses that regulatory and governance factors positively impact power sector performance outcomes. Countries with stronger governance are associated with a lower frequency of system interruptions (but not duration of interruptions), greater access to electricity, smaller urban-rural gaps in power access, lower electricity losses (total and non-technical), lower tariff rates, better bill collection rates, and lower generation costs.

The main governance dimensions are control of corruption, government effectiveness, the rule of law, and regulatory quality. The indicator 'voice and accountability' appears to only affect (negatively) average generation cost and average industrial tariff. The governance indicator 'political stability' does not appear to matter for any of the performance outcomes.

On the other hand, the results indicate that a larger share of IPPs in power generation is associated with a higher frequency of system interruptions (SAIFI) and higher tariff rates but lower generation costs. A larger share of IPPs, however, does not appear to affect access to electricity, the urban-rural gap, electricity losses, or bill collection rates. This could suggest that IPP share does not help in what may be described as a government's social or developmental goals.

It is interesting to note that the IPP share in power sectors appears to lower generation costs, as is expected of private businesses. However, it seems to accompany higher tariffs. The latter could be an indication that IPPs' political influence increases as their share increases, possibly compromising public interest and leading to regulatory capture and weakening oversight.

These results are instructive for shaping public policy, as they underscore the importance of improving government effectiveness, the rule of law, and regulatory quality, and the control of corruption so that IPPs can better fulfill their potential.

The study's primary limitation is that of limited data, which raises the risk of omitted variable bias. However, it still underscores the role of governance in effectively leveraging private sector investment to further energy access and equity.

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### Appendix 1: Descriptive Statistics

<b>Power sector performance indicators</b>		<b>Max</b>	<b>Min</b>	<b>Avg</b>	<b>St dev</b>
1	Share of power generation by pvt. companies (percentage of total)	100.00	0.15	53.97	29.03
2	Electricity access percentage (2018)	100.00	15.00	78.33	27.06
3	Urban-rural access gap (percentage of population)	75.48	-0.14	22.38	26.86
4	Average industrial tariff (USD/kWh)	0.61	0.05	0.15	0.09
5	SAIFI	90.00	0.08	17.51	21.62
6	SAIDI	368.00	0.50	37.83	67.28
7	Electricity losses (percentage of electricity output)	69.00	5.20	20.19	13.44
8	Bill collection rate (percentage)	100.00	40.00	86.02	20.52
9	Average generation cost (USD 1,000/GWh)	320.00	6.20	101.11	76.21
10	Non-technical losses (percentage of output)	59.00	0.50	11.93	11.23
<b>Governance indicators</b>		<b>Max</b>	<b>Min</b>	<b>Avg</b>	<b>St dev</b>
1	Control of corruption	81.43	6.19	35.13	17.27
2	Government effectiveness	76.67	0.95	38.85	19.68
3	Political stability/absence of violence	70.48	1.90	32.00	19.65
4	Rule of law	80.48	2.86	37.58	16.56
5	Regulatory quality	89.05	8.10	41.68	19.86
6	Voice and accountability	84.73	4.43	41.44	18.99

## Appendix 2: Electricity Access Percentage

Governance indicators →	Control of corruption	Gov. effectiveness	Political stability	Rule of law	Regulatory quality	Voice/ accountability
Ind. variable	Coeff Sig	Coeff Sig	Coeff Sig	Coeff Sig	Coeff Sig	Coeff Sig
GDP per cap	0.003 ***	0.001	0.004 ***	0.003 ***	0.002 *	0.004 ***
IPP share	0.049	0.023	0.048	0.058	0.011	0.041
Governance	0.094	0.826 ***	0.029	0.251	0.517 **	-0.219
Constant	57.44 ***	40.41 ***	59.37 ***	52.50 ***	47.17 ***	67.17 ***
Adj. R <sup>2</sup>	0.281	0.456	0.278	0.292	0.349	0.296
DW stat	2.140	2.128	2.112	2.207	2.201	1.947
Akaike IC	9.195	8.916	9.199	9.179	9.095	9.175
F-stat	7.248 ***	14.405 ***	7.174 ***	7.614 ***	9.589 ***	7.714 ***

## Appendix 3: Urban-Rural Access Gap (Percentage of Population)

Governance indicators →	Control of corruption	Gov. effectiveness	Political stability	Rule of law	Regulatory quality	Voice/ accountability
Ind. variable	Coeff Sig	Coeff Sig	Coeff Sig	Coeff Sig	Coeff Sig	Coeff Sig
GDP per cap	-0.003 ***	-0.001	-0.003 ***	-0.003 ***	-0.002 **	-0.004 ***
IPP share	0.047	0.077	0.041	0.033	0.093	0.057
Governance	-0.211	-0.867 ***	-0.178	-0.436 *	-0.583 ***	0.194
Constant	43.49 ***	58.18 ***	41.91 ***	50.70 ***	52.09 ***	31.25 ***
Adj. R <sup>2</sup>	0.349	0.535	0.347	0.379	0.427	0.349
DW stat	1.789	1.799	1.793	1.883	1.815	1.660
Akaike IC	9.073	8.737	9.076	9.026	8.945	9.074
F-stat	9.584 ***	19.415 ***	9.517 ***	10.77 ***	12.942 ***	9.576

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#### Appendix 4: SAIFI

Governance indicators →	Control of corruption		Gov. effectiveness		Political stability		Rule of law		Regulatory quality		Voice/ accountability	
	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig
GDP per cap	-0.002	**	-0.001		-0.002	***	-0.001	*	-0.001		-0.002	***
IPP share	0.194	*	0.195	*	0.191	*	0.177		0.223	**	0.199	*
Governance	-0.356	*	-0.489	**	-0.095		-0.412	*	-0.477	**	-0.013	
Constant	29.50	***	33.31	***	21.81	**	32.35	***	32.73	***	19.52	**
Adj. R <sup>2</sup>	0.283		0.314		0.225		0.284		0.316		0.219	
DW stat	1.622		1.743		1.549		1.666		1.628		1.484	
Akaike IC	8.743		8.699		8.821		8.742		8.695		8.828	
F-stat	6.393	***	7.242	***	4.962	***	6.413	***	7.327	***	4.832	***

#### Appendix 5: SAIDI

Governance indicators →	Control of corruption		Gov. effectiveness		Political stability		Rule of law		Regulatory quality		Voice/ accountability	
	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig
GDP per cap	0.002		0.003		0.000		0.002		0.004		0.001	
IPP share	-0.058		-0.057		-0.034		-0.097		0.017		0.048	
Governance	-0.681		-1.078		0.183		-0.928		-1.270		0.167	
Constant	58.83	*	70.24	**	33.79		68.75	*	75.18	**	43.90	
Adj. R <sup>2</sup>	-0.054		-0.031		-0.076		0.044		0.007		0.076	
DW stat	2.424		2.531		2.329		2.429		2.481		2.358	
Akaike IC	11.399		11.376		11.419		11.39		11.353		11.420	
F-stat	0.300		0.593		0.035		0.421		0.907		0.031	

### Appendix 6: Electricity Losses (Percentage of Output)

Ind. variable	Governance indicators →		Control of corruption		Gov. effectiveness		Political stability		Rule of law		Regulatory quality		Voice/ accountability	
	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig
GDP per cap	-0.001		0.000		-0.001	**	0.000		0.000		0.000		-0.001	***
IPP share	0.060		0.071		0.066		0.051		0.083		0.062		0.062	
Governance	-0.295	***	-0.355	***	0.039		-0.307	**	-0.333	***	0.044		0.044	
Constant	29.36	***	29.40	***	20.27	***	30.03	***	29.12	***	19.81	***	19.81	***
Adj. R2	0.276		0.325		0.133		0.256		0.280		0.134		0.134	
DW stat	1.856		1.783		2.079		2.113		1.917		2.104		2.104	
Akaike IC	7.446		7.376		7.626		7.473		7.440		7.624		7.624	
F-stat	6.325	***	7.735	***	3.153	**	5.823	***	6.447	***	3.171	**	3.171	**

### Appendix 7: Non-Technical Losses (Percentage of Output)

Ind. variable	Governance indicators →		Control of corruption		Gov. effectiveness		Political stability		Rule of law		Regulatory quality		Voice/ accountability	
	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig
GDP per cap	0.000		0.000		-0.001		0.000		0.000		0.000		-0.001	**
IPP share	0.040		0.051		0.036		0.040		0.057		0.032		0.032	
Governance	-0.109		-0.195	*	-0.041		-0.103		-0.165	*	0.070		0.070	
Constant	15.08	***	17.49	***	12.96	***	15.12	***	16.33	***	10.13	***	10.13	***
Adj. R2	0.117		0.181		0.076		0.096		0.157		0.098		0.098	
DW stat	2.218		2.114		2.233		2.302		2.194		2.180		2.180	
Akaike IC	6.861		6.787		6.908		6.885		6.815		6.883		6.883	
F-stat	2.372	*	3.277	**	1.844		2.103		2.927	*	2.123		2.123	

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**Appendix 8: Bill Collection Rate (Percentage)**

Governance indicators →	Control of corruption		Gov. effectiveness		Political stability		Rule of law		Regulatory quality		Voice/ accountability	
	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig
GDP per cap	-0.006		-0.014	**	-0.005		-0.006		-0.013	***	-0.006	
IPP share	0.026		-0.022		0.004		0.013		0.048		0.005	
Governance	0.400		0.887	**	0.142		0.691		1.028	**	0.236	
Constant	86.81	***	88.28	***	93.90	***	76.49	***	75.37	***	88.95	***
Adj. R <sup>2</sup>	-0.019		0.197		-0.108		0.064		0.339		0.105	
DW stat	0.915		1.441		0.104		1.121		1.625		0.345	
Akaike IC	8.948		8.709		9.032		8.862		8.514		9.028	
F-stat	0.904		2.228		0.511		1.344		3.568	**	0.526	

**Appendix 9: Average Industrial Tariff (USD/kWh)**

Governance indicators →	Control of corruption		Gov. effectiveness		Political stability		Rule of law		Regulatory quality		Voice/ accountability	
	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig
GDP per cap	0.000		0.000		0.000		0.000		0.000		0.000	
IPP share	0.001	*	0.001	**	0.001	*	0.001	*	0.001	**	0.001	*
Governance	-0.001		-0.002	**	0.000		-0.002	*	-0.002	*	0.001	
Constant	0.1600	***	0.1800	***	0.1100	***	0.1900	***	0.1700	***	0.1000	**
Adj. R <sup>2</sup>	0.079		0.169		0.036		0.118		0.115		0.046	
DW stat	2.109		2.112		2.027		2.363		2.113		2.050	
Akaike IC	-1.912		-2.015		-1.866		1.955		1.952		1.877	
F-stat	2.292	*	4.050	**	1.554		3.005	**	2.945	**	1.728	

**Appendix 10: Average Generation Cost (USD 1,000/GWh)**

Governance indicators →	Control of corruption		Gov. effectiveness		Political stability		Rule of law		Regulatory quality		Voice/ accountability	
	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig
GDP per cap	0.000		0.004		-0.001		0.000		0.003		-0.001	
IPP share	-1.321	**	-1.221	**	-1.220	**	-1.263	**	-1.252	**	-1.294	**
Governance	-1.266		-1.876	*	-0.247		-0.802		-1.865	*	-0.635	
Constant	215.53	***	215.92	***	176.34	***	196.3	***	226.75	***	197.24	***
Adj. R <sup>2</sup>	0.187		0.273		0.138		0.156		0.256		0.149	
DW stat	1.841		1.279		2.067		1.904		1.555		1.923	
Akaike IC	11.456		11.344		11.514		11.49		11.367		11.501	
F-stat	2.841	*	3.997	**	2.283		2.479	*	3.755	**	2.406	*