Role of IPPs and Problems in Energy Sector of Pakistan: Critical Evaluation

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Abstract:

Pakistan's energy sector has been facing a severe crisis for decades due to increasing population and industrial growth, which have strained its power infrastructure. Independent Power Producers (IPPs) were introduced as a solution to attract private investment and alleviate pressure on the public sector while speeding up power project development. Initially praised, IPPs have faced numerous challenges, necessitating a critical assessment of their effectiveness. Key issues include overreliance on expensive fuels, circular debt, and inefficient transmission and distribution systems. The sector must now adopt best practices to address these problems, embrace sustainability, and implement better tariff policies. Additionally, improving distribution efficiency and privatizing distribution companies could enhance revenue collection and operational performance. Ensuring the timely completion of power transmission projects is crucial for optimizing electricity evacuation from new power plants. This policy paper outlines necessary interventions to tackle Pakistan's energy crisis and foster a more efficient and sustainable energy sector.

Key words: *Pakistan, energy sector, Independent Power Producers (IPPs), circular debt, transmission and distribution efficiency*

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Introduction

Pakistan's energy sector has been grappling with a severe crisis for decades. The increasing population, as well as industrial growth, has placed an immense burden on the country's power infrastructure. In this context, Independent Power Producers (IPPs) emerged as a key solution to meet the nation's energy requirements. The introduction of IPPs was hailed as a groundbreaking approach to attract private investment, alleviate the burden on the public sector, and expedite the development of power projects. However, as time progressed, the sector encountered a myriad of challenges, prompting a critical evaluation of the effectiveness and efficiency of IPPs in addressing the energy crisis. There is a need to critically evaluate the energy sector, introduce best practices, and learn from past shortcomings. The energy sector, while meeting the nation's power needs, must embrace sustainability and environmental consciousness.

Problem Statement

The energy sector in Pakistan is faced with heavy reliance on imported fossil fuels, high tariffs, and inadequate investment in infrastructure. There is a need to establish a feasible, affordable, and environmentally friendly energy mix. One major area of concern is the contracts signed with IPPs, which are criticized for lacking transparency and long-term vision. The "Capacity Payments" method used in power purchase agreements with IPPs has resulted in substantial circular debts and high tariffs. If the current situation remains unchanged, the circular debt in the power sector will soon balloon to unsustainable levels. The paper intends to evaluate the operational efficiency and effectiveness of IPPs in meeting the supply-side requirements of the power sector and assess their impact on the economy and environment in Pakistan.

Scope:

The paper will delve into the historical context of IPPs' evolution and will examine the advantages offered by IPPs, including accelerated project implementation, diversified energy sources, and reduced strain on government finances. The paper will shed light on the persistent problems plaguing the power sector and the IPPs exacerbating certain issues like high tariffs, regulatory hurdles, contractual disputes, delayed payments, and environmental concerns. The paper aims to propose policy recommendations that can bridge the existing gaps and ensure accountability.

Research methodology

A combination of quantitative and qualitative methods has been utilized in this research. Extensive exploration of relevant databases has been conducted to gather data. All the aforementioned sources have been critically analyzed to derive empirical findings and formulate sustainable recommendations.

Literature Review:

Extensive research involved consulting well-researched articles on the internet to gain insights into the government's policies and initiatives concerning the power sector and to identify the key challenges it faces. The study relies on power system statistics from NEPRA and NTDC annual reports, along with research papers comparing the efficiency and environmental impact of private power plants. Due to the technical nature of the topic, a comprehensive understanding of the parameters was necessary to conduct an in-depth and objective analysis of the private sector's role in meeting power sector demands. Relevant data was gathered from the Economic Survey of Pakistan, the websites of the Energy Ministry and various regulatory authorities, as well as scholarly articles on the subject and journals.

Overview of Energy Landscape:

There are both public and private sector entities for electricity generation in Pakistan:
IPPs: To meet the rising demand for power, the government resorted to Independent Power Producers (IPPs), which are private entities operating power plants and selling electricity to the government. They have played a crucial role in augmenting power generation capacity and reducing the burden on government-owned utilities. Privately owned independent power producers generated 53% of the country's power (ADB, 2021). The current fuel mix in Pakistan indicates that 68.7% of the installed capacity is based on thermal sources, with five thermal IPPs using a combined cycle system for higher efficiency and lower emissions (Fahd Ali, 2007). Pakistan's total installed capacity for power generation is 41,557 MW against the peak demand of 31,000 MW (Energy, 2022).

The major components of the energy mix include:

Thermal Power: The largest contributor to electricity generation in Pakistan is thermal power, primarily fueled by natural gas and oil. This includes both government-owned power plants and Independent Power Producers (IPPs). The system energy generated by public sector thermal power plants is significantly less than that of IPP thermal units, despite a relatively small difference in installed capacities. During the year 2021-22, a total of 31.8% was

generated from natural gas, furnace oil contributed 14.3%, while 12.6% of the power was generated from coal (Finance, 2022).

Hydropower: Pakistan is endowed with significant hydropower potential due to its geographical location and various rivers. The contribution of hydropower was 25.8% during 2021-22 (Finance, 2022).

Renewable Energy: Recently, the government has been trying to harness wind, solar, and biomass. Though their share is increasing, they still represent a relatively small portion of the overall energy mix: wind 4.6%, solar 1.4%, and bagasse 0.9% of the installed capacity (Finance, 2022).

Nuclear: A portion of the energy is delivered by nuclear power plants. Nuclear power plants contributed 8.6%.

Consumption Pattern

A total of 89,361 GWh of energy was consumed in the year 2021-22. Households were by far the largest consumers, consuming 47% of the total energy consumption. The industrial sector consumed 28%, the agriculture sector 9%, commercial 7%, while 8% of power was consumed in other sectors (Energy, 2022). More energy consumption in households than in the industrial sector is in itself a worrisome indicator.

Energy Demand-Supply Gap

The demand for electricity consistently exceeds the available supply, leading to frequent blackouts and load shedding. This shortfall hampers industrial productivity, economic growth, and the quality of life for the population. The maximum total demand stands at nearly 31,000 MW, whereas the transmission and distribution capacity is stalled at approximately 22,000 MW (Rehman, 2019). The installed capacity hovers above 41,000 MW, which means Pakistan has 10,000 MW of extra capacity installed for power generation, but the demand of industries and households cannot be met due to a lack of capacity in the transmission and evacuation lines, resulting in power outages and load management at times of peak demand. As the IPPs are paid based on installed capacity, the government has to make payments without utilizing any electricity.

Regulatory Framework

The Ministry of Energy is the overarching authority formulating and implementing the energy policy of Pakistan and overseeing the National Grid. Under the Ministry of Energy are PPIB and AEDB. PPIB deals with investments in generation and transmission, while AEDB deals with projects based on renewable energy resources. Ten regional distribution companies under PEPCO are connected to a single national grid (PPIB, 2021). There are four thermal plants owned by the government, the 'National Transmission and Dispatch Company' (NTDC), as well as CPPA-G. WAPDA and NEPRA

set and review the tariffs, while the hydropower plants in the country are owned by WAPDA as WAPDA Hydroelectric. K-Electric generates and distributes power for Karachi and is a public limited company. Other key players in the power sector of Pakistan are PAEC, the provinces, AJK, and GB, as provinces have been empowered after the 18th Amendment to generate and sell energy to the National Grid.

PPIB

It was set up following the 1994 power policy, with the goal of promoting private sector investment. It facilitates private sector investors through one-window operations in projects and related infrastructure, executes performance agreements with sponsors, and deals with sovereign guarantees on behalf of the government. PPIB has also been mandated to facilitate specified public sector projects (PPIB, 2021).

Central Power Purchase Authority-G

In 2002, NTDC obtained a license and was assigned the CPPA function. As a result, all DISCOs now purchase power through a representative responsible for negotiating, signing, administering billing, and settling PPAs. In 2009, CPPA-G was established as a power company to take over CPPA and market development functions from NTDC. The formal transfer of functions between NTDC and CPPA-G was completed in mid-2015, marking the commencement of CPPA-G's commercial operation. The authority and scope of CPPA-G are regulated by NEPRA Market Operator Rules.

National Electric Power Regulatory Authority (NEPRA):

NEPRA's primary duties include granting licenses for electric power generation, transmission, and distribution. They are responsible for setting and enforcing standards to ensure the safe operation and supply of electric power to users. Additionally, NEPRA is tasked with evaluating and approving investments and programs proposed by utility companies. NEPRA plays a crucial role in determining tariffs for electricity generation, transmission, and distribution. It establishes tariffs for independent power plants based on the type of fuel used (NEPRA, 2023).

Power Policies in Perspective

Tarbela and Mangla dams mostly met the power demand until the late 1980s. However, demand for power was continuously rising, and it was felt that additional capacity would be needed. As power projects required significant capital investment, the government faced difficulties in financing such projects. Over the years, the government implemented various energy policies to attract private investment, promote renewable energy, improve energy efficiency, and enhance the overall performance and sustainability of

the sector. With the support of the World Bank, PSEDF was launched in 1986 to attract private investment. The power sector gradually transitioned from being dominated by public utilities WAPDA and KESC to greater and greater involvement of the private sector (Fahd Ali, 2007).

The 1994 power policy introduced bulk power tariffs with capacity payments and energy payments, offering attractive financial arrangements and fiscal incentives to investors. The 1998 policy emphasized competitive tariffs and a focus on indigenous coal and hydropower projects. The exemption available to power projects under the 1994 policy was reduced to promote competition with local producers. The policies successfully attracted investments, and by 2002, the total power generation from IPPs reached around 3500 MW (Fraser, 2005). The 2002 policy included international competitive bidding and provided options for negotiations in project planning. It outlined different arrangements for hydropower and thermal power projects and guaranteed payments. The 2013 power policy faced criticism for inadequate stakeholder deliberations and not addressing the power sector's unjustified energy mix. The policy failed to address the growing trend of domestic energy consumption surpassing industrial consumption. The 2015 power policy aimed to provide sufficient and cost-efficient generating capacity, encourage the use of indigenous resources, cater to all stakeholders, and protect the environment. The policy includes provisions for water usage charges for hydropower projects, indexed tariffs for inflation, and facilitation of foreign exchange remittance for project-related payments. The policy explored opportunities for cross-border energy trade to import electricity from neighboring countries and promote regional energy cooperation. It also opened the way for private investment in transmission lines and energy infrastructure. The Alternative and Renewable Energy Policy (Finance, 2022) was introduced in 2019 with renewed emphasis on solar and wind. The National Electricity Policy 2021 aims for a self-sustainable power sector for optimal utilization of indigenous resources; integrated planning approach; efficient, liquid, and competitive market design; and affordable and environmentally friendly outcomes for consumers (Energy, 2021).

COMMISSIONED IPPs & ITP:

The 2015 policy allowed for Independent Transmission Lines (ITP) in addition to IPPs. A list of IPPs and an ITP commissioned under various power policies so far is attached as Annex-A.

Critical Appraisal of IPPs

Contractual Pitfalls:

The evaluation of Independent Power Producers (IPPs) in Pakistan requires an analysis of the contracts signed by the government. The 1994 policy aimed to redefine incentives based on input from financial investors and the

international financial community, leading to the establishment of 20 IPPs with a combined capacity of 4,500 MW, of which 4,075 MW was actualized. The success of the 1994 policy in attracting investment can be attributed to several factors, including an elaborate contract framework, indicative bulk tariffs with indexation for fuel and inflation, attractive fiscal incentives, a standardized security package, and the creation of PPIB (Fraser, 2005). Despite the achievement of establishing numerous IPPs, the objective of providing low-cost electricity to consumers was compromised. Instead of competitive bidding, a tariff ceiling was set (US cents 6.1/KWh for the first ten years and US cents 5.5/KWh over the project's life), offering little incentive for investors to reduce costs or produce efficiently. As a result, the energy sector's privatization yielded generous returns for investors but led to overcapacity. Lack of consideration for the capacity and location of plants, along with the absence of fuel efficiency incentives, resulted in the installation of plants using imported furnace oil as fuel. These plants relied on less efficient technology, such as diesel sets and steam turbines, instead of more efficient combined cycle plants. Generous incentives attracted excessive investment, which initially did not align with economic growth, causing overcapacity. Consequently, returns were guaranteed regardless of whether the extra capacity was utilized or not.

In the contracts, two major issues arose. Firstly, despite specifying English Law as the governing law, all cases were decided under Pakistani law. Secondly, the contracts allowed Independent Power Producers (IPPs) the right to pursue international arbitration, but the Government did not honor this provision. In January 1999, WAPDA took legal action against HUBCO and others in a senior civil judge's court in Lahore, trying to prevent HUBCO from resorting to international arbitration. The court initially ruled in favor of WAPDA, issuing an ex parte order restraining HUBCO from pursuing international arbitration. However, in March 1999, the Sindh High Court overturned this ruling. Unfortunately, the Supreme Court later favored the initial senior civil court's order, reinstating the restriction on HUBCO from seeking international arbitration.

Operational Efficiencies of IPPs

One of the key goals of a well-functioning energy system is to provide electricity at affordable prices. The high cost of electricity has led to payment defaults by individual consumers and has also raised the production costs for industries, making Pakistani exports less competitive in the global market. To evaluate the operational efficiency of Independent Power Producers (IPPs), essential parameters include auxiliary consumption, maximum load, plant load factor, capacity factor, and utilization factor. Some IPPs, namely AES Lalpir, AES Pak Gen, Saba Power, Saif Power, Sapphire, and Halmore, demonstrate lower capacity and utilization factors, indicating inefficiency. It is important to note that despite this, IPPs generally outperform public thermal power plants in terms of operational efficiency. The primary reason

for the underperformance of certain IPPs is attributed to high tariffs and the resulting shortage of working capital caused by non-payment of charges by the CPPA (Central Power Purchasing Agency). Consequently, these IPPs face difficulties in meeting their fuel payment obligations to suppliers like PSO (Pakistan State Oil).

Cost Factor of Electrical Energy

The affordability aspect of each source of energy can be gauged from two essential factors: the cost of generating electricity (COGE) and capital expenditure (CAPEX). Nuclear and hydel sources of energy have the highest CAPEX, whereas solar and natural gas have low CAPEX. The CAPEX for wind and oil is average or medium. Nuclear power has the lowest cost of generation. Considering the cost of generation aspect, the IPPs have not fared well. The cost per kWh ranges from Rs. 17 to 25 for IPPs running on furnace oil. The IPPs are low CAPEX and high COGE projects, thus negating the very principle of the need for finance from the private sector for capital-intensive projects. The agreed-upon tariff rate conceals the actual cost of Independent Power Producers (IPPs) to WAPDA and the public. The capacity payment, designed to ensure attractive returns for investors, created no incentive for IPPs to be cost-effective. Determining the true cost per unit of electricity produced by IPPs is challenging, making it difficult to assess potential lower tariffs. However, renegotiations have shown that tariffs can be reduced while still providing satisfactory returns to IPPs. The argument for offering indexation to inflation and the exchange rate to attract investment resulted in excessively high tariff rates (Fahd Ali, 2007).

Undue Incentives to IPPs

The major costs related to Independent Power Producers (IPPs) were incurred through fiscal incentives, which were likely offered to attract IPPs initially. However, it is unclear whether these incentives were truly necessary. There should have been a clearer tariff structure that incorporated all IPP benefits into a transparent rate or provided detailed and reliable cost information to the public for an informed decision. Hindsight raises questions about whether the significant public funds spent on IPPs could have been used to finance higher-capacity public plants instead, leading to doubts about the necessity of attracting IPPs or if support should have been directed to WAPDA instead (Fahd Ali, 2007). Furthermore, the IPPs faced accusations of charging excessive tariffs, but they adhered to the agreements and calculated tariffs based on their costs as per the bulk power tariff scheme. The accuracy of their quoted costs and whether they took sufficient cost-reduction measures, given their guaranteed profits, remain topics of debate.

Circular Debt

The energy supply chain involves Generation Companies (GENCOs) selling electricity to Distribution Companies (DISCOs), who, in turn, supply it to consumers. Independent Power Producers (IPPs) heavily reliant on oil as fuel

face liquidity issues due to this vicious cycle and often operate their plants at lower capacities. The circular debt flow has been influenced by five main factors. Firstly, the high cost of power generation has resulted in collection and operational inefficiencies for Distribution Companies (DISCOs). Secondly, delays and shortcomings in tariff determination have contributed to the circular debt. Thirdly, line losses, along with poor revenue collection, have played a role. Fourthly, the government's partial and often delayed payment of Tariff Differential Subsidies (TDS) to DISCOs and K-Electric has been a contributing factor. Lastly, the circular debt has been compounded by expensive borrowings by PHPL and expensive late-payment charges on the payables of CPPA-G. The net annual circular debt flow for the year 2019-2020 stood at PRs 538 billion, and it increased to Rs 2.58 trillion by 30 June 2021. The circular debt balance is equivalent to 5.6% of the country's gross domestic product (GDP) and accounts for 6.8% of Pakistan's general government debt (ADB, 2021).

Negative Impact on BoP:

Power generation is specifically dominated by thermal plants running on oil and gas. The analysis of thermal generation reveals that furnace oil is the leading contributor to system energy, i.e., 52.4% of the total fuels used for electricity generation. It is followed by natural gas, diesel oil, and coal. Considering the huge quantum of imports of crude oil, it is evident that they directly contribute to the current account deficit. Therefore, to reduce the current account deficit, electricity generation through oil must be reduced.

Govt Power Purchase Model:

Attention is drawn to the element of capacity purchase price determined via Fixed Energy Invoice (FEI), which is charged at a bulk tariff rate. FEI comprises various components, including fixed operations and maintenance costs, insurance costs, administrative costs, and the return on equity. The size of the escalable component increases based on a predetermined indexation set at the time of financial close. This policy guarantees that the profit of the IPPs, represented by the return on equity, will be paid and will also rise over time. In other words, investors face no business risk since they are assured of a specific return on their investment. However, this assurance can lead to cost inefficiencies on the IPP side. Additionally, the FEI being paid in US dollars instead of rupees is burdensome, as the steady devaluation of the rupee results in the government paying more in real terms.

Transparency and Accountability in IPP Operations:

The Government leveled official accusations against certain Independent Power Producers (IPPs), particularly HUBCO, claiming that they coerced the Government into signing deceptive and unaffordable contracts. Despite legal actions taken, no significant outcomes were achieved, but Pakistan's reputation suffered, resulting in a decreased likelihood of attracting new foreign investments. Conflict resolution mechanisms in such contracts should

be clear.

Environmental Concerns:

Heavy reliance on fossil fuel-based power generation in Pakistan has resulted in environmental concerns, with significant air pollution and greenhouse gas emissions. Oil-fueled power plants are major contributors to CO2, SO2, and NOx emissions, while natural gas is the least harmful, emitting only CO2. Coal-fired plants are the most harmful, releasing substantial quantities of CO2, SO2, Nitrous Oxide, and Mercury Oxides. Environmental impact assessments and guidelines were initially ignored in policies promoting private sector investment. Recently, there has been a shift towards cleaner renewable energy sources, but these projects take time to establish. Meanwhile, the government has turned to coal-fired power plants due to their cost-effectiveness, despite their massive pollution. Although coal is cheaper for electricity production, its environmental impact may outweigh the benefits. Under CPEC, coal-fired plants with more efficient super-critical and ultra-super critical boilers are being prioritized to enhance power generation in the short term.

Impact of the Energy Crisis

a. Frequent power outages and energy shortages lead to disruptions in industrial operations, reduced capacity utilization, and increased production costs. This caused reduced productivity and competitiveness, impacting economic growth.
b. As energy is a crucial input, its price increases have led to an increase in the overall price level, causing severe inflation in the economy.
c. The government subsidizes energy prices to ease the burden on consumers. These subsidies have diverted resources that could have been used for development projects and essential services.
d. The energy crisis constrains economic growth by limiting industrial output, reducing investor confidence, and increasing production costs. As a result, GDP growth is hampered, making it challenging for the country to achieve its development targets. Some industries have relocated to China and Bangladesh, causing an increase in unemployment.
e. Energy shortages and frequent power outages have impacted the daily lives of citizens. Public dissatisfaction with the government's inability to address the crisis has, at times, led to protests and demonstrations, putting pressure on the government.
f. The energy crisis was the focus of opposition parties to criticize the government's performance. Political opponents used the crisis to highlight governance failures and demand a change in leadership. Successive governments' popularity has suffered because of the energy crisis, particularly the PPP government of 2008-2013.
g. The crisis led to questions about the transparency of government

decisions related to energy policies, subsidies, and allocation of resources. Allegations of corruption or mismanagement in the energy sector have eroded public trust in the government.

Recommendations

a. There is a need for an improved and transparent regulatory framework for IPPs. The licensing and approval process must be streamlined. The inconsistencies in policies and uncertainties in the redressal mechanism must be addressed as a priority. There should be a clear tariff and pricing mechanism and a fair competitive process for ensuring balanced contracts. Timely payments and dispute resolution mechanisms should be in place. The role of Public-Private Partnerships (PPP) in the energy sector must be enhanced.
b. Steps must be taken to increase renewable energy capacity with increased incentives for green energy projects. AEDB must ensure the implementation of environmental standards and monitoring mechanisms. The introduction of smart grid technologies, including advanced metering infrastructure (AMI), distribution automation, and remote monitoring, can enhance system efficiency and reduce losses.
c. Keeping in view past fallacies, studies for forecasting future demand should be carried out with extreme caution. Efforts should be made toward energy conservation and demand management through public awareness and education campaigns. Energy efficiency standards should be incorporated into building codes and strictly imposed before giving electricity connections from the grid.
d. There should be an annual independent audit and performance evaluation of each and every IPP and public sector utility company. All IPP contracts, agreements, annual performance reports, and financial cash flows should be publicly available and must be scrutinized by parliamentary committees. Citizen engagement and feedback mechanisms would ensure transparency.
e. Given the primary goal of addressing the energy shortfall, it is advisable to establish new power plants using more affordable fuels like coal and LNG in the short term. When considering coal-fired plants, it is highly recommended to opt for those equipped with ultra-supercritical boilers, as they are known for their superior efficiency.
f. With the aim of cost reduction and improved efficiency, the government may carefully renegotiate contracts with existing IPPs, keeping in view the sanctity of contracts but ensuring equity. The contracts may be evaluated by experts with the objective of cost reduction and improving efficiency.
g. Immediate attention should be given to breaking the vicious cycle of circular debt by clearing outstanding payments. Considering the government's recent initiatives in investing in coal-based and R-LNG-

based power plants, it is advisable to discontinue sourcing from oil-fired power plants. This action would lead to a reduction in the import of furnace oil, ultimately easing the strain on foreign exchange reserves and lowering the trade deficit.

h. The abundant coal reserves in Sindh should be harnessed for electricity generation, and the government should explore the possibility of utilizing underground coal gasification as an environmentally friendly option for power production. The coal reserves in Thar are predominantly lignite, and the government's choice of subcritical boilers for electricity generation from local coal may lead to pollution and environmental harm. Given these circumstances, underground coal gasification appears to be the most suitable approach for generating electricity from these reserves.
i. The electrical energy system in Pakistan is severely hindered by transmission and distribution losses. Distribution Companies (DISCOs) face challenges in collecting payments for the energy lost during transmission and distribution before reaching the end consumers. The government's performance in this regard has been unsatisfactory. It is crucial for the government to take the initiative to privatize the distribution companies to improve the collection system's efficiency and enhance their capacity to make timely payments to power generators.
j. Timely completion of power transmission projects is necessary to facilitate power evacuation from newly installed power generation projects. The IPP model should be used to harness private investment in transmission and distribution networks.

Conclusion

The energy crisis in Pakistan presents a pressing challenge that requires immediate attention and well-considered policy interventions. The reliance on IPPs has brought its own set of issues, contributing to the complexity of the energy landscape. The policy paper has shed light on critical issues such as overdependence on costly fuels, circular debt, an inefficient transmission and distribution system, and environmental concerns. The thrust towards private sector investment was not accompanied by measures to enhance distribution efficiency and set appropriate tariff policies. Keeping in view carefully considered future demand growth, efforts should be made to bring efficient energy generation systems into Pakistan. Moreover, the privatization of distribution companies should be pursued to improve efficiency, revenue collection, and timely payments to power generators. Timely completion of power transmission projects must be ensured to evacuate electricity from new power plants effectively.

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