

Exploring **CTBCM** Prospects in Pakistan's Power Sector Outlook

by

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ABBREVIATIONS

CfDs	Contracts for Difference
CPPA-G	Central Power Purchasing Agency Guaranteed Limited
CTBCM	Competitive Trading Bilateral Contracts Market
DISCOs	Distribution Companies
EMRs	Electricity Market Reform
EPAs	Energy Purchase Agreements
GHGs	Greenhouse Gases
IPPs	Independent Power Producers
NEPRA	National Electric Power Regulatory Authority
NTDC	National Transmission and Despatch Company
PPAs	Power Purchase Agreements
RLNG	Re-Gasified Liquefied Natural Gas

ABSTRACT

This study highlights the challenges and bottlenecks within Pakistan's power sector. It suggests reforms focusing on the Competitive Trading Bilateral Contracts Market (CTBCM) model proposed by the National Electric Power Regulatory Authority (NEPRA) in 2019. Despite Pakistan's significant power generation capacity, political instability and inadequate governance have exacerbated the sector's inefficiencies, leading to severe consequences such as circular debt and widespread load-shedding. The current single-buyer model of power under the government of Pakistan has led to monopolistic practices and financial strain on the government and consumers alike. The discussion explores the role of CTBCM (systematic shift) in reducing electricity prices, controlling power theft and load-shedding, bringing more investment in the power sector, and encouraging the integration of renewable energy (RE) sources into the national grid. Additionally, the study examines what needs to be done to support the implementation of CTBCM to avoid future challenges and threats to the power sector.

Keywords:

CTBCM, Renewable energy, Power sector, IPPs, CPPA-G

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1. INTRODUCTION

For decades, Pakistan's power sector has been undergoing a crippling situation despite being the most instrumental in the growth and sustainability of the economy. Unfortunately, political instability coupled with social unrest has further exacerbated the power sector outlook and the policy-making process. Increasingly, this has resulted in severe repercussions, incurring trillions of losses to the national exchequer in the form of circular debt.

Pakistan's current power market model relies on the Central Power Purchasing Agency Guaranteed Limited (CPPA-G), which wields authority over all power producers in terms of Purchasing Power Agreements (PPAs). The CPPA-G functions as the sole power purchaser on behalf of the Distribution Companies (DISCOs) and sells it to the consumer at an average basket price. In addition, the contractual agreements between the three central departments of the power sector, i.e., generation, transmission, and distribution, are managed by the government through CPPA-G.

Despite being under the government's control, the power sector faces severe challenges, such as transmission losses, power plant inefficiencies, and electricity theft practices in the distribution department.

These inefficiencies, and subsidy-based regimes, are the primary drivers behind the increasing circular debt.

Experts believe now is the time to rebuild the power sector by introducing regimented and regulated electric market reforms. The Competitive Trading Bilateral Contracts Market (CTBCM) model proposed by the National Electric Power Regulatory Authority (NEPRA) in 2019 is one such initiative towards reforming the single-buyer model. The CTBCM model aims to eliminate monopoly in the electricity market and stimulate competition, enabling bulk consumers (require power of 1 MW or more) to procure electricity from sellers (generation plants) through bilateral contracts. If put into practice, the CTBCM will emerge as a more effective and efficient model, particularly facilitating the business and industrial sectors that are the primary victims of the power sector inefficiencies.

The study highlights the significance of the CTBCM model and the urgency of implementing it in letter and spirit. It will also discuss the CTBCM's potential contribution to Pakistan's economic and social development and how CBTCM can facilitate lowering Greenhouse Gas (GHG) emissions through promoting RE.

2. METHODOLOGY

This study is primarily the outcome of a one-day conference titled “Advancing CTBCM: A Multi-Stakeholder Conference,” organized by Renewables First on 15 July 2024. The conference, which featured participation from both public and private sector stakeholders as well as experts, provided valuable information on the issue and a way forward.

The study employed a qualitative research method to obtain in-depth information about the CTBCM model. The data comprises secondary sources, including newspaper articles, research papers, and booklets, to conduct a desk review.

3. LITERATURE REVIEW

Globally, power market reforms have played a paramount role in reshaping the energy landscape. These reforms aimed to ensure efficiency, sustainability, and fair competition in the global market. By promoting market-oriented approaches, such as Power Purchase Agreements (PPAs) and Contracts for Difference (CFDs), reforms optimize resource allocation, reduce air pollution, and improve power market efficiency. [1]

Moreover, these reforms are meant to reduce the dominance of the single-buyer model control regulatory dynamics, emphasize the need for effective regulatory policies, and attract long-term investments in the power sector. [2]. Power market reforms are essential for achieving a balanced, sustainable, competitive energy future that may benefit all stakeholders.

The UK’s Electricity Market Reform (EMR) introduced a competitive electricity market for capacity and renewables, significantly reducing costs and increasing RE integration. Since introducing these reforms in 2014, the costs of offshore wind energy dropped by 60%, from USD 190 per MWh to less than USD 65 per MWh by 2019. This substantial reduction in costs led to more affordable electricity prices and increased the share of RE in the national grid from 17% in 2010 to 47% in 2020 [3]. This led to declining coal usage and carbon emissions, promoting a cleaner energy mix, and demonstrating

how competitive auctions can attract investments and lower electricity prices.

Revisiting Electricity Market Reforms (EMR): Lessons for ASEAN and East Asia [4] highlights that India’s extensive power sector reforms have addressed inefficiencies, and promoted competition. These reforms include unbundling state electricity boards, introducing independent regulatory commissions, establishing power exchanges, and enhancing market efficiency and reliability. Financially, these reforms have attracted substantial private investment, with over USD 20 billion (B) invested in the power sector between 2010 and 2020. The increase in competition and efficiency has also contributed to a 15% reduction in the average cost of electricity for consumers.

These measures offer insights for Pakistan, particularly in restructuring state-owned enterprises and helping NEPRA (an already established regulatory framework) to impose power market reforms. These examples also illustrate how competitive auctions can reduce costs, increase efficiency, and attract private investment. By implementing similar reforms, Pakistan can achieve significant improvements in its power sector, reducing electricity prices, enhancing system reliability, and increasing the share of RE in its energy mix.

4. DISCUSSION AND ANALYSIS

4.1 De-Monopolizing Pakistan’s Power Sector Through CTBCM

To understand how CTBCM will dismantle the single-buyer model, one must familiarize oneself with the current market model and its underlying conditions. CPPA-G, which was formed out of the National Transmission and Dispatch Company (NTDC) in 2015, purchases electricity from all the producers, which include generation companies (GENCOs) and the Independent Power Producers (IPPs) on behalf of the DISCOs. These purchases are based on two agreements: Power Purchasing agreements (PPAs) for thermal power plants and Energy Purchase Agreements (EPAs) for RE power plants. Therefore, CPPA-G’s functions include power procurement and the settlement of PPAs and EPAs. This setup exemplifies a monopoly system where

competition among the producers is non-existent, thus denying buyers the freedom of purchase.

Aside from industries that have resorted to captive generation and domestics that have installed rooftop solar, all other consumers rely on the government for electricity procurement due to a lack of alternate options. Consequently, they pay NEPRA-notified tariffs, which the government increases repeatedly to meet its revenue expenses. High tariffs sometimes invite public protest or cause electricity theft. If consumers are given the option to purchase electricity from the seller of their choice, such issues can be significantly controlled.

With the introduction of CTBCM, the market monopoly will be demolished by creating two primary entities: the market participants and the service providers. The market participants will include the sellers (competitive suppliers) and buyers in the multi-buyer market, whereas the service providers will consist of the following:

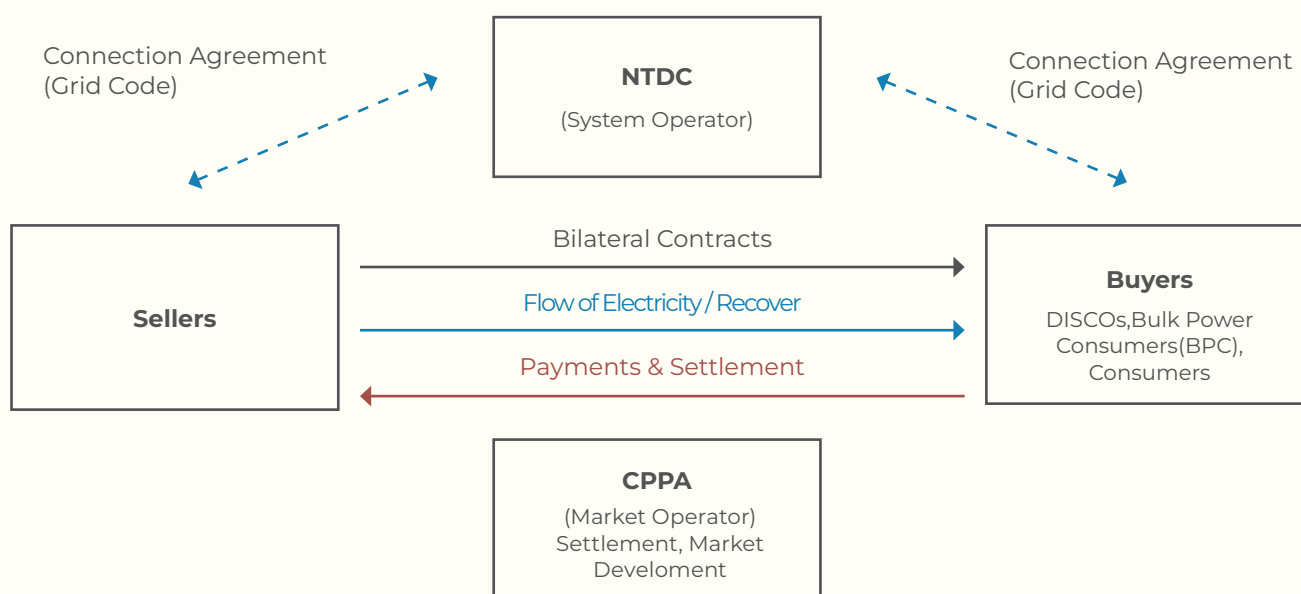
- The operators, including CPPA-G and NTDC, function as the market and system operators, respectively.
- Transmission Service Providers, which fall under the responsibility of NTDC.
- Distribution Network Service providers
- Metering Service Providers, which include NTDC

and DISCOS

- PPIB acting as the Independent Auction Administrator

This bilateral buying and selling model will introduce competition and, hence, lower the rate due to increased competition. Sellers will also gain from the opportunity to compete in the market, promoting their products through investments in research and development. Additionally, an open market will provide national and international investors a chance to invest in local manufacture and operation of RE sources, further enhancing the market's sustainability and efficiency.

The following diagram gives a more precise and clear understanding of the CTBCM model.



Source: [Introduction to CTBCM \(Advanced\)](#)

4.2 Prospects of a Competitive Market for Pakistan's Power Sector

The energy crisis in the country stems primarily from inefficient power plants and poor planning due to improper policies, which are continued.

To meet the supply-demand, the generation capacity expansion planning was conducted while considering the peak demand that only occurs during the summer for some hours. To meet this demand, thermal power plants, also called peaking plants, were installed in the system without considering their take-or-pay-contract nature and high generation costs accumulating in Pakistan's circular debt. The focus remained on the power generation/generation sector, neglecting the necessary upgrades of transmission infrastructure to match the installed capacity. As of today, the total installed power capacity of Pakistan is approximately 44,000 MW, most of which consists of 'take or pay' and must-run power plants. Despite such

massively installed capacity, some areas of the country still face regular load-shedding, reasons for which will be discussed later on.

More than half of the existing capacity incurs capacity charges paid by the government regardless of whether it is actively generating electricity. This means that power plants receive capacity payments even if they are not running, highlighting a lack of planning and ineffective government decision-making. Plants are granted license extensions despite reaching their retirement dates. According to the National Power System Expansion Plan (2011–2030), 127.5 MW of the Gul Ahmad power plant and 123.5 MW of the Tapal power plant were scheduled to retire in 2019–20. However, NEPRA approved a ten-year license extension for them because it has only stressed the retirement of GENCO's older power plants but has never mentioned the

retirement of IPPs' thermal plants, which would have lessened the sector's financial burden and diverted precious fuel to the most efficient power plants [5]. Capacity payments of PKR 8.344 trillion (T) have been made to the IPPs during the last 10 years. It has been anticipated that capacity payments of PKR 2.1 T will be paid to the IPPs during the fiscal year 2024-25 [6].

Since the focus remained on power generation, an installed capacity exceeding the system demand strains the power market as the consumer has to pay for the surplus electricity they do not use and make the capacity payments of power plants that are not generating even a single unit of electricity. Furthermore, industries utilizing captive generation (off-grid) do not pay for the on-grid electricity, which places a more significant financial burden on the on-grid consumers. On the contrary, if these captive generation plants are connected to the grid, they can contribute to the generation supply and reduce overall electricity costs. Unfortunately, this has not been made possible on a larger scale, so Pakistan's industrial sector remains off the grid.

4.2.1 Addressing issues of theft and load-shedding

Owing to high electricity prices, a substantial number of households and industries have resorted to power theft or meter tampering [7].

As a counter measure to theft, DISCOs must produce load-shedding for long hours in areas where power theft is routine. However, this approach of shutting down high-loss feeders is problematic as it is tantamount to punishing law-abiding citizens, who regularly pay their bills alongside those who participate in theft practices. CTBCM presents a rational and logical solution to theft

4.2.2 Attracting local and foreign investment

Pakistan possesses enormous indigenous resources that are being wasted due to the prevailing economic crisis and the successive government's inability to utilize them effectively. It is also causing a rapid increase in imports. After revamping the power sector, local and foreign investors must be attracted to invest in the country. This will reduce reliance on imports.

In March 2023, the Government of Pakistan merged the Alternative Energy Development Board (AEDB) into the Private Power and Infrastructure Board (PPIB) to extend one window for all technologies. This proposed merger will align CTBCM, ensuring energy security and stability. An efficient CTBCM model would enhance energy security by diversifying the energy sources and reducing dependency on fossil fuels for power generation by promoting local and foreign investments in RE.

All the reasons mentioned above place a substantial financial burden on the government, which has to uphold its agreements and make regular capacity payments to generation companies. Therefore, to make these capacity payments, the government imposes high tariffs on consumers, who are already under severe economic stress. Most stakeholders believe that CTBCM is the only solution in the current scenario that can bring sustainability to the devastating power sector and lessen the woes of consumers. This is because competitive bidding can replace the existing fixed capacity payments with market-driven prices. This shift ensures that only the most efficient and cost-effective plants are contracted, reducing the overall cost burden on the power sector. In addition to this, CTBCM can incentivize investments in RE projects, which typically have lower operational costs. It will also promote transparency in pricing through competitive auctions, leading to more accurate and fair pricing capacity that reflects the actual market conditions rather than predetermined, often inflated rates.

and load-shedding by allowing generation companies and bulk consumers to negotiate and transact electricity on their terms. A steady, dependable, and cost-effective power supply will better satisfy the consumers, and the need to take drastic measures, such as cutting off the power supply in various regions, will subside. Estimates show that the rate of electricity theft in Pakistan is alarmingly high, with losses amounting to PKR 600 B annually. [8] Adopting CTBCM could save this, as bulk consumers will not resort to theft if electricity is made available at a lower tariff.

Reon Technology recently announced its partnership with Fazal Group to implement an 8.064 MW solar energy system. In the first quarter of 2024, Chinese firm Hanersun Technologies and Pakistani counterpart, My Energy, have also collaborated to spearhead the development of 500 MW solar system projects in Pakistan. These initiatives demonstrate the growing interests of local and foreign investors in the power sector. A competitive market will attract investors, fostering innovation and investment in the future of Pakistan's power sector, which will mainly focusing on RE.

4.2.3 CTBCM and high tariffs

CTBCM can be crucial in countering the high tariffs imposed on bulk consumers. The latest tariff determination set by NEPRA for FY 2024-25 is PKR 35.5 /kWh, whereas PKR 29.78/kWh in FY 2023-24. Such an abrupt increase, along with various taxes, has badly impacted the life standard of the commoner [9].

A competitive market will allow consumers to choose from various procurement options, enabling them to select those with more favorable prices and improved services. For instance, the cost of electricity procured from solar and wind power plants is cheaper than that of Re-Gasified Liquefied Natural Gas (RLNG) based power plants. The EU's example supports this stance as their liberated electricity markets have shown a reduction in household energy prices by 10-15% due to increased competition.

CTBCM will also mitigate any extra costs consumers have to pay, such as:

- Capacity payments that consumers have to pay for idle or unutilized power plants as regulated by the government, under the CTBCM model, the government will recover a portion of the capacity payments by charging stranded costs (included in the use of system charge) from participants opting to leave the regulated electricity grid for a specified period after which the participants are under no obligation to pay the charges. This will relieve the sellers and consumers of the financial burden of stranded costs and also ensure that the government is mindful of future planning and investments in the power sector.
- Payments made as compensation for those who do not pay their electricity bills (people who cannot afford to pay) or engage in theft practices (primarily because of prolonged hours of load shedding). If everyone pays their bill, then the tariff per consumer would be reduced.

4.2.4 Emissions control

A market that offers abundant RE sources will facilitate the procurement of RE by implementing the CTBCM model. The world wants to shift to RE, so most market players have invested in or are planning to invest in RE projects.

In this scenario, procurement of RE will accelerate, allowing CTBCM to target Scope 2 emissions of a company (emissions produced as an indirect result of electricity purchased from a power generation company) that will buy electricity from emissions-free renewable power plants. By addressing these emissions, CTBCM will also help reduce Scope 1 emissions (produced directly from industrial processes such as burning of fuel or thermal captive generation) as industries will be encouraged to replace thermal captive power plants with RE plants instead to achieve their net-zero goals and compete in an international market. Consequently, implementing CTBCM is poised to reduce the country's overall emissions.

The role of CTBCM is not only limited to facilitating the procurement of green energy, but it will also help future industrialists to compete in the EU market as a leading export destination under the Carbon Border Adjustment Mechanism (CBAM) in 2026. It is the world's first carbon border tax to reduce carbon emissions by imposing a carbon tax on EU imports to address an issue called 'carbon leakage' or offshoring emissions [10]. On the website of ArcelorMittal, one of the major steel producers and exporters to the EU, the company has stated in its manifesto how it has begun adjusting its carbon strategies to comply with CBAM. The company is also investing in greener technologies and enhancing its carbon reporting and transparency to meet the new standards and avoid financial penalties in the future. Similarly, this tax will incline companies and industries based in Pakistan towards RE (to reduce carbon tax) so that their products are acknowledged in the EU markets.

5. CTBCM: CHALLENGES AND WAY FORWARD

5.1 The Harsh Reality of DISCOs

Experts believe that NEPRA needs to review its Grid Code 2023, which allocates the responsibility of electricity provision in the country to IPPs, leaving service providers under no obligation. This is what they say is impractical, as DISCOs and NTDC cannot incorporate the specified voltage and frequency supply values into their system due to the requirement of sophisticated equipment. This will increase the tariff rather than lowering it.

Furthermore, the underlying conditions of DISCOs only expose their incompetence in fulfilling responsibilities (distribution network service provider and metering service provider) assigned under the CTBCM model. This incompetency is primarily the result of the following issues and will only further aggravate the problems should DISCOs continue to function the same way:

- Ten government-owned DISCOs have incurred a loss of about PKR 589 B during FY 2023-24 [11].
- Regular over-billing to consumers, as pointed out by the Power Minister Awais Ahmed Khan Leghari, despite their shift to solar power [12] NEPRA, too, accused the distribution companies of massive overbilling after a detailed investigation last year. This overbilling results from the country's electricity wastage.
- Circular debt, which has reached PKR 2.6 T [13] In which DISCOs is a significant contributor.
- High-capacity payments, which the consumers pay as per DISCOs demand.

Last year, the purchasing price for DISCOs was PKR

23 per unit, and this year, it is PKR 35 as per NEPRA's State of Industry Report. CTBCM will reduce the tariff. Firstly, switching to renewables and investing in local manufacturing will reduce dependence on loans and reduce the capacity charge (investing in rupees rather than dollars). Secondly, procuring RE will reduce energy charges as it is fuel-free. Thirdly, installing rooftop solar panels will diminish the use of system charges (UoSC) and transmission losses included in the electricity tariff, both of which consumers have to pay NTDC. These changes will mainly target the purchase price for DISCOs, further reducing tariff and circular debt. It can also be suggested that the government split DISCOs into small units to overcome theft and inefficiency. They have extensive coverage areas; therefore, managing the vast consumer base becomes difficult.

5.2 Outdated Transmission and Distribution Infrastructure

The country has a large generation capacity but cannot transmit and distribute this energy due to a lack of sufficient, efficient, and upgraded infrastructure. Because of the increase in the population of major metropolitan areas, the electricity demand has increased. Still, distribution companies have yet to make plans to lay down new transmission and distribution lines due to the extreme difficulty of installing lines in such high-congestion areas. [14]. This is primarily because installing new transmission lines has become extremely challenging due to heavily populated areas. The only viable solution under the circumstances is to increase the transmission capacity of existing transmission lines.

In Pakistan, 5-7 GW of electricity is produced via captive generation because of high electricity rates and unreliability. This unreliability comes from the inefficient transmission lines that transmit such high volts of electricity without causing frequency and voltage disruptions. Industries cannot afford to lose millions of raw materials and products due to an unreliable on-grid electricity supply, which disrupts industrial operations and processes by damaging frequency-sensitive machinery.

If there is a power outage for even a second at an Engro Polymer Plant, it disrupts plant operations by 7-8 days, and takes 10-12 days to return to the same productivity level. The current transmission system has yet to be developed to sustain the installed power capacity. Equal importance should be given to the grid's reliability and capacity when discussing a competitive market.¹

Grid lines need to be improvised and enhanced to increase their transmission capacity and efficiency to address this issue parallel to CTBCM. This way, captive-generated power plants can be brought back to the grid, which will, in turn, reduce electricity prices.

Further, suppose electricity theft is considered a serious crime in severe crime in countries like the USA and India, where huge fines and imprisonment are imposed as punishments. In that case, there is no reason the government of Pakistan cannot take similar action. Although there are electricity theft laws (Section 462 (O) of the Pakistan Penal Code) in Pakistan, they have never been implemented. The government must consider this and take immediate action against those involved in this crime to ensure that theft is controlled once CTBCM is implemented.

¹ These were the views expressed by Mr. Arif Jalil, at the conference, who currently serves as the Vice President Operations at Engro Polymers and Chemicals Ltd.

6. CONCLUSION

It is imperative to engage stakeholders who need to understand the importance of CTBCM fully and may not support or adhere to the plan effectively. All stakeholders need to join hands in achieving a common goal in CTBCM. There are powerful and resourceful people who can play a significant role in convincing and pushing the government to announce a cut-off date for the launch of CTBCM without setbacks.

Pakistan direly needs R&D in all the industrial sectors, especially energy, which is the backbone of economic growth. For this purpose, industry, academia, and research organizations should join. The power sector needs drastic changes in smart grids, energy storage,

and advanced metering infrastructure. However, all this is possible if the market is allowed to operate on its terms under the CTBCM model with limited interference from the government. The Sustainable Development Goal (SDG) 7 emphasizes the importance of “ensuring affordable, reliable, sustainable, and modern energy for all” by 2030. Achieving this target necessitates the development of improved energy infrastructure and innovative energy models, especially those that promote RE. This is essential for progressing towards an eco-friendly future, and CTBCM is one of the steps to achieve this goal

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