

Competitive Trading Bilateral Contract Market (CTBCM)

Transforming Pakistan's Power Sector
Through Competitive Energy Markets

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EXPLORING COMPETITIVE TRADING BILATERAL CONTRACTS MARKET (CTBCM) THROUGH FINGERTIPS' MODEL

Pakistan

A Comprehensive Data-Driven Analysis

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Sources: NEPRA, CPPA-G, NTDC, IEEFA, World Bank, ADB, Renewables First, SDPI

EXECUTIVE SUMMARY

Pakistan's electricity sector stands at a historic crossroads. For three decades, the country operated under a centralized Single-Buyer Model (SBM) where the Central Power Purchasing Agency (CPPA-G) served as the sole intermediary between generators and distributors. This model, while initially effective in attracting private investment, ultimately entrenched a system of perverse incentives, mounting circular debt, and energy costs that have throttled industrial competitiveness.

The Competitive Trading Bilateral Contracts Market (CTBCM) is Pakistan's most ambitious energy market reform to date — a structural overhaul that transitions the country from a monopolistic, government-controlled procurement model to a decentralized wholesale electricity marketplace. Approved by NEPRA in November 2020 and officially launched on May 31, 2022, CTBCM enables bulk power consumers (≥ 1 MW) to procure electricity directly from generators through negotiated bilateral contracts, bypassing the single-buyer intermediary.

46.6 GW Installed (FY24)	Capacity	~29 GW Peak Demand (2025)	PKR 2.4 Trillion Circular Debt (Mar 2025)	PKR 1.9 Trillion Capacity (FY24)	Payments
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This report delivers a comprehensive, data-driven analysis of CTBCM covering its historical origins, current regulatory and operational status, future outlook through 2030, and detailed industrial and policy implications. It draws on verified data from NEPRA, CPPA-G, NTDC, IEEFA, World Bank, ADB, and leading Pakistani energy think tanks.

SECTION 1: HISTORICAL CONTEXT

1.1 Origins: Pakistan's Single-Buyer Electricity Model

Pakistan's electricity sector was born under state ownership. For most of its post-independence history, electricity generation, transmission, and distribution were vertically integrated under the Water and Power Development Authority (WAPDA), established in 1958. This monolithic structure served Pakistan adequately during low-demand decades but could not sustain the explosive energy needs of a rapidly industrializing economy.

1.1.1 The 1992 WAPDA Strategic Plan and Sector Unbundling

The pivotal shift began in 1992 when WAPDA's Strategic Plan recognized the unsustainability of state monopoly and recommended unbundling the sector to introduce competition. This plan, though largely aspirational at the time, laid the intellectual foundation for all subsequent reforms.

Key 1990s Milestones

- 1992: WAPDA Strategic Plan advocates sector unbundling and competition
- 1994: Private Power Policy introduced: first large-scale IPP program in South Asia
- 1997: National Electric Power Regulatory Authority (NEPRA) established under NEPRA Act 1997
- 1997: WAPDA unbundled into 10 regional DISCOs, 4 GENCOs (GENCO-I through IV), and NTDC
- 1998–2002: First wave of IPPs commissioned under 1994 Policy (Hub Power, Kapco, AES Pak Gen etc.)
- Late 1990s: NEPRA directs NTDC to transition toward CTBCM by July 2009 — deadline never met

1.1.2 The Single-Buyer Model (SBM): Structure and Architecture

Under the SBM formalized in the early 2000s, CPPA-G (Central Power Purchasing Agency – Government) acted as the sole wholesale buyer of electricity. The operational chain was rigid:

- Generators (IPPs and GENCOs) sold power exclusively to CPPA-G under long-term Power Purchase Agreements (PPAs)
- PPAs were structured on a two-part tariff: fixed capacity charges (payable regardless of dispatch) and variable energy charges
- CPPA-G then on-sold bulk power to 11 Distribution Companies (DISCOs) and K-Electric
- DISCOs distributed power to 35+ million end consumers under NEPRA-regulated tariffs
- Government provided sovereign guarantees to IPPs, shielding them from credit risk and commercial disputes

This model offered certainty to investors and rapidly expanded installed capacity. However, it fundamentally misaligned incentives: generators were paid regardless of whether their electricity was used, while DISCOs had no responsibility for procurement planning and passed all costs to consumers through regulated tariffs.

1.2 Key Milestones: From Single-Buyer to CTBCM

Table 1.1: CTBCM Reform Timeline (1992–2025)

Year	Milestone / Event	Significance
1992	WAPDA Strategic Plan	First recommendation for sector unbundling and competition
1994	Private Power Policy	Opened electricity generation to private investment (IPPs)
1997	NEPRA Act & Establishment	Created independent regulator; WAPDA unbundled into DISCOs/GENCOs/NTDC
2002	CPPA-G Formed	Centralized bulk power procurement under a single government entity
2013	NEPRA Act Amendments	Strengthened NEPRA's regulatory mandate; empowered it to design wholesale market
2015	ECC Decision No. ECC-78/9/2015	Cabinet's Economic Coordination Committee formally approved CTBCM roadmap
2015	Market Operator Rules	NEPRA issued Market Operator Registration, Standards and Procedure Rules
2018	CPPA-G as Market Operator (Nov)	CPPA-G registered as Market Operator for transition planning
2019	NEPRA High-Level Design Approved	Conceptual design of CTBCM finalized with ADB technical assistance
2019	ARE Policy 2019	Target: 20% renewables by 2025, 30% by 2030
2020	NEPRA Detailed Design (Nov 12)	Full design and implementation roadmap for CTBCM formally approved
2020	ECC CTBCM Approval	Cabinet-level endorsement of transition from SBM to competitive wholesale market
2021	NEPRA Act Amendment (Sec 23A)	Made Market Operator function a licensed activity under NEPRA Act
2022	Market Operator Licence (May)	NEPRA granted CPPA-G the Market Operator licence; MCC approved
2022	CTBCM Trial Launch (May 31)	NEPRA directed all licensees to begin 6-month trial run

2022	8 New NEPRA Regulations	Full regulatory framework enacted for MO, traders, suppliers, DISCOs
2023	Implementation Delays	DISCOs and Ministry refused UoSC hearings; full commercial launch deferred
2024	IPP Contract Renegotiations	GoP renegotiated/terminated PPAs with 5 IPPs amid capacity payment crisis
2025	Ongoing Reform	NEPRA continues phased CTBCM operationalization; market maturation underway

1.3 ADB Technical Assistance and International Support

The design and implementation of CTBCM was not undertaken in isolation. The Asian Development Bank (ADB) provided critical technical assistance through multiple programs that shaped the model's architecture:

- ADB's Energy Sector Reforms program provided legal, regulatory, and technical advisory services for wholesale market design
- ADB-funded consultants contributed to the High-Level Design (2019) and Detailed Design (2020) of CTBCM
- ADB's Energy Transition Mechanism (ETM) is now offering pathways for early retirement of fossil fuel plants — applicable to Pakistan's stranded thermal assets
- World Bank provided complementary support through its Pakistan Sustainable Energy Program (P169313), covering energy efficiency and market readiness
- USAID and bilateral donors supported capacity building for NEPRA and CPPA-G staff

1.4 Installed Capacity and Demand Growth: A Structural Mismatch

One of the most consequential features of Pakistan's electricity sector is the dramatic mismatch between installed generation capacity and actual electricity demand.

Table 1.2: Pakistan Electricity Capacity vs. Demand Trends

Period	Installed Capacity (MW)	Peak Demand (MW)	Surplus/Deficit	Capacity Factor (%)
FY 2010	~20,000	~15,000	+5,000 MW surplus	~55%
FY 2015	~23,000	~20,000	Near-balanced	~60%
FY 2018	~31,000	~24,000	+7,000 MW surplus	~45%
FY 2020	~38,000	~26,000	+12,000 MW surplus	~40%

FY 2022	~40,000	~28,000	+12,000 surplus	MW	~38%
FY 2023	~41,000	~28,500	~12,500 surplus	MW	~36%
FY 2024	~41,000 (dependable)	~29,000	~12,000 surplus	MW	~34%
FY 2025 (est.)	46,605 (installed)	~29,000	~17,600 surplus	MW	<30%

KEY FINDING

Pakistan's power sector has a surplus of 10–17 GW depending on measurement basis. Energy sales contracted by 9.4% in FY2023 and 2.83% in FY2024, while capacity payments — payable regardless of dispatch — surged from PKR 0.97 trillion in FY22 to PKR 1.9 trillion in FY24. The average utilization rate of the generation fleet stood at only 34% in 2024.

1.5 The Circular Debt Crisis: Origins and Escalation

Circular debt — a cascading chain of unpaid government subsidies that accumulates as arrears across the electricity value chain — is Pakistan's most debilitating energy sector problem. It began accumulating in 2006 when government-set tariffs fell below the actual cost of electricity supply.

1.5.1 Mechanics of Circular Debt

The mechanism is straightforward but devastating:

- Government sets end-consumer tariffs below cost-recovery levels (subsidized tariffs)
- Revenue shortfall means DISCOs cannot fully pay CPPA-G for bulk power
- CPPA-G cannot fully pay IPPs and GENCOs their capacity and energy payments
- IPPs and GENCOs cannot fully pay fuel suppliers (PSO, SNGPL, SSGC)
- Unpaid dues accumulate as circular debt — eventually parked in Power Holding Private Limited (PHPL)

Table 1.3: Circular Debt Accumulation History

Date Period	Circular Debt Stock (PKR)	Key Driver
2006	First accumulation	Below-cost tariffs introduced
2013	~PKR 480 billion	Rapid IPP expansion without tariff adjustment
2019–20	~PKR 1.6 trillion	Subsidies under PM Imran Khan's relief tariffs
Dec 2021	~PKR 2.47 trillion	COVID-era suppressed demand + capacity payments

Dec 2023	~PKR 2.55 trillion	Post-IMF tariff hikes partially offset by new debt
Jan 2024	PKR 2.636 trillion	Rooftop solar exodus reducing grid revenue
Mar 2024	~PKR 2.8 trillion (flow)	46% capacity payment surge + declining sales
End FY2024	PKR 2.4 trillion (stock)	IMF-mandated tariff hikes + DSS ring-fencing
Jul 2024	PKR 5.73 trillion (total inc. PHPL)	All obligations including parked PHPL debt
Mar 2025	PKR 2.396 trillion (active)	Marginal stabilization; PKR 398B decline from Mar 2024
Jun 2025	PKR 1.6 trillion (stock)	Significant reduction via debt service surcharge mechanism

Composition of Circular Debt (March 2025): Payables to IPPs/GENCOs: PKR 1.633 trillion (68%); Debt parked in Power Holding Private Limited (PHPL): PKR 0.683 trillion (28%); Payables by GENCOs to fuel suppliers: PKR 79 billion (3%). The circular debt represents approximately 2.1% of Pakistan's GDP.

1.6 Industrial Impact Under the Single-Buyer Regime

Pakistan's export-oriented and energy-intensive industries bore the brunt of the SBM's structural failures. With tariffs among the highest in the region and reliability chronically poor, industrial competitiveness was severely undermined.

Table 1.4: Industrial Sector Impact Under Single-Buyer Model

Industry Sector	Electricity Share of Industrial Demand	Key Problems Under SBM	Estimated Cost Impact
Textiles	~35–40% of industrial consumption	Load-shedding 6–12 hrs/day; tariff ~PKR 65/kWh by 2024	15–20% production cost from energy
Cement	~10–12% of industrial consumption	Energy-intensive grinding; no option to source cheaply	~30% of total production cost
Fertilizer	~8–10% of industrial consumption	Gas curtailment + high electricity tariff	Urea production cost 40–50% energy
Steel/Iron	~6–8% of industrial consumption	High-voltage consumers penalized; no cheap direct contracts	~25–35% of cost
IT/Data Centers	Emerging/growing	Unreliable power, forced diesel backup, high tariffs	Competitiveness vs. regional peers lost

The textile sector — which accounts for 60% of Pakistan's total exports and employs approximately 40% of the industrial labor force — suffered most acutely. Persistent load-shedding forced factories to invest in expensive captive generation (diesel generators, gas gensets), adding 8–12% to unit production costs. As electricity tariffs more than doubled between 2022 and 2025, multiple textile units reported production curtailments and export order losses, particularly to competitors in Bangladesh, Vietnam, and India who accessed cheaper, more reliable power.

The cement sector, with its energy-intensive grinding processes, saw electricity constitute nearly 30% of production costs. Fertilizer manufacturers faced a dual crisis of gas curtailment and rising electricity tariffs, driving up urea prices and pushing farmers toward imported fertilizers. The steel sector, heavily reliant on electric arc furnaces (EAFs), struggled with high-voltage tariffs that made domestic steel uncompetitive against imports.

SECTION 2: CURRENT STATUS

2.1 Official Launch and Regulatory Framework

CTBCM was officially launched on May 31, 2022, when NEPRA directed all its licensees to commence market operations on a trial run basis for six months. Simultaneously, NEPRA granted CPPA-G the Market Operator (MO) license and approved the Market Commercial Code (MCC) — the rulebook governing all wholesale electricity transactions.

Regulatory Framework: 8 New NEPRA Regulations (2022)

- NEPRA Licensing (Market Operator) Regulations, 2022
- NEPRA (Electric Power Trader) Regulations, 2022
- NEPRA Licensing (Electric Power Supplier) Regulations, 2022
- NEPRA Electric Power Suppliers (Performance Standards) Regulations, 2022
- NEPRA Licensing (Distribution) Regulations, 2022
- NEPRA Consumer Eligibility Criteria (Electric Power Suppliers) Regulations, 2022
- NEPRA Consumer Eligibility Criteria (Distribution Licensees) Regulations, 2022
- NEPRA (Registration) Regulations, 2022

2.1.1 Phased Implementation Plan

CTBCM follows a carefully phased implementation roadmap. NEPRA's approach mirrors international best practice of graduated market opening:

Table 2.1: CTBCM Phased Implementation Plan

Phase	Name	Key Features	Status
Phase 0	Market Readiness	IT systems (MMS, SDXP), institutional setup, capacity building	Largely Completed
Phase 1	Single Buyer Plus (SBP)	DISCOs procure directly from generators; CPPA-G as MO; Market rules tested	Trial Commenced 2022
Phase 2	Bilateral Contract Market	Bulk consumers (≥ 1 MW) can contract directly with suppliers; competitive suppliers emerge	Implementation Underway
Phase 3	Full Competitive Market	Spot market, balancing market, full price discovery; all eligible consumers can participate	Target: 2026–2028

2.2 Market Architecture and Participants

CTBCM introduces a fundamentally different institutional architecture compared to the Single-Buyer Model.

2.2.1 Market Participants

Table 2.2: CTBCM Market Participants and Roles

Participant Category	Role in CTBCM	Examples
Generators (IPPs)	Sell electricity via bilateral contracts or through auctions; merchant sales allowed	Hub Power, Engro Powergen, CPPGCL, Lucky Electric
GENCOs	State-owned generators transitioning to competitive market	GENCO-I (Jamshoro), GENCO-II (Guddu), GENCO-III (Muzaffargarh), GENCO-IV (Faisalabad)
Distribution Companies (DISCOs)	Procure power through bilateral contracts or IAA auctions; serve regulated consumers	LESCO, HESCO, MEPCO, PESCO, QESCO, SEPCO, IESCO, FESCO, GEPCO, TESCO, PHESCO
CPPA-G (Market Operator)	Settlement, balancing, invoicing, oversight; administers IAA auctions	Central Power Purchasing Agency – Government
NTDC (System Operator)	Grid operations, dispatch, transmission planning; obtaining separate SO licence	National Transmission & Despatch Company
Bulk Power Consumers	Consumers ≥ 1 MW can directly contract with competitive suppliers or DISCOs	Textile mills, cement plants, fertilizer units, steel mills, data centers
Electric Power Traders	Licensed intermediaries facilitating bilateral contracts	New entrants under EPT Regulations 2022
Competitive Suppliers	Supply electricity to bulk consumers at negotiated rates	New market entrants post-Phase 2
Independent Auction Admin. (IAA)	Administers centralized procurement auctions for DISCOs	New institutional role within CTBCM
K-Electric	Vertically integrated utility for Karachi; separate licensing regime	K-Electric Limited (private)

2.2.2 Market Implementation and Monitoring Group (MIMG)

NEPRA established the Market Implementation and Monitoring Group (MIMG) to oversee the transition and monitor compliance with CTBCM obligations. MIMG coordinates between NEPRA, CPPA-G, NTDC, DISCOs, and industry stakeholders, resolving implementation bottlenecks and tracking readiness milestones.

Additionally, NEPRA directed creation of Market Implementation and Regulatory Affairs Departments (MIRADs) within all 11 DISCOs to build procurement and contracting capacity at the distribution level.

2.3 Current Power Sector Snapshot (2025)

46,605 MW Installed Capacity (Mar 2025)	~41,000 MW Dependable Capacity (FY24)	~29,000 MW Peak Demand	~12,000+ MW Surplus Capacity
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Table 2.3: Pakistan Generation Capacity Mix (FY2024–25)

Generation Source	Installed Capacity (MW)	Share of Installed (%)	Generation Share FY24 (%)
Hydropower (WAPDA)	~9,800	21%	~29% (40 TWh)
Thermal (Gas/RLNG)	~11,000	24%	~25% (22% RLNG)
Coal (Thar + Imported)	~8,900	19%	~16%
Nuclear (PAEC)	~3,500	8%	~15% (high-capacity factor)
Wind	~2,100	5%	~4%
Solar PV (Utility-Scale)	~1,100	2%	~1.5%
Rooftop Solar (Net-Metered)	~4,900 (Mar 2025)	~10%	Off-grid, growing rapidly
Other Renewables (Bagasse)	~400	1%	~0.5%
Furnace Oil	~4,800	10%	~6%
Total	~46,605	100%	100%

SOLAR BOOM

Pakistan imported 17 GW of solar PV panels in 2024 alone — nearly half of the national grid's total installed capacity — driven by 50% price drops, government tax exemptions, and surging electricity tariffs. By March 2025, net-metered rooftop solar capacity reached 4.9 GW. Behind-the-meter installations remain largely undocumented, suggesting actual solar capacity is significantly higher.

2.4 Pricing Mechanisms Under CTBCM

CTBCM introduces a multi-layered pricing architecture that moves Pakistan away from administratively determined tariffs toward market-discovered prices:

2.4.1 Bilateral Contract Pricing

- **Standardized Contracts:** Fixed terms specified by the Market Operator; price components include energy charge, capacity charge, and T&D wheeling tariff
- **Customized Contracts:** Tailored to mutual agreement between generators and bulk consumers, coordinated with MO approval
- **Consumer Choice:** Eligible consumers (≥ 1 MW) may choose between their DISCO's regulated tariff or a competitive supplier's negotiated rate
- **Wheeling Charges:** Consumers using the grid for power delivery pay NTDC/DISCO Use of System Charges (UoSC) — a regulated 'toll' for transmission and distribution infrastructure

2.4.2 Reference Tariffs and Cost Comparison

As of 2024–25, regulated electricity tariffs for industrial consumers stood at approximately PKR 65/kWh, making Pakistan's industrial electricity among the most expensive in the region.

Table 2.4: Industrial Electricity Tariff Comparison

Country	Industrial Electricity Tariff (Approx.)	CTBCM / Market Comparison
Pakistan (2024–25)	PKR 65/kWh (~\$0.23/kWh)	Among highest in region — primary CTBCM reform driver
Bangladesh	~\$0.08–0.10/kWh	Subsidized, competitive for textiles
India	~\$0.08–0.12/kWh	Open Access available; competitive market maturing
Vietnam	~\$0.08/kWh	Competitive for manufacturing FDI
Turkey	~€0.09–0.12/kWh	BILAT contracts available since 2006
Pakistan (CTBCM Target)	PKR 30–40/kWh (projected)	Competition to drive down costs 30–50%

2.5 Contract Types and Bilateral Market Operations

Under the Market Commercial Code (MCC), the following contract structures govern electricity transactions:

CTBCM Contract Types

- **Power Purchase Agreements (PPAs):** Long-term contracts between generators and DISCOs/buyers (5–25 years)
- **Competitive Bilateral Contracts:** Directly negotiated between generators and eligible bulk consumers (≥ 1 MW)

- Short-Term Contracts: Spot and near-term purchases for flexibility and balancing
- Merchant Sales: Generators not under PPAs can sell on merchant/spot basis
- Auction-Based Contracts: DISCOs procure through IAA-administered competitive auctions for standardized power

2.6 Challenges in Current Implementation

Despite the formal launch in May 2022, CTBCM's full operationalization has faced significant headwinds:

- Use of System Charges (UoSC): DISCOs and the Energy Ministry resisted engaging in UoSC determination hearings throughout 2023, stalling commercial market launch; no UoSC was formally approved by NEPRA by end-2023
- DISCO Institutional Capacity: Most DISCOs lack the financial discipline, credit rating, and technical expertise for active bilateral procurement; MIRADs are still being built up
- IPP Renegotiations: Ongoing PPA renegotiations create investor uncertainty; 5 IPP contracts terminated in 2024, with 18 others under revision — complicating bilateral market entry
- Rooftop Solar Disruption: 17 GW of solar panel imports in 2024 have radically altered the demand profile, reduced grid consumption and raising per-unit fixed costs for remaining captive consumers
- Governance Resistance: Entrenched interests within DISCOs and the power ministry have resisted market reforms that would reduce their control over procurement

SECTION 3: FUTURE OUTLOOK

3.1 Demand Growth Projections (2025–2035)

Pakistan's electricity demand trajectory is subject to significant uncertainty, shaped by competing forces: economic growth driving demands up, while rooftop solar and energy efficiency are reducing grid demand. The IGCEP 2024 (covering 2024–2034) provides the most current official planning basis.

Table 3.1: Pakistan Electricity Demand Forecasts (2025–2035)

Scenario	FY2025 Demand	FY2030 Demand	FY2035 Demand	CAGR
IGCEP 2024 Base Case	~130 TWh	~165 TWh	~215 TWh	~5%
IGCEP 2024 High Demand	~140 TWh	~185 TWh	~240 TWh	~6%
IEEFA Estimate	~125 TWh	~155 TWh	~195 TWh	~4%
Low Growth (Solar + Efficiency)	~120 TWh	~135 TWh	~155 TWh	~2–3%
Peak Demand (MW) — Base	~29,000 MW	~38,000 MW	~50,000 MW	~5%

DEMAND UNCERTAINTY

Electricity demand in Pakistan has consistently been over-forecast by official planning bodies. Actual FY2024 consumption (111,110 GWh) fell below IGCEP 2020 projections by 15–20%. The rapid uptake of distributed solar — 17 GW imported in 2024 alone — has fundamentally disrupted demand modeling assumptions. Revised IGCEP 2024 adopts more conservative demand forecasts.

3.2 Renewable Energy Expansion

Pakistan possesses extraordinary renewable energy potential — estimated at over 340 GW of technically exploitable wind and solar resources. The government has set ambitious targets for clean energy integration:

Pakistan's Renewable Energy Targets

- ARE Policy 2019: 20% renewable capacity by 2025, 30% by 2030 (excluding hydro)
- IGCEP 2021 revised: 60–61% of generation from wind, solar, bagasse, and hydro by 2030
- Ember (2025): Pakistan aims for 58% renewable electricity by 2030 (incl. hydro)
- Climate NDC 2021: 60% electricity from renewables by 2030; 30% reduction in emissions per capita by 2030
- Solar Target: IGCEP 2024 optimizes for large-scale solar additions through 2034
- Major Hydro: 4,500 MW Diamer-Bhasha Dam (target commissioning: 2029), Dasu HPP (4,320 MW)
- Nuclear: Chashma Unit-5 (1,200 MW) under construction

Table 3.2: Renewable & Clean Energy Capacity Roadmap

Energy Source	Current Capacity (2025)	2030 Target/Projection	Key Projects
Large Hydro	~9,800 MW	~14,000 MW	Diamer-Bhasha (4,500 MW), Dasu (4,320 MW)
Wind	~2,100 MW	~4,000–5,000 MW	Jhimpir, Gharo corridor expansions
Solar PV (Utility)	~1,100 MW	~5,000–8,000 MW	Various under IGCEP 2024
Rooftop Solar	~4,900 MW (net-metered)	~10,000–15,000 MW	Consumer-led, driven by tariff differential
Nuclear	~3,500 MW	~4,700 MW	Chashma-5 (1,200 MW)
Coal (Thar domestic)	~2,640 MW	~3,200 MW	Thar Block II expansion
Total Renewables + Hydro + Nuclear	~21,500 MW	~35,000–38,000 MW	Targets ~58–60% generation share

3.3 CTBCM's Role in Reducing Circular Debt

Circular debt is at the heart of why CTBCM matters. The fundamental argument for CTBCM is that market-based procurement will impose discipline on an ecosystem that has chronically rewarded inefficiency.

3.3.1 CTBCM's Anti-Circular Debt Mechanisms

- **Elimination of Sovereign Guarantees:** Under CTBCM, new generators will no longer receive sovereign-backed take-or-pay guarantees. Credit risk will be borne by market participants — forcing bankability and commercial discipline
- **Competitive Pricing Pressure:** Generators facing competition will have incentive to operate efficiently; inefficient plants will naturally be dispatched less, reducing capacity payment obligations
- **Direct DISCO Accountability:** DISCOs required to actively procure and manage bilateral contracts will face direct financial consequences for procurement failures, ending the passive cost pass-through model
- **PKR-Denominated Contracts:** CTBCM enables local-currency contracts, reducing the foreign exchange exposure that has inflated capacity payments (many IPP PPAs are USD-indexed)
- **Merchant Market:** IPPs retiring from legacy contracts can sell power on merchant basis, receiving market prices rather than capacity charges — reducing guaranteed payment obligations

Table 3.3: CTBCM Impact on Circular Debt Components

Circular Debt Component	Current (2025)	CTBCM Impact (5–10 Year Horizon)	Mechanism
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Capacity Payments to IPPs	PKR 1.9 trillion/yr (FY24)	Reduced via competition + contract expiry	No new take-or-pay; market dispatch
T&D Losses	~17–20%	Modest improvement via accountability	DISCO billing discipline
DISCO Collection Shortfalls	~73.9% recovery ratio (FY24)	Improved competitive pressure via market	Creditworthiness requirements
Fuel Cost Indexation (USD)	~40–50% of IPP tariffs	PKR contracts for new entrants	Domestic currency contracts
Government Subsidies	~PKR 500B+/year	Reduced as market prices reflect reality	Targeted subsidies replace blanket

KEY INSIGHT

Removing capacity payments while keeping other cost factors unchanged would reduce the cost of electricity from PKR 30.6/kWh to PKR 12.8/kWh — a 58% reduction. CTBCM, by introducing competition for new capacity procurement and allowing uneconomic plants to retire naturally, is the structural mechanism for achieving this over time.

3.4 Industrial Competitiveness: CTBCM Opportunities

For Pakistan's export industries, CTBCM represents a potential competitive transformation. Direct access to negotiated electricity contracts — especially with renewable energy generators — can significantly alter cost structures:

Table 3.4: Industrial Sector CTBCM Opportunities

Sector	Current Energy Cost Burden	CTBCM Opportunity	Expected Benefit
Textiles	~15–20% of total cost; PKR 65/kWh grid tariff	Contract directly with wind/solar for PKR 25–35/kWh	35–45% energy cost reduction; ~5–7% total cost savings
Cement	~30% of production cost	Long-term bilateral contracts with hydro generators	10–20% cost reduction; improved margins
Fertilizer	~40–50% energy cost (gas + electricity)	Direct contracts; captive plant integration	Input cost reduction; urea price competitiveness
Steel (EAF)	~25–35% cost is electricity	High-voltage bilateral contracts with peaker plants	15–25% electricity cost savings

IT/Data Centers	Reliability critical; high tariffs	Contract with solar + battery; green energy certification	Reliability + ESG compliance + cost savings
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Carbon Border Adjustment Mechanism (CBAM) Alignment: From 2026, Pakistani exporters to the EU will face mandatory carbon pricing under CBAM for energy-intensive goods. Textiles (60% of exports), steel, cement, aluminium, and fertilizers are all affected. CTBCM's ability to enable direct procurement from renewable generators will allow Pakistani industries to decarbonize their energy mix and reduce CBAM liability — a critical competitive necessity.

3.5 Risks and Challenges

3.5.1 Governance and Political Economy

- Institutional resistance from DISCOs, which historically operated as passive pass-through entities and resist accountability-based procurement
- Energy Ministry's reluctance to cede procurement control; delays in UoSC approvals reflect turf-protection behavior
- Risk of regulatory capture — NEPRA must maintain independence from political pressures for tariff populism

3.5.2 Transmission Bottlenecks

- NTDC's transmission network has rated capacity of over 53,000 MVA but is plagued by aging infrastructure, congestion, and poor interconnections
- 88% of new generation projects in IGCEP through 2030 are already committed — meaning CTBCM's competitive price signals cannot easily redirect capacity in the short term
- Transmission expansion requires PKR 500+ billion in investment; CTBCM success depends on adequate wheeling infrastructure

3.5.3 Financial Sustainability

- With average plant utilization at 34%, stranded cost recovery remains a problem even as new contracts are negotiated
- Rooftop solar boom is further eroding grid revenue base, increasing per-unit fixed costs for remaining consumers
- The transition period creates a 'chicken-and-egg' problem: investment in competitive generation requires assured demand, but demand migration to CTBCM requires competitive pricing

3.5.4 Investor Confidence

- Repeated PPA renegotiations (1998, 2012, 2020, 2024) have damaged Pakistan's reputation as a secure IPP destination
- Coercive contract terminations criticized by IPP investors as undermining rule of law
- CTBCM's long-term credibility depends on NEPRA enforcing market rules transparently and consistently

3.6 Comparative Lessons/Scenarios

Table 3.5: Comparative Country Lessons for CTBCM

Country	Reform Model	Key Success Factors	Lessons for Pakistan
United Kingdom	Electricity Market Reform (EMR) 2013; Contracts for Difference (CfDs); Capacity Market (CM)	Long-term price stability via CfDs; CM incentivized flexible generation; 2022 auction secured 11 GW RE at record-low prices; 250,000 jobs created in clean energy	Use CfDs for renewable energy long-term revenue certainty; combine bilateral market with capacity market for security; accept short-term transition costs for long-term gains
Turkey	Bilateral electricity market since 2006 under EPIAS; EXIST spot market since 2015; ~60% of electricity traded through bilateral contracts	Phased liberalization; maintained regulated fallback for small consumers; transparent auction system for capacity procurement	Gradual opening prevents system shock; maintain regulated tier for small consumers while opening bulk market; invest in metering and settlement IT
India	Open Access framework; Power Exchanges (IEX, PXIL); competitive auctions; partial bilateral market	Solar auction prices below PKR 15/kWh; EV adoption driving demand growth offsetting losses	Auction-based RE procurement is proven; Open Access comparable to CTBCM; address T&D loss reduction simultaneously
Philippines	WESM (Wholesale Electricity Spot Market) since 2006; bilateral contracts + spot market	Clear market rules; independent market operator; phased consumer eligibility	WESM model is closest to CTBCM; independent market operation critical; ADB Energy Transition Mechanism applicable for stranded thermal retirement

SECTION 4: KEY FIGURES & DATA

4.1 Comprehensive Power Sector Statistics

46,605 MW (Mar 2025) Total Capacity	4,900 MW (Mar 2025) Net-Metered Solar	17 GW Solar PV Imported (2024)	53,000+ MVA Transmission Capacity
127,523 GWh Energy Generation FY24	111,110 GWh Energy Consumption FY24	~17–20% % of generation T&D Losses	73.9% % of bills recovered Recovery Ratio FY24

4.2 Financial Data

Table 4.1: Pakistan Power Sector Financial Metrics

Financial Metric	FY2022	FY2023	FY2024	Mar 2025
Capacity Payments (PKR trillion)	0.97	1.31	1.90	2.1+ (annualized)
Energy Purchase Price (PKR billion)	N/A	N/A	Declined YoY 7%	N/A
Circular Debt Stock (PKR trillion)	~2.0	~2.47	~2.4	2.396
Average Utilization Rate (%)	~38%	~36%	34%	<30% est.
Industrial Tariff (PKR/kWh)	~32	~42	~58	~65
Domestic Tariff (PKR/kWh)	~22	~32	~52	~62

4.3 CTBCM Reform Timeline Summary

Table 4.2: Complete CTBCM Reform Chronology

Year	Event	Key Outcome
1992	WAPDA Strategic Plan	Sector unbundling recommended

1994	Private Power Policy	IPP era begins
1997	NEPRA Act	Independent regulator created
2002	CPPA-G established	Single-buyer model formalized
2013	NEPRA Act Amendment	Wholesale market empowerment
2015	ECC Decision 78/9/2015	CTBCM formally approved by Cabinet
2015	Market Operator Rules	NEPRA issues MO framework
2018	CPPA-G as MO (Nov)	Market transition planning begins
2019	CTBCM High-Level Design	Conceptual architecture approved
2019	ARE Policy	30% renewables target by 2030
Nov 2020	CTBCM Detailed Design	Full CTBCM design and roadmap approved by NEPRA
2021	NEPRA Act Sec 23A	MO licensing made statutory
2021	National Electricity Policy	CTBCM embedded in national energy policy
May 2022	MO License + MCC Approval	CPPA-G licensed as MO; Market Commercial Code issued
May 31, 2022	CTBCM Trial Launch	6-month trial run directed by NEPRA
Aug 2022	Industry Consultations	NEPRA sessions with cement (APCMA) and FMCG on CTBCM
2023	UoSC Delays	DISCOs/Ministry resist hearings; market in limbo
Nov 2023	UoSC Hearing	Hearing held but no approval; market stalled
2024	IPP Renegotiations	5 IPP PPAs terminated; 18 under take-and-pay conversion
2024–25	Solar Disruption	17 GW solar imports reshape demand; CTBCM accelerated
2025–26	Target: Phase 2 Launch	Full bilateral market for bulk consumers

SECTION 5: INDUSTRIAL IMPLICATIONS

5.1 Sector-by-Sector Analysis

5.1.1 Textiles: Pakistan's Crown Jewel Industry

The textile sector is Pakistan's most critical manufacturing industry: it contributes ~25% of industrial GDP, employs ~40% of the industrial labor force, and accounts for 60% of total exports. It is also the most electricity-intensive sector.

Textiles Under CTBCM

- **Current Challenge:** Electricity tariff of ~PKR 65/kWh; load-shedding historically costing 6–12 hours/day; forced captive generation adds 8–12% to production costs
- **CTBCM Opportunity:** Direct bilateral contracts with solar/wind generators could bring tariff down to PKR 25–35/kWh
- **Carbon Competitiveness:** EU CBAM compliance requires decarbonized electricity; CTBCM enables green energy procurement contracts
- **Export Linkage:** 75.8% of textile exports go to EU; carbon-clean energy is a prerequisite for GSP+ retention
- **Employment Impact:** 15–20% energy cost reduction could restore 50,000–100,000 industrial jobs lost to high tariffs
- **NEPRA APCMA Sessions (Aug 2022):** All-Pakistan Cement Manufacturer Association (also representing textile interests) engaged in CTBCM consultations

5.1.2 Cement: Energy-Intensive and Export-Oriented

Pakistan's cement industry is among Asia's largest, with installed capacity exceeding 70 million tonnes per year. Electricity accounts for approximately 30% of production cost (primarily for grinding mills), making tariff sensitivity extremely high.

Cement Under CTBCM

- **Current Energy Cost:** ~30% of total production; dominated by electricity for grinding + kiln fuel
- **CTBCM Model:** Long-term bilateral contracts with hydro generators offer stable, competitively priced power
- **Regional Export Competition:** Afghan, Indian, and Chinese cement competes with Pakistan; cost reduction critical
- **CBAM Exposure:** Cement is in Phase 1 CBAM (from 2023); carbon-intensity reporting mandatory
- **NEPRA Sessions:** APCMA directly engaged in Aug 2022 CTBCM workshops

- Captive Generation Transition: Many mills have gas gensets; CTBCM allows migration to grid bilateral contracts when cheaper

5.1.3 Fertilizers: Critical for Food Security

Pakistan's fertilizer industry — dominated by urea production — is a dual-energy-intensive sector: it relies on natural gas as both fuel and feedstock, plus significant electricity consumption for milling and transport processes.

Fertilizer Under CTBCM

- Energy Share: 40–50% of total urea production cost is energy (gas + electricity)
- Gas Crisis: Depleting domestic gas reserves force switch to expensive RLNG; electricity cost becomes proportionally more significant
- CTBCM Benefit: Direct bilateral electricity contracts reduce input cost; supports competitiveness vs. imported urea
- Food Security Link: High fertilizer input costs translate to higher food prices; CTBCM reform has direct food security implications
- CBAM Phase 2: Fertilizers likely to be included in expanded CBAM scope; decarbonized power essential

5.1.4 Steel: Electric Arc Furnace Sector

Pakistan's steel industry, predominantly based on Electric Arc Furnace (EAF) technology, is directly dependent on electricity. High tariffs have made domestic production uncompetitive with imports from China, Turkey, and Ukraine.

Steel Under CTBCM

- Energy Dependency: EAF steelmaking consumes 300–400 kWh per tonne; electricity is 25–35% of variable cost
- Current Disadvantage: At PKR 65/kWh, Pakistani EAF steel is significantly more expensive than imported alternatives
- CTBCM Mechanism: Large steel consumers (>1 MW, typically much larger) can negotiate directly with generators
- CBAM Direct Exposure: Iron and steel is in Phase 1 CBAM from 2023; carbon-clean electricity is mandatory for EU market access
- Investment Incentive: Lower energy costs under CTBCM could attract investment in value-added steel production

5.1.5 IT and Data Centers: The Emerging Sector

Pakistan's IT sector — growing at 20%+ annually and generating \$2.6 billion in exports (FY24) — requires reliable, affordable electricity. Data centers are 24/7 consumers for whom reliability is even more critical than tariff levels.

IT/Data Centers Under CTBCM

- Reliability Critical: Uptime requirements of 99.9%+ cannot be met under current load-shedding regime
- CTBCM Opportunity: Contract with solar + battery storage generators for guaranteed, uninterrupted supply
- Green Data Centers: Global tech companies require Renewable Energy Certificates (RECs) for sustainability reporting
- CTBCM + RE = Green Power Certificates: Bilateral contracts with solar/wind generators can be structured as green power contracts
- Strategic Importance: Pakistan aims to scale IT exports to \$10B by 2030; reliable energy is prerequisite

5.2 Sectoral Electricity Consumption Breakdown

Table 5.1: Sectoral Electricity Consumption (FY2024)

Sector	FY24 Share	Consumption	FY24 GWh	Growth Trend
Residential	~46%		~51,000 GWh	Declining (solar migration)
Industrial	~27%		~30,000 GWh	Declining (solar + economic slowdown)
Agricultural	~12%		~13,300 GWh	Stable
Commercial	~8%		~8,900 GWh	Modest growth
Government/Other	~7%		~7,800 GWh	Stable
Total Grid Sales	100%		~111,110 GWh	-3.6% YoY in FY24-25

Within the industrial sector, the priority sectors for energy efficiency and CTBCM engagement based on energy intensity and CO₂ emissions intensity are: cement, textiles, steel, fertilizers, and paper/pulp manufacturing. In FY2022–23, final energy consumption in the industrial sector totaled approximately 14,197 MTOE.

SECTION 6: POLICY & COMMITMENTS

6.1 NEPRA's Official Commitments for CTBCM

NEPRA's Formal Commitments

- Phased CTBCM implementation with regulatory milestones for each phase
- Market Operator licensing and Market Commercial Code enforcement
- Issuance of 8 new NEPRA regulations in 2022 providing full legal framework
- Creation and oversight of MIMG for implementation monitoring
- Direction to all licensees to commence trial run from May 31, 2022
- Direction to NTDC to obtain separate System Operator license
- Direction to DISCOs to establish MIRADs (Market Implementation and Regulatory Affairs Departments)
- Use of System Charges (UoSCh) determination for fair grid access pricing
- NEPRA PSCE (Power Sector Centre of Excellence) at LUMS for capacity building
- IT infrastructure: Market Management System (MMS) and automated dispatch (SDXP)

6.2 Government Energy Transition Targets

Table 6.1: Government Energy Policy Commitments

Policy / Target	Commitment	Deadline	Status
ARE Policy 2019	20% renewable capacity	2025	Partially achieved via rooftop solar; utility-scale behind target
ARE Policy 2019 (Phase 2)	30% renewable capacity	2030	On track with hydro + solar trajectory
IGCEP / National Policy	60% clean energy (RE + hydro + nuclear)	2030	Hydro + nuclear provide ~44%; solar + wind to bridge gap
NDC 2021	30% emissions reduction per capita vs BAU	2030	Dependent on energy transition progress
CTBCM Full Launch	Competitive wholesale electricity market	2025–2026 (revised)	Phase 2 implementation in progress
Circular Debt Resolution	End net accumulation of circular debt	2027 (IMF target)	IMF 9th Review conditional on debt flow containment
Regional Power Trade	CASA-1000 and SAARC energy connectivity	2025–2028	CASA-1000 (Tajikistan-Pakistan) under construction

EV Policy	30% electric vehicles in new sales by 2030	2030	Policy in place; implementation early stage
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6.3 International Commitments: Paris Agreement & SDGs

Pakistan's energy reforms, including CTBCM, are embedded within a broader framework of international obligations:

6.3.1 Paris Agreement Alignment

- Pakistan ratified the Paris Agreement in 2016, committing to NDCs that include energy sector decarbonization
- Updated NDC (2021) commits to 50% of electricity from renewable sources by 2030 (under certain scenarios) and 30% reduction in projected GHG emissions per capita
- CTBCM directly enables NDC implementation by creating market conditions for renewable energy investment without guaranteed sovereign off-take
- Carbon pricing alignment: CTBCM's market-based pricing can integrate carbon pricing mechanisms in future phases

6.3.2 SDG Alignment

- SDG 7 (Affordable and Clean Energy): CTBCM is central to reducing electricity costs and expanding clean energy access
- SDG 8 (Decent Work and Economic Growth): Lower industrial energy costs support manufacturing competitiveness and employment
- SDG 9 (Industry, Innovation, Infrastructure): CTBCM modernizes energy infrastructure and enables industrial innovation
- SDG 13 (Climate Action): Enables renewable energy deployment at scale through competitive market mechanisms
- SDG 17 (Partnerships): Supported by ADB, World Bank, USAID, and bilateral technical assistance programs

6.3.3 ADB Support and Energy Transition Mechanism

- ADB has provided technical assistance across CTBCM's entire design cycle from 2015–2022
- ADB's Energy Transition Mechanism (ETM) offers concessional financing for early retirement of coal and oil plants, potentially applicable to Pakistan's aging IPP fleet
- ADB-financed Jamshoro Coal-Fired Power Plant (ironically) represents a stranded asset challenge CTBCM must address
- World Bank's Pakistan Sustainable Energy Program (P169313) provides complementary support for energy efficiency and market readiness

6.4 Key Stakeholder Commitments

Table 6.2: Stakeholder Commitments Matrix

Stakeholder	Commitment	Mechanism
NEPRA	Phased market opening; regulatory oversight; Market Commercial Code enforcement	NEPRA Act; 2022 Regulations; MIMG
CPPA-G (Market Operator)	Neutral market operation; settlement; IAA administration; MMS platform	MO Licence 2022; MCC 2022
NTDC (System Operator)	Grid operations; separate SO licence; Transmission System Expansion Plan (TSEP)	SO Licence Application; IGCEP 2024
DISCOs (11 companies)	Establish MIRADs; bilateral procurement plans; credit-rated off-take	MIMS directions from NEPRA
PPIB / Ministry of Energy	New IPP contracts under competitive rather than sovereign-guaranteed terms	ARE Policy 2019; NEP 2021
Government of Pakistan	IMF conditions on energy sector reform; circular debt containment; tariff rationalization	IMF SBA Program (2023–present)
ADB	Technical assistance; loan financing for transition; ETM support	ADB TRTA; ETM framework
IPPs (transitioning)	Access to bilateral market; merchant sales; quick unpaid dues settlement	CTBCM commercial framework
Industry (textile, cement, etc.)	Register as bulk consumers; negotiate bilateral contracts; invest in energy efficiency	Consumer Eligibility Regulations 2022

6.5 Critical Path for CTBCM Success

Based on international experience and Pakistan-specific analysis, the critical path for CTBCM's successful implementation requires:

Critical Success Factors

- 1. Use of System Charges (UoSC): NEPRA must finalize and gazette UoSC determination — the most immediate unresolved prerequisite
- 2. DISCO Creditworthiness: DISCOs must improve financial standing to become credible bilateral contract counterparties
- 3. Transmission Investment: PKR 500+ billion in NTDC grid expansion to eliminate bottlenecks that constrain market dispatch
- 4. IT Infrastructure: Full deployment of MMS and SDXP platforms for transparent settlement and dispatch automation

- 5. IPP Transition: Orderly transition of legacy IPP contracts to market terms — commercially transparent, not coercive
- 6. Regulatory Consistency: NEPRA must maintain independence and enforce rules consistently to rebuild investor trust
- 7. Consumer Education: Bulk consumers need guidance on how to navigate bilateral contracting — NEPRA's industry workshops are a start
- 8. Renewable Energy Auctions: IAA must conduct transparent, competitive auctions to procure new capacity under CTBCM rather than negotiated PPAs

CONCLUSION

Pakistan's CTBCM reform is both necessary and overdue. The Single-Buyer Model that served as the backbone of Pakistan's electricity sector for two decades has reached the limits of its viability. It has produced a sector with 46.6 GW of installed capacity against 29 GW of peak demand, a circular debt of PKR 2.4 trillion, capacity payments devouring PKR 1.9 trillion annually, industrial tariffs that have made Pakistan's exports uncompetitive, and a solar disruption that is fundamentally changing the demand landscape regardless of whether the market reforms proceed.

CTBCM offers a structural solution: by introducing competition in wholesale electricity markets, enabling direct bilateral contracting between generators and bulk consumers, and phasing out the sovereign-guarantee-backed single-buyer model, Pakistan can gradually move toward a market where electricity prices reflect actual costs, inefficient plants face natural market pressure to retire, investment flows to renewable energy based on commercial rather than politically negotiated terms, and industries gain the energy cost competitiveness needed to compete in global markets.

The reform is not without significant risks. Governance resistance, transmission bottlenecks, investor confidence concerns stemming from IPP renegotiations, and the dramatic disruption of rooftop solar adoption all create implementation challenges. Pakistan's track record of delayed reforms — CTBCM was first directed by NEPRA for completion by 2009 — demands cautious optimism.

ASSESSMENT

CTBCM represents Pakistan's best structural bet for a fiscally sustainable, industrially competitive, and climatically responsible electricity sector. The regulatory framework is in place. The political consensus, expressed through multiple cabinet approvals and NEPRA directives, is established. What remains is disciplined, consistent implementation — a challenge of governance and political economy as much as technical design. The alternative — continuing with a monopolistic, subsidy-dependent single-buyer model — leads only to deeper circular debt, further industrial decline, and missed climate targets.

Key Data Sources: NEPRA State of Industry Reports (2022–2024); CPPA-G Market Operator Licence Application (2022); NEPRA CTBCM Official Page (nepra.org.pk/ctbcm.php); Pakistan Electricity Review 2025 (Renewables First); IGCEP 2024 (NTDC/NEPRA); IEEFA Pakistan Power Sector Reports (2024); Pakistan Economic Survey 2024–25 (MoF); World Bank Pakistan Country Climate Report; International Growth Centre Pakistan Energy Reports; Dawn.com CTBCM Analysis (May 2025); Wikipedia Electricity Sector in Pakistan; SDPI CTBCM Working Papers.