



POWER SECTOR

AN ENIGMA WITH NO EASY SOLUTION

Edited by

Tahir Basharat Cheema, Nadeem Ul Haque and Afia Malik

POWER SECTOR

An Enigma with No Easy Solution

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Research for Social Transformation & Advancement

Pakistan Institute of Development Economics, Islamabad

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Book reviewed by Mr Anwar Kamal (Senior Advocate, Supreme Court of Pakistan, and Former Advisor to the National Electric Power Regulatory Authority)

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LIST OF ACRONYMS

ADB	Asian Development Bank
AEBS	Area Electricity Boards
AEDB	Alternate Energy Development Board
AGC	Automatic Generation Control
AGP	Auditor General of Pakistan
AI	Artificial Intelligence
AJK	Azad Jammu & Kashmir
AMI	Advanced Metering Infrastructure
ARE	Alternate and Renewable Energy
AT&C	Aggregate Technical and Commercial
B2B	Business-to-Business
BODs	Board of Directors
BOO	Built Own Operate
BOOT	Built Own Operate Transfer
BPCs	Bulk Power Consumers
CBA	Collective Bargaining Agreement
CCGT	Combined Cycle Gas Turbine
CCPPs	Combined Cycle Power Plants
CD	Circular Debt
CDWP	Central Development Working Party
CEO	Central Executive Officer
CFPPs	Coal Fired Power Plants
CPEC	China Pakistan Economic Corridor
CPGCL	Central Power Generation Company Limited
CPP	Capacity Purchase Price
CPPA-G	Central Power Purchasing Agency
CSD	Customer Service Director

CTBCM	Competitive Trading Bilateral Contract Market
CTOs	Chief Technology Officers
DBT	Decreasing Block Tariff
DC	Direct Current
DG	Distributed Generation
DISCO	Distribution Company (Public Sector)
EMS	Energy Management System
EPP	Energy Purchase Price
FATA	Federally Administered Tribal Area
FBC	Fluidized Bed Combustion
FCOs	Field Circle Offices
FESCO	Faisalabad Electric Supply Company
FSC	Fuel Supply Contract
GENCO	Public Sector Generation Company
GEPCO	Gujranwala Electric Power Company
GHCL	Generation Holding Company Limited
GIS	Geographical Information System
GOP	Government of Pakistan
GPP	Government Power Plants
GWh	Gigawatt hours
HESCO	Hyderabad Electric Supply Company
HQs	Headquarters
HRD	Human resource Development
HRM	Human Resource Management
HT	High Tension
HUBCO	Hub Power Company Limited
IESCO	Islamabad Electric Supply Company
IFIs	International Financial Institutions
IGCEP	Integrated Generation Capacity Expansion Plan
IPPAC	Independent Power Plants Association

IPPs	Independent Power Plants
IT	Information Technologies
KAPCO	Kot Addu Power Company Limited
KE	K-Electric
KPK	Khyber Pakhtunkhwa
KWh	Kilowatt hours
LDC	Load Dispatch Center
LESCO	Lahore Electric Supply Company
LOI	Letter of Intent
LT	Low Tension
MD	Managing Director
MO	Market Operator
MEPCO	Multan Electric Power Company
MLDA	Multilateral Donor Agency
MOU	Memorandum of Understanding
MP&M	Material Procurement and Management
MVA	Mega Volt Amp
MW	Megawatt
NEPRA	National Electric Power Regulatory Authority
NPCC	National Power Control Center
NPMV	Non-Project Missed Volume
NTDC	National Transmission and Dispatch Company
O&M	Operation & Maintenance
OEMs	Original Equipment Manufacturers
OFGW	Optic Fiber Ground Wire
PAR	Power Acquisition Request
P&D	Planning and Development
PC	Planning Commission
PD	Power Division
PD-MoE	Power Division, Ministry of Energy

PEDO	Pakhtunkhwa Energy Development Organization
PEPCO	Pakistan Electric Power Company
PESCO	Peshawar Electric Supply Company
PHPL	Power Holding Private Limited
PLC	Power Line Carrier Communication System
PMDC	Pakistan Mineral Development Corporation
PMOs	Project Management Operations
POE	Panel of Experts
PP&MC	Power Planning and Monitoring Company
PPA	Power Purchase Agreement
PPDB	Punjab Power Development Board
PPIB	Private Power and Infrastructure Board
PPRA	Public Procurement Regulatory Authority
PSCEs	Power Sector Corporatized Entities
PSDP	Public Sector Development Program
PSO	Pakistan State Oil
QASPP	Quaid-e Azam Solar Power Park
QESCO	Quetta Electric Supply Company
R&D	Research and Development
RCC	Regional Control Centre
RFO	Refined Furnace Oil
RLNG	Regassified Liquefied Natural Gas
RTUs	Remote Terminal Units
SBP	State Bank of Pakistan
SCADA	Supervisory Control and Data Acquisition
SDGs	Sustainable Development Goals
SECP	Security and Exchange Commission of Pakistan
SEPCO	Sukkur Electric Power Company
SO	System Operator
SOPs	Standard Operating Procedures

SSGC	Sui Sothern Gas Company
SVC	Static Var Compensator
T&D	Transmission and Distribution
TDCs	Tariff Differential Claims
TESCO	Tribal Electric Supply Company
TOU	Time of Use
TSEP	Transmission System Expansion Plan
UHV	Ultra-High Voltage
USAID	United States Agency for International Development
WAPDA	Water and Power Development Authority
WB	World Bank
WPP	Wind Power Plants

PREFACE

Pakistan's energy sector has been in crisis for years. Supply shortages persist while losses increase continuously. Too many players in the system confuse each other to cumulate losses and give subsidies while, at the same, the circular debt is rising continually. The government is borrowing from commercial banks to finance the sector deficit. The demand-supply gap has evolved over the years from deficits to excess installed capacity, but there is a shortage of cash flows and supporting infrastructure to run it. The result is load shedding. Surprisingly, no government has taken it seriously, saying decisions are too difficult. No serious research has gone into understanding the issues. No white paper has ever been prepared.

Mismanagement/ weak governance is at every stage in the supply chain. Our decision-makers' lack of informed long-term vision has led to distribution side inefficiencies, expensive fuel mix, and rising capacity payments. The results are unreliable electricity supplies, unaffordable electricity, and increasing business costs. There is no well-thought-out integrated energy plan.

The government's only plan to tackle the long-standing financial issue is to increase consumer-end tariffs. An increase in tariffs, in the presence of so many inefficiencies in the system, further adds to the power sector deficit; circular debt. Besides, an increase in consumer-end tariffs is further burdening compliant consumers.

Policymakers are taking decisions randomly or on the advice of international financial institutions; who don't understand the local dynamics of the problem. There is a limited understanding of the value and operational electricity chain problems. There is a lack of a holistic power sector approach. For instance, the Competitive Trading Bilateral Contract Market (CTBCM) prepared by an international consultant is approved to be implemented without realizing that market development is complex and must meet specific prerequisites. The reason is the shortage of in-depth policy research covering all power sector units.

Under the guidance of Dr Nadeem Ul Haque, PIDE prepared a detailed power sector study to fill the research gap. PIDE formed a 'PIDE Power Commission' comprising

experts from the power sector carrying decades of policy and operational experience. This in-depth research on the power sector, with the hard work of experts in the Commission, with rich and deep insights on various segments of the power sector, has come up with a workable, sustainable, and integrated solution to power sector woes.

The book highlights premier challenges in the power supply chain, including generation, transmission, distribution, regulations, tariffs, power sector/project planning, asset management and control, competitive market, and independent power plants (IPPs). While going through the comprehensive overview of the power sector, the book has proposed immediate, medium, and long-term policy interventions.

It is hoped that the decision-makers will consult this book and actionable suggestions presented in it while taking policy decisions to make the sector financially viable.

PIDE POWER COMMISSION

Objective:

A financially viable power sector with supply reliability, competitive & affordable tariffs, relying on indigenous and green energy resources, with access to electricity for all.

Commission Members

- Engr TAHIR BASHARAT CHEEMA (Former MD, PEPCO) – Team Lead
- Engr SALIS USMAN (General Manager, Power Planning, NTDC)
- Engr MUJAHID ISLAM BILLAH (Ex. CEO, FESCO)
- Mr BASHARAT ALI (CFO, PEPCO)
- Engr SAJAD HAIDER SYED (Deputy Manager, NTDC)
- Engr MASOOD AKHTAR (Former GM, NPCC)
- Engr AZHAR IQBAL (Director Finance, PEPCO)

- Engr ADNAN RIAZ MIR (General Manager, Monitoring, PP&MC)
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- Dr NADEEM UL HAQUE (Vice Chancellor, PIDE)
- Ms AFIA MALIK (Senior Research Economist, PIDE)

EXECUTIVE SUMMARY

PIDE Power Commission, led by Engr Tahir Basharat Cheema, is the most knowledgeable energy team ever assembled in the energy sector. The team has assiduously researched the entire power supply chain, including generation, transmission, distribution, regulations, tariffs, power sector/project planning, competitive market, and private power projects. The book has gone into power sector history and every power supply chain segment to find the current crisis's root.

The book is organized into twelve chapters. The first chapter discusses the premier challenges faced by the power sector. Chapter Two compares the operational and commercial efficiency across distribution companies. This chapter primarily reflects on the reasons behind the deficient performance of distribution companies. Chapter Three highlights that it is impossible to deal with distribution challenges without considering some external factors linked with distribution companies' performance. Chapter Four elaborates on the challenge of privatizing the monopolized utility.

Chapter Five highlights the evolution of the generation side of the electricity supply chain. It explains how and when things got worse in terms of ownership, quality, and fuel mix. Chapter Six explains the advent of IPPs in the Pakistan Electricity System. What was wrong with the policies, and how these adversely affected the future landscape of the power sector.

Chapter Seven discusses the load dispatch systems, challenges, and causes of power breakdowns/blackouts in the NTDC system and why the system faced delays in restoration. Chapter Eight deliberates power procurement challenges and hurdles. The chapter also reflects on weaknesses in asset management and the reasons behind them. Chapter Nine is about power system planning. The chapter reflects on the planning failures of the last three decades, the role of NTDC in power planning and factors affecting planning processes and practices. The chapter traced history to connect distribution performance with distribution system planning.

Chapter Ten is about regulatory affairs and consumer-end tariffs. It reviews NEPRA performance, the tariff determination process, tariff anomalies and the current tariff structure. Chapter Eleven delves into the forthcoming Competitive Trading Bilateral Contract Model (CTBCM) and finds that establishing a power exchange market in Pakistan in the current scenario seems impracticable. The focus should be on bilateral contracts.

The final chapter provides a future architecture for the power sector in Pakistan. This chapter details the revenue recovery plan, managerial reforms, and the significance of technology and renewable energy sources.

The main recommendations include:

Distribution

- *Decentralize power for better management; make companies accountable for their decisions.*
- *Split large DISCOs to prevent large natural monopolies from using market power for advantages. Smaller units can be administered more effectively.*
- *The strengthening of human resources at all levels through independent professional management and Human Resource Management (HRM).*
- *Mandate listing of the DISCOs in the stock exchange with a limit of 5% maximum by one shareholder; let the institutional investors come in and manage the business.*
- *An independent/apolitical board with sufficient capabilities to develop a business model. Board members should be chosen, bearing in mind the conflict of interest of industrialists who demand benefits from companies.*
- *Upgrade distribution infrastructure at the earliest (max 3-5 year depending on specific up-grade modules). DISCOs must be mandated to do that with matching funds from PSDP and their resources.*
- *Only an affordable tariff in different geographical parts of the country can enable effective revenue collection and improvement of financial health for investment in infrastructure up-gradation.*
- *Decentralize the electricity billing system at the DISCO level. The ultimate solution is the pre-paid smart metering system linked to the DISCO billing system.*
- *The future strategy for each state-owned company needs to be thoroughly grounded in its service area's political, economic, social, environmental, and urban governance realities.*
- *Outright privatization is not feasible, only a time-bound management contract of selected areas.*

- *One thing is clear: the DISCOs could not be improved until unprofessional bureaucracy is involved in its affairs.*

Generation

- *Forensic audit of both public and private generation companies immediately, followed by recoveries without any relaxation from IPPs.*
- *There should be no conditionalities for the IPPs in the pipeline.*
- *In future, no sovereign guarantees; all investments must be based on competition and the financial dynamics of the sector. A competitive bidding document must be in place before commissioning future projects.*
- *In the short term, a moratorium on IPPs, including the proposed solar projects of 10,000MW.*
- *So many parallel sector entities with limited capacity cannot safeguard the people's interests needs to reduce the number & strengthen the remaining.*

Power Control & Allied Issues

- *Comprehensive grid studies for steady-state and transient stability and reliability, considering the renewables and future energy plans up to 2040, are critical.*
- *The priority in cost allocation for capacity building and training concerned staff is a must.*

Asset Management and Procurement in Power Sector

- *Ensure proper coordination between the functional departments*
- *Deputation of dedicated project managers and improved project management practices is necessary.*
- *Developing PMOs and SOPs, etc., can be the starting point toward the reform process.*

- *There is a need to have a set of coordinated activities that improve the performance and quality of the electricity grid.*
- *Major equipment replacement work, extension requirements, and rehabilitation works need to be reviewed and prioritized based on power system planning studies, substation and transmission line constraints and system stability.*
- *Intelligent Power Network Stability systems with vital telecommunication media should replace the under/over frequency schemes..*
- *For a well-developed asset management framework, understand and include available techniques in the strategic planning of the power industry.*
- *A progressive development, i.e., continuously evolving processes, is required to develop the asset management system..*

Power System Planning

- *Fragmentation in power planning must change and go over to the Planning Commission (PC).*
- *It is time that NTDC and DISCOs build their professional and institutional capacity, launch formal R&D components in their organization, and encourage their professionals to proactively contribute to the PC's planning process.*
- *Policymakers/planners should understand the complex economic, political, water, and environmental interrelations and energy systems' uncertainties.*
- *Coordination in the planning process at the PC should not be limited to the energy sector but serious consultation with other sectors.*

Regulation & Consumer-end Tariffs

- *NEPRA must be empowered to play its role as specified in Clause 31 of the NEPRA Act. NEPRA should eliminate all kinds of subsidies and cross-subsidies from the tariff*
- *NEPRA needs to simplify its rules and processes to minimize delays.*
- *NEPRA needs to build its capacity to work and cope with sector challenges and market forces while meeting its obligations as a regulator.*

- *For recovery of capacity payments, there is a need to increase sales/ consumption by reducing prices significantly.*
- *Transitioning from a deficit regime to a surplus one requires changing the load separation model for power tariffs.*
- *Tariff structure should be based on economic efficiency, cost recovery, simplicity, transparency, and non-discrimination.*
- *A linear (flat) tariff rate is the best way to maximize revenues and minimize inefficiencies in the sector.*
- *Notify differential tariffs for each geographical market (DISCO), that is, tariff determination based on service cost.*
- *All the socio-economic and political obligations of the government must be duly budgeted and not part of consumer tariffs to burden compliant consumers. We already have a social protection system. There is no need to subsidize electricity.*

Electricity Market: CTBCM

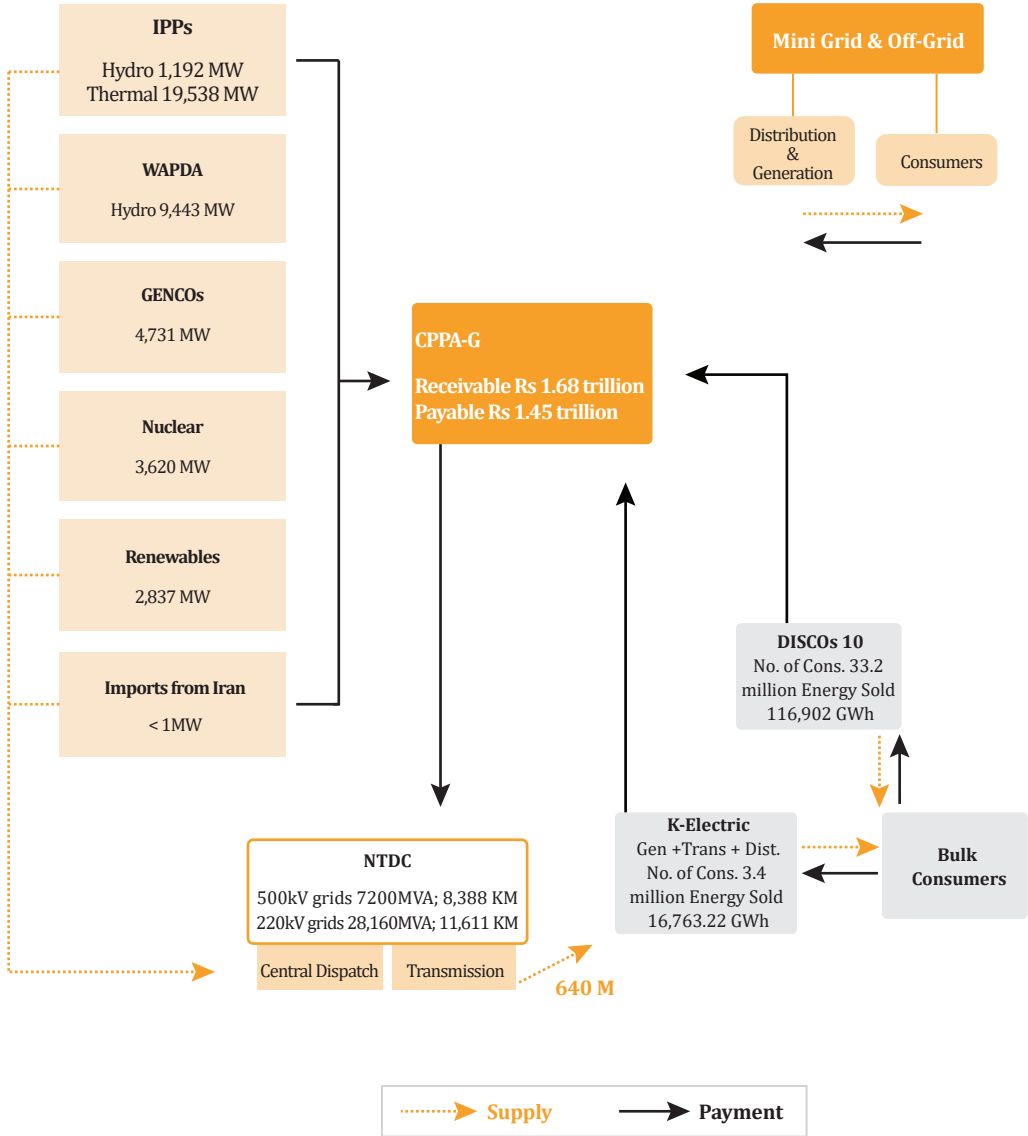
- *The market should start with bilateral contracts keeping transmission constraints and participants' capacities in mind. When demand and supply balance and the market attain more maturity, establish an electricity trading platform.*
- *All DISCOs should also be allowed to purchase energy on a short-term contract and acquire generation assets falling inside their territorial jurisdictions and outside.*
- *NEPRA should facilitate 'wheeling' by discouraging those creating hurdles, with wheeling costs equivalent to MC.*
- *Negotiate PPAs with IPPs to free at least 50% of their capacity to be traded in the market.*
- *The electricity market requires legal, regulatory, financial, and human capacity at every level - build the capacity first.*

Future Architecture of the Power Sector

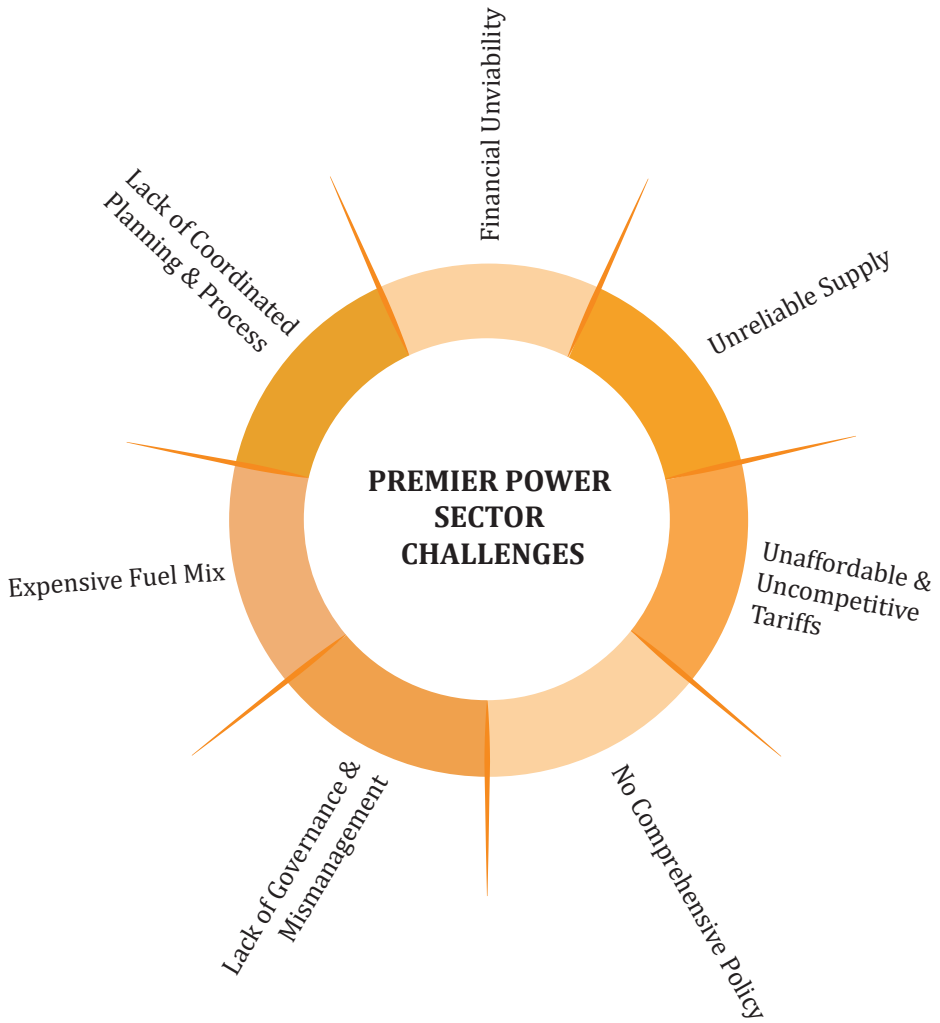
- *Reduce the government footprint and ultimately move the government out of the power sector by 2030.*
- *HRD and HRM are compulsory for a successful entity. Upgrade the training institute(s) of WAPDA considering the present-day requirements.*
- *Shut down entities with similar functions. Shutting or merging twenty-plus free float entities operating now into a single National Energy Authority could bring about sanity and coordination in the energy sector.*
- *We need a power policy considering federation challenges, a national goal and subsequent planning and implementation strategies.*
- *The power companies need to rely more on IT services; adopt innovative managerial techniques. They must undertake technological changes at the earliest.*
- *There is a need to optimize the generation portfolio. There is a need to monitor, forecast, and manage a complex mix of small to large generation units.*
- *Due to the highly volatile global energy market, distributed generation using localized renewable energy sources is the ultimate solution for energy security.*
- *Move from centralized energy management to decentralized management; storage technologies; micro & smart grids.*
- *Energy conservation and efficiency in use should be the priority.*
- *A Power Commission comprised of hardcore power sector professionals should be formed to guide and monitor the reform process.*

PAKISTAN POWER SECTOR (JUNE 30, 2021)

Circular Debt Rs 2.25 trillion (June 30, 2022)
 Cumulative Losses Rs 5.7 trillion (since FY2007)
 Cumulative Subsidies Rs 3.4 trillion (since FY2007)



PREMIER POWER SECTOR CHALLENGES

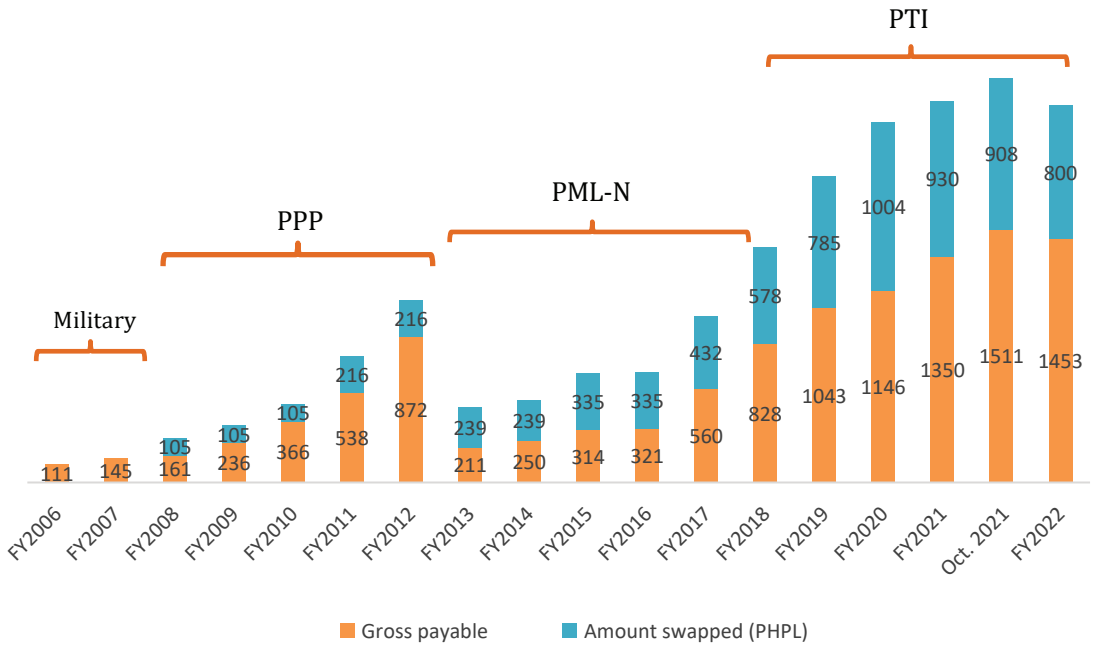


1. POWER SECTOR: PREMIER CHALLENGES

The power sector in Pakistan is facing several challenges for years and it continues.

1.1. FINANCIAL VIABILITY AND POWER SECTOR LOSSES

Figure 1.1. Circular Debt Growth (Rs Billion)



Source: Malik (2020a) and NEPRA State of Industry Reports (2020, 2021, 2022)

- Circular debt (CD), a power sector deficit that originated in FY2006, is continuing, reaching Rs 2.25 trillion at the end of June 2022 (3.4% of GDP) with no respite in sight¹. The sector’s cumulative losses since FY2006 are around Rs 5.7 trillion (including liquidity injections), equivalent to 9% of the current GDP.
- Since FY2007, cumulative budgetary support has crossed Rs 3.4 trillion, which could have been used on other productive activities
- Government borrowed from commercial banks to finance the power sector deficit, crowding out private borrowing. The stock of government guarantees is increasing non-stop.

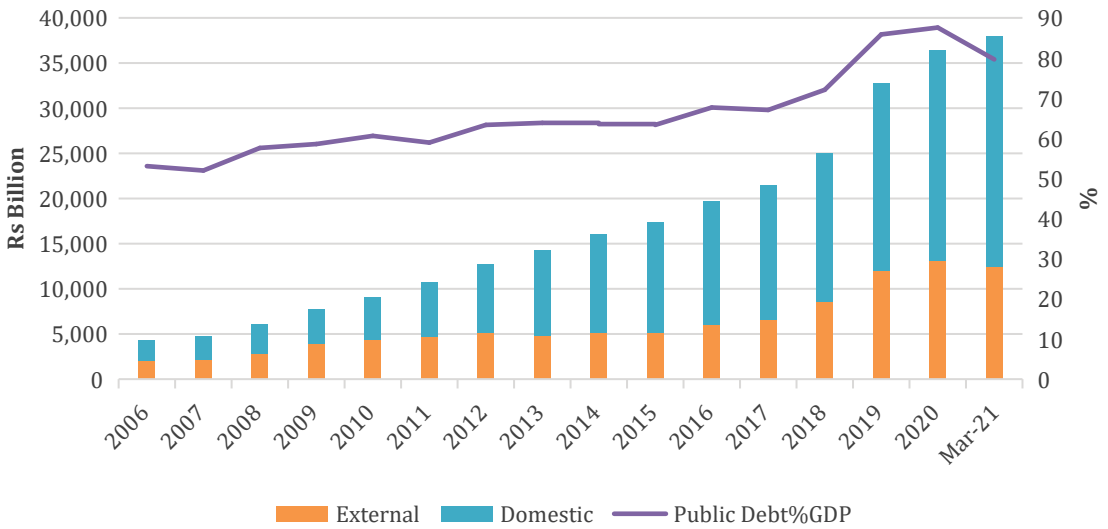
Table 1.1. Total Government Guarantees Stock: Power Stock

Total Govt. Guarantees Stock (Rs. Billion)	
Jun -19	1,562
Jun -20	1,961
Jun -21	1,999
Sep -21	2,055

Source: Ministry of Finance: Debt Policy Statements (Various Years)

¹ The slight reduction in CD is only after stock payments of Rs 564 billion (offsetting the debt flow of Rs 536 billion during FY2022) from the budget for servicing the PHPL debt (Rs 130 billion), repaying arrears to independent and government power producers (IPPs and GPPs) in return for revised purchasing power agreements (Rs 384 billion), and repaying arrears to other IPPs (Rs 50 billion).

Figure 1.2. Public Debt

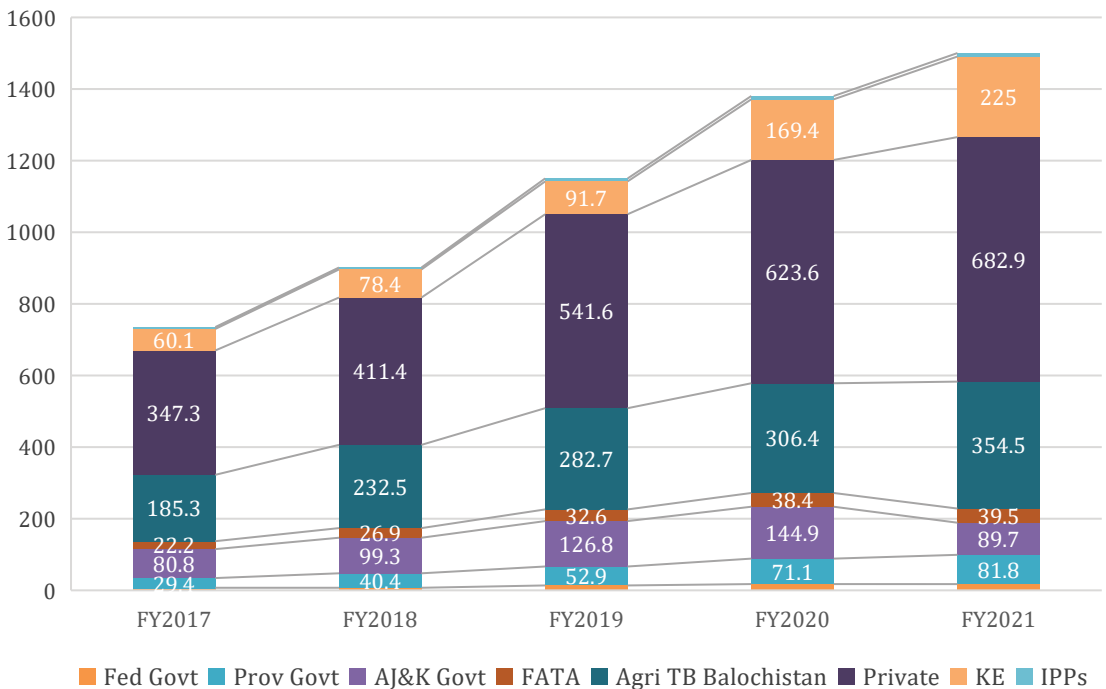


Source: Ministry of Finance: Debt Policy Statements (Various Years)

- On paper, CD first broke out in FY2006 with a steep rise in international fuel prices, which increased the generation cost, but consumer-end tariffs remained almost frozen. FY2008 and onwards, tariffs started rising. But circular debt kept growing.
- The root of this challenge can be traced back to the 1990s when long-term and unviable contracts were made with private investors on the advice of the World Bank (WB) without analyzing their long-term impact (details in Section VII). The same mistake was repeated over the years, trapping the sector and the whole economy.
- Additionally, underlying structural issues in the form of misgovernance, mismanagement in the energy supply chain_ inefficiencies in the generation and distribution, irrational tariff structure, and weak regulatory infrastructure, all are responsible for sector losses. They are adding to the costs of electricity services.

- Over the years, underlying structural issues have remained untouched
- Numerically, high T&D losses of distribution companies (DISCOs), lower recovery of the billed amount and delays in payment of subsidies all add to the circular debt accumulation. The fact ignored intentionally or unintentionally is that an increase in tariffs encourages theft and lowers bill recovery.
- Sectoral managers/ decision-makers cannot tackle this deficit. They rely on donor (e.g., WB, ADB, USAID) advice, who don't understand ground realities. These donors and our bureaucracy are responsible for this prolonged menace.
- As a result, all efforts to curtail this deficit through an increase in consumer-end tariffs further increase receivables (Figure 1.3).

Figure 1.3. Receivables (Rs Billion)



Source: NEPRA State of Industry Reports (Various Years)

- Private consumers², agriculture tube wells³, and the Government (Federal, Provincial & AJK)⁴ and its departments are the major defaulters.
- The financial impact of running defaulters is around Rs. 700 million. These consumers are still connected with the system; the respective DISCOs have taken no action to recover their defaulted payments.

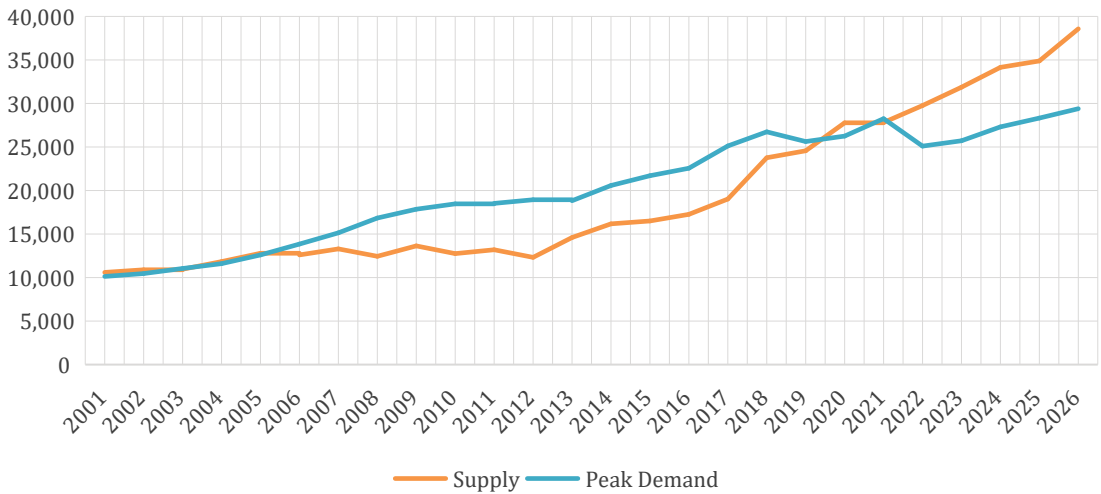
1.2. SUPPLY RELIABILITY

- Despite the tall claims of an increase in generation capacity, the power sector is in deficit after remaining in surplus for only a year in FY2020. Under the presumption of energy efficiency, NTDC has forecasted a decline in peak demand in FY2022, a weaker upward trend after that and a surplus of 9176MW by FY2026 (Figure 1.4).
- We have the installed capacity but not generating enough to meet peak demand (Figure 1.6).

² The growth in receivables from private consumers can be attributed, in part, to electricity theft but mainly to the point that private consumers are reaching an elasticity point whereby they are more willing to delay because of recent significant tariff increases and extra surcharges imposed (Malik, 2020). Evidence also suggests their dissatisfaction with service delivery (Malik and Khawaja, 2021).

³ In FY 2021, 73% of the electricity procured by QESCO is consumed by agriculture consumers for running tube wells. As per the subsidy policy (from 2001 to 2010), agriculture consumers had to pay Rs 4,000 per month; the remaining amount was to be paid by QESCO, the Baluchistan government and the Federal government in a ratio of 30:30:40, respectively. The subsidy program ceased in 2010 but was restored in December 2012 without any clarification regarding the distribution of outstanding dues across the respective

Figure 1.4. NTDC Peak Demand and Generation Capability (MW)

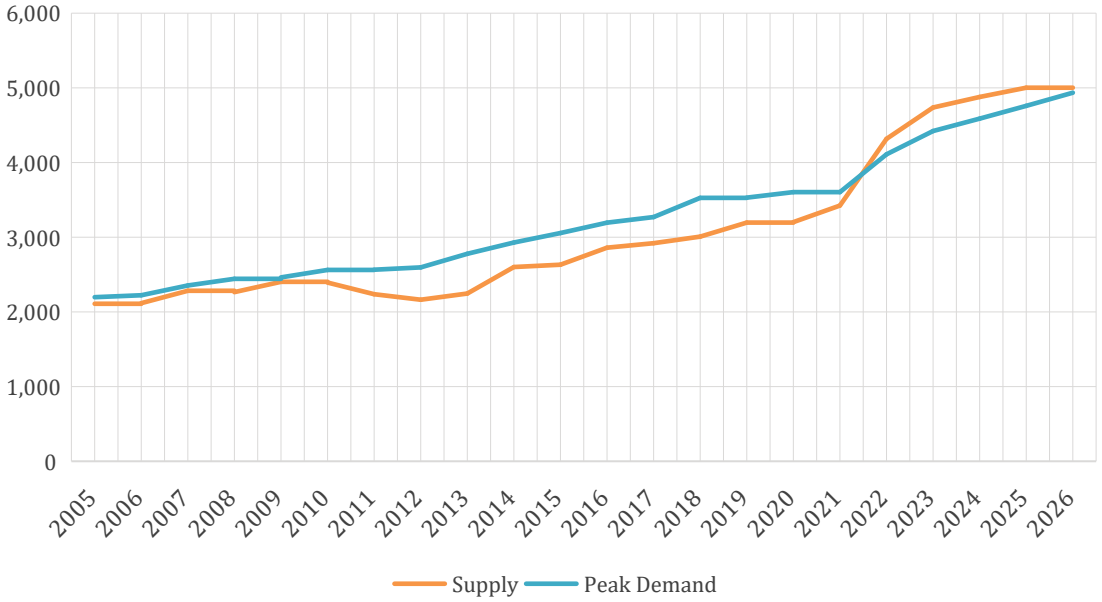


Source: NTDC Electricity Marketing Data (2022) & NEPRA State of Industry Reports (2021)

entities. In this period of 27 months, consumers were reluctant to pay their share of electricity bills beyond Rs 4000, therefore defaulted on their bills for these ²⁷ months. This outstanding amount (Rs 55.3 billion) affects subsequent billing. So even if these consumers desire to clear their current period liabilities, they cannot do so without clearing the accumulated backlog (SBP, ²⁰¹⁹).

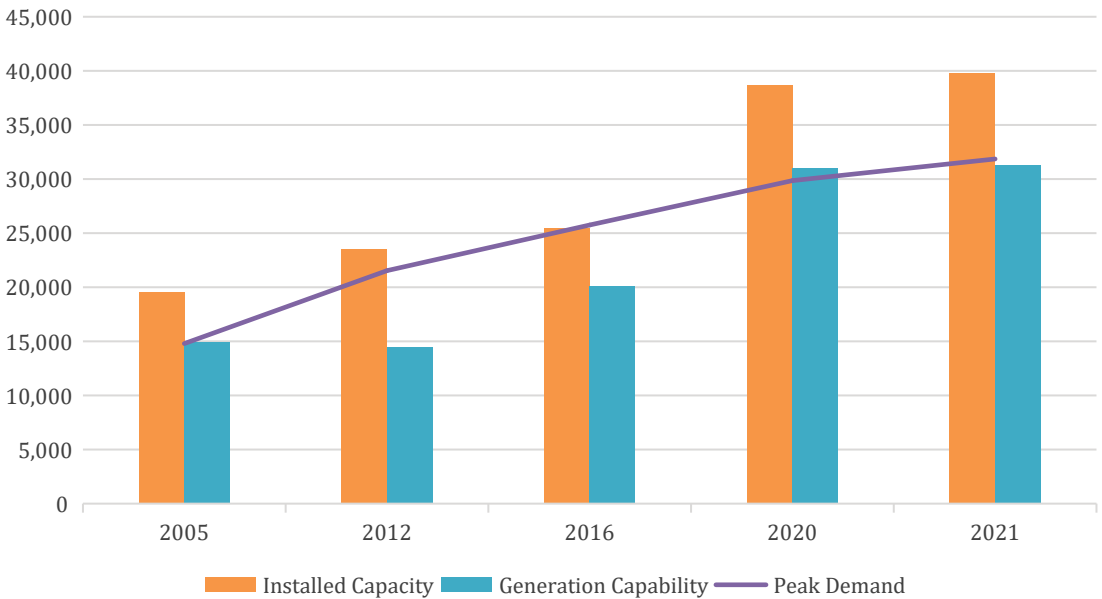
⁴ Price increase since 2015 exempts FATA and AJK via subsidies. For instance, the government subsidizes WAPDA for receivables from AJK. But it is insufficient as the government in AJK does not accept NEPRA determining tariffs and allows a tariff of only Rs 2.59 per KWh (agreed at the time of Mangla Dam Construction). The difference adds to the receivables. In FY2021, the government paid a chunk of these arrears, reducing receivables from AJK and FATA.

Figure 1.5. KE Peak Demand and Generation Capability (MW)



Source: NTDC Electricity Marketing Data (2022) & NEPRA State of Industry Reports (2021)

Figure 1.6. Installed Capacity, Maximum Generation Capability and Peak Demand (MW)



Source: NTDC Electricity Marketing Data (2022) & NEPRA State of Industry Reports (2021)

- Reliance on imported fuels and fiscal challenges often lead to shortages in (generation) supplies, resulting in power outages⁵.

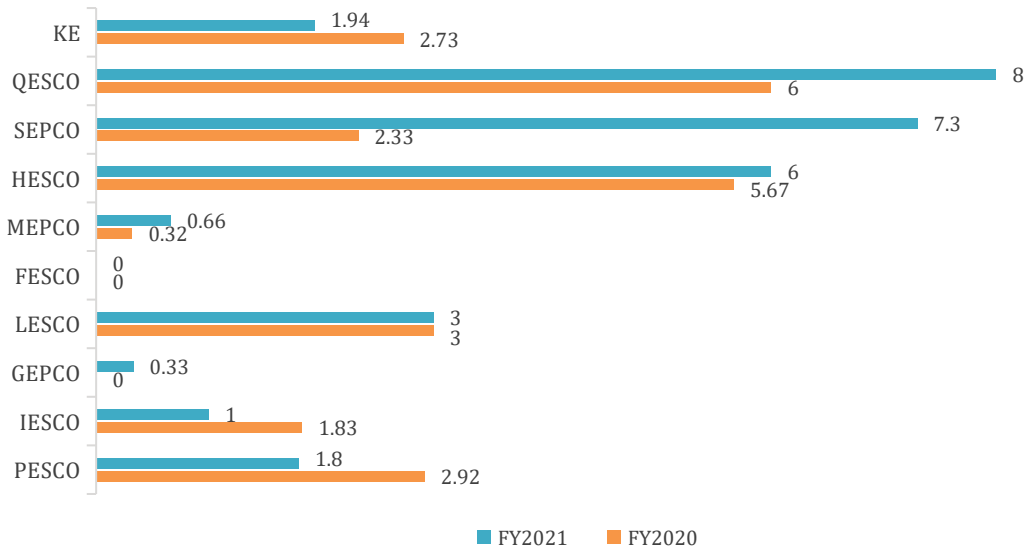
Beyond that,

- Power outages are an issue due to commercial loadshedding in several parts of the country_ several clusters in KPK, Sindh and Baluchistan. In FY2020, commercial load shedding remained in practice despite having surplus capacity⁶.
- Excluding commercial load shedding in forecasting future demand reflects a lack of commitment toward identifying troubled spots and bringing them under the complaint consumer’s net.
- Apart from assuming future energy efficiency, excluding under-met demand due to commercial load shedding is also not considered in forecasted peak demand (Malik and Ahmad, 2022).

⁵ Reference is to power outages of 8 to 10 hours in April-May 2022; imported fuel shortage and technical reasons are cited as responsible for the shutdown of power plants. In power sector dominated by ‘Take or Pay’ based thermal power plants and ‘Must Run’ renewable plants, underutilization/non-utilization of available generation capacity apart from power outages, impacts the per unit cost of generation and consumer -end tariff. In FY 2022, RLNG plants despite being the most efficient ones could not be operated up to their maximum available capacity due to RLNG shortage. Besides, some of the RFO and coal power plants could not maintain the desired fuel inventory due to non-payments by CPPA-G. Similarly, due to system (transmission and distribution) constraints, renewable plants were unable to dispatch electricity.

⁶ Also known as revenue-based load shedding.

Figure 1.7. Average Loadshedding



Source: NEPRA Distribution Companies Performance Report (2021)

Note: The data submitted by PESCO is different from ground realities (NEPRA, 2021).

- Distribution companies (state-owned) or privatized KE are responsible for providing an uninterrupted supply of available electricity to consumers in their territories.
- The Daily Log Reports of System Operator (NTDC) show load management/ load-shedding of around 2,500 MW to 3,000 MW during FY 2020-21. Similarly, KE also continued to carry out load-shedding in its service territory (NEPRA State of Industry Report, 2021).
- The Power Policy of 2013⁷ explicitly allowed load shedding in loss-making areas. KE adopted this strategy for the first time. Now, other DISCOs are following. Although in the new Power Policy 2021, there is no explicit provision for this policy. But the practice continues.
- This strategy should have been adopted only for a short period. During which non-compliant consumers are mainstreamed or forced to pay for the electricity they use. This has not been done over the last nine years.

⁷ Section 7.8, page 17, Power Policy 2013.

- No audit by the regulator, i.e., NEPRA; why does this commercial load shedding continues for so long?
- Commercial load shedding has reduced demand and compatible less use of available generation capacity, inflation of capacity charges and its likely impact on increasing tariffs for compliant consumers.

In addition,

- It skewed planning for new power generation, transmission, and distribution infrastructure; and compromised future assessments. Thus, negatively influencing investor interests.
- The practice of load shedding is creating discontent among the three small provinces (KPK, Sindh and Baluchistan), affecting the federation.

On the other hand,

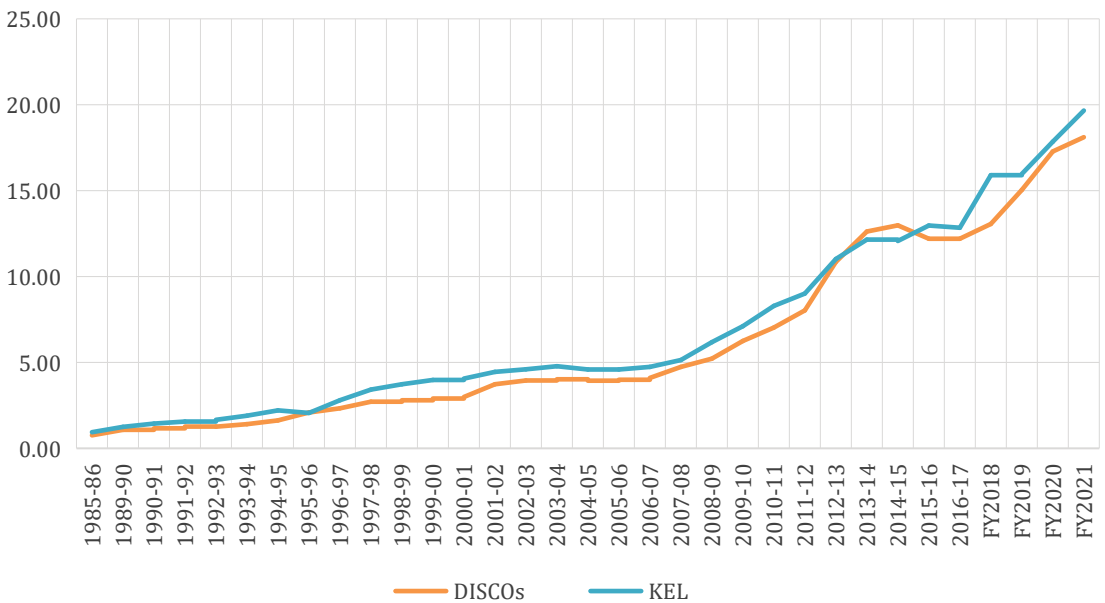
- There is a stark difference in electricity usage between day and night. Likewise, seasonal variation in electricity usage is high in Pakistan. Summers and winters differ in peak demands of anything between 8,000 to 13,000MWs. TOU tariffs variation is not enough to cater to this enormous demand difference.
- For instance, in FY 2022, 28,253 MW was the peak demand in June 2022 while during December 2021 the peak demand came down to 15,962 MW. On the other hand, the installed capacity with ‘Take or Pay’ and must run power plants was 40,813 MW. Higher installed capacity as compared to demand in the system burdens the power sector adversely. Therefore, the gap between the ‘Take or Pay’ available power generation capacity and demand in the system needs to be as minimum as possible.

1.3. UNAFFORDABLE & UNCOMPETITIVE TARIFFS

- A massive increase in consumer-end tariffs in the last few years (Figure 1.8) _ a percentage increase in average sale price was about 51% between FY2017 and FY2021.

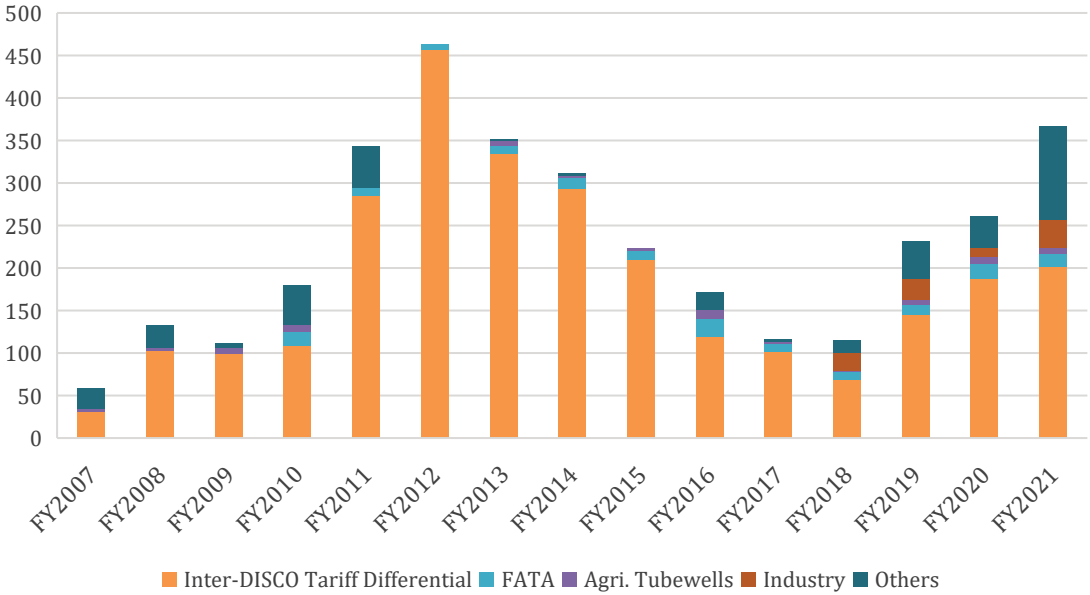
- Electricity tariff in Pakistan is around 30% to 40% higher than in countries like India, Malaysia, Turkey, and China (Sattar and Umar, 2020).
- The government is under pressure to reduce electricity subsidies (IMF condition) and increase consumer tariffs.
- Several surcharges to finance banks and other government liabilities further increase consumer tariffs.
- Due to existing anomalies in the subsidy structure, not only are consumer-end tariffs shooting up, but government subsidies are also rising (Figure 1.9). Thus, increasing not only the consumer burden but fiscal burden.

Figure 1.8. Average Sale Price (Rs/KWh)



Source: NTDC Electricity Marketing Data (2022) & NEPRA State of Industry Report (Various Years)

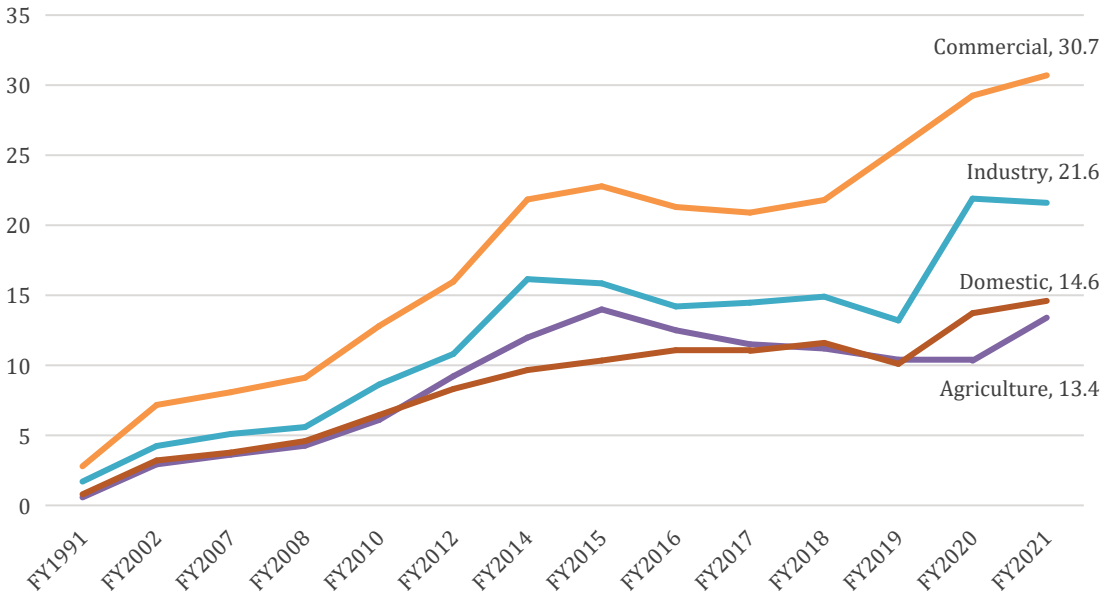
Figure 1.9. Power Sector Subsidies (Rs Billion)



Source: Ministry of Finance: Budget in Brief (2008 to 2022)

- Cross-subsidization across sectors is affecting industrial competitiveness (Figure 1.10). However, special tariff dispensation has been allowed to the zero-rated industry through a budgeted subsidy since FY2018, which is not sustainable given government fiscal constraints. Details on tariff structure in Pakistan are in Chapter 10.

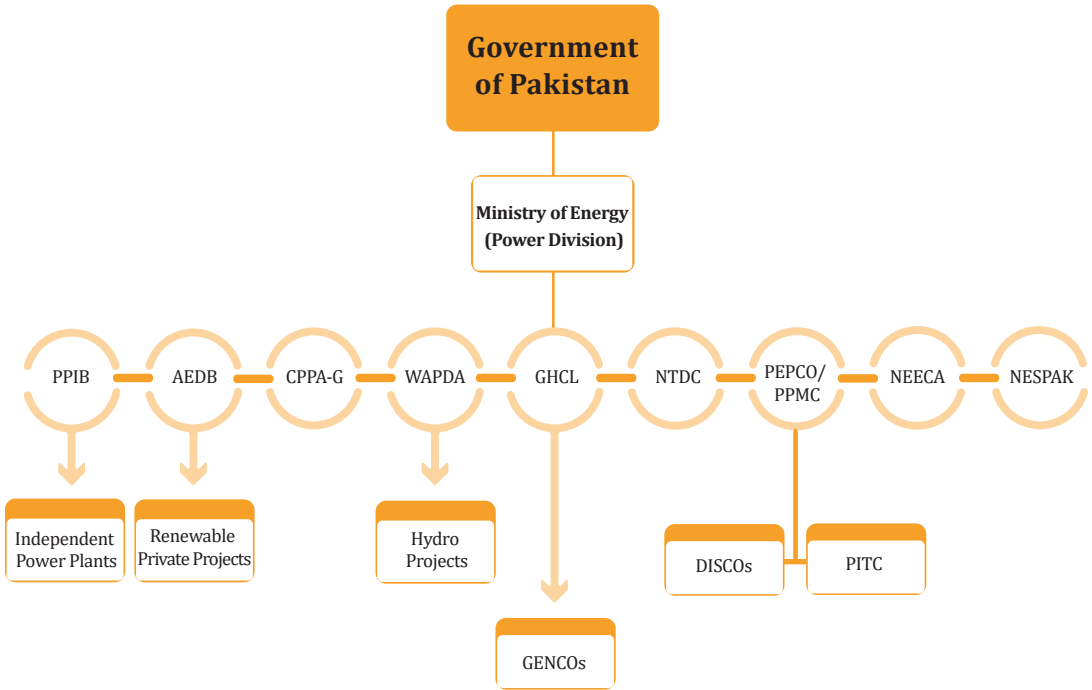
Figure 1.10. Average Sale Price (Rs/KWh)



Source: Authors' Estimations

1.4. GOVERNANCE

Figure 1.11. Power Sector Governance Structure



- Presently, the power sector governance lies with the Power Division (PD) in the Ministry of Energy (MoE).
- National Transmission and Dispatch Company (NTDC), the ten state-owned distribution companies (DISCOs) and the four state-owned generation companies (GENCOs) are all under the direct control of the Secretary, Joint or Deputy Secretaries of the Power Division.
- The GENCOs (four in number) with an installed capacity of 4881 MW are managed by the GENCO Holding Company Ltd. (GHCL); GHCL is not accountable to anyone.
- There is no effective coordination between the power sector's generation, transmission, and distribution facets⁸.

⁸ Under WAPDA, the sector used to have cohesive management and the availability of over 9,000 engineers and other professionals for assistance and support.

- With the vague job description of the Federal Secretary, frequent changes in the personality have been witnessed in recent years
- In the absence of required technical expertise, the PD is left to discuss losses and recovery issues superficially while ignoring other vital aspects⁹.
- Consequently, nothing has changed; neither losses have reduced, nor has recovery improved. Receivables are going up, and CD is increasing non-stop.
- The reform process started in the late 1990s and, after three decades, is in a deadlock.
- CEOs in state-owned companies change frequently; professionals are not considered for these posts.
- Despite being corporatized, it is not clear under which law these companies are governed.
- Over the years, the sector's government footprint (power division) has become even more robust than decentralizing power.

1.5. CORPORATE GOVERNANCE AND MANAGEMENT

- The management of NTDC, GENCOS, and DISCOs is two-tiered, i.e., CEOs and BODs.
- According to SECP Public Sector Companies (Corporate Governance) Rules, 2013, it is mandatory for each company to have independent directors_ 40% of its total members.
- On paper, every DISCO has independent board members with limited authority to make decisions.

Box 1.1. Corporate Governance

- Corporate governance defines the rights and responsibilities of a board, managers, shareholders, and other stakeholders. It outlines decision-making rules & procedures (Haque and Hussain, 2021).
- Corporate governance of the utility_ private or state-owned is crucial for effective operations. Its mechanisms, such as monitoring, board of directors and executive plans, are significant (Cited from Malik, 2021).

These companies (GENCOS, NTDC, and DISCOs) are under complete government control; board and management positions at DISCOs are held by government employees or political appointees with limited experience. Officials sitting on multiple energy boards aggravate this issue.

⁹ Relying on donor reports and advisory.

- Board members in these companies comprise non-sectoral professionals. Even if some professional is appointed, is not allowed to stay for long.
- Not only are boards incompetent, but they also have no clear objectives or guidelines and no power to take critical decisions.
- CEOs only have acting charge and not permanent office holders, appointed on a seniority basis, and not based on their managerial capacity. The authority to appoint rests with the PD and with the boards.
- CEOs are kept busy in meetings, with little or no time to manage the company (DISCOs or GENCOs).
- As is evident from the minutes of the board meetings¹⁰, the meetings only discuss human resource issues.
- In recent months, new boards have been appointed in all ten DISCOs. Though some professionals were appointed, the majority remained non-professionals.
- Preference is given to those who remained affiliated with KE, in various capacities. In addition, a few from ENGRO and having linked with the AES Corporation (which had set up the most IPPs in the country) are chosen as board members¹¹.
- Consultants are given preference over professionals in the selection¹².

¹⁰ This information is extracted from newspaper clippings, studies, informal discussions with some DISCO officials etc.

¹¹ Chairman NTDC is also on the board of KE, clearly violating corporate law. NTDC and KE deal in billions of US\$ business with each other.

¹² As reported in newspapers, relying on KE employees is to prepare for the future privatization of these companies.

Table 1.2 Governance Profile of State-Owned DISCOs

	Independent Directors *	Ex-officio/ Non-executive Directors	Change in CEOs since 2016	Shareholding
FESCO	5	2	4	100% Govt.
HESCO	8	3	5	100% WAPDA
QESCO	5	1	3 **	100% WAPDA
TESCO	4	4	4	100% WAPDA
PESCO	4	4	4	100% WAPDA
LESCO	6	3	5	100% Govt
IESCO	7	3	5	88% WAPDA; 12% others
GEPCO	5	5	4	99% Govt; 1%others
MEPCO	7	2	4	100% WAPDA
SEPCO	7	NA	3	100% WAPDA

Source: Financial Footprint: SOE Annual Report (2018-19), Ministry of Finance, Government of Pakistan; and official websites of relevant companies.

* Independent directors excluding chairman and company secretary

** current information not available, different information in different source.

- Non-professional BOD, temporary CEOs in the last decade and non-availability of the most necessary national power policy_ NTDC is not fully able to deliver the needed power to the distribution companies and accept and transmit ARE of the requisite level.
- Any positive change in the sector depends on a change in its governance structure and not on the availability of power.

- No significant change can be expected if the sector continues to be governed by bureaucracy. If professionals are not allowed to manage, all power sector issues will remain and grow.
- There will remain a shortfall in revenues against the projected energy usage, thus adding to the existing power sector deficit, that is, CD. This deficit will, turn, reduce the sector’s capacity to pay for its generation receipts. Thus, reduced generation, load shedding, and increased capacity payments burden requiring consumer-end tariff to increase.

Table 1.3. Financial Position of State-owned Companies

	Assets (Rs Million)	Liabilities (Rs Million)	Net Profit (Rs Million)
GENCOs (I, II, III, IV)	448,609	380,749	3,165
NTDC	401,813	244,069	11,236
DISCOs	1,983,044	2,838,875	-1,143,052
WAPDA	2,013,060	527,772	-7,724

Source: Federal Footprint: SOE Annual Report (2018-19)

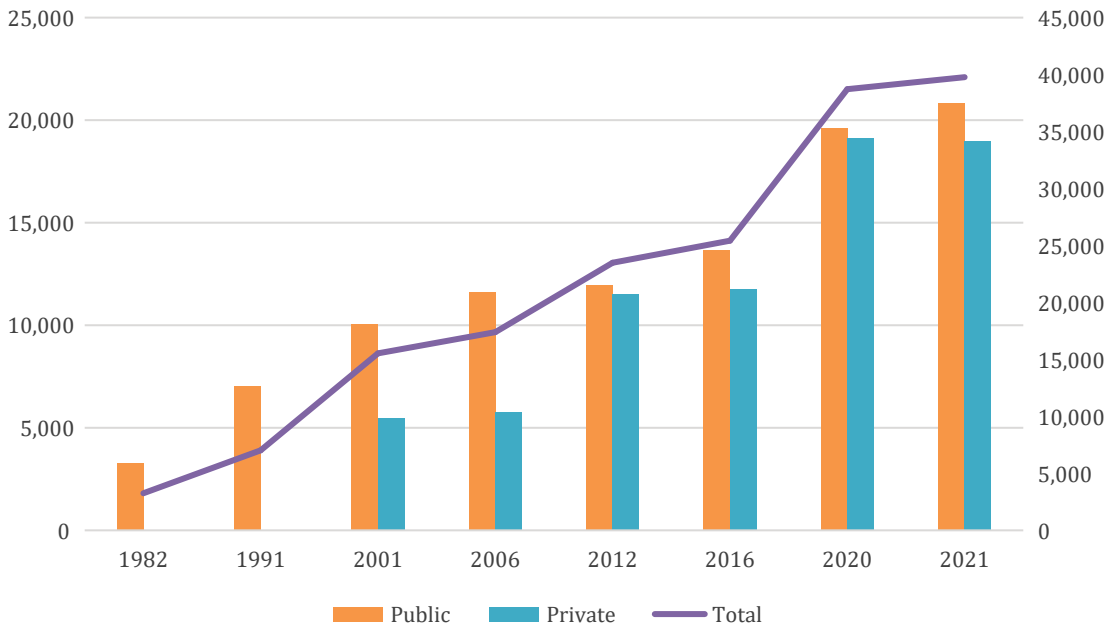
1.6. LACK OF COORDINATED PLANNING

- Our policymakers' lack of informed long-term vision has cost Pakistan dearly (Alahdad, 2012).
- The induction of IPPs has relieved some burden on the public sector. Still, unplanned contracts have considerably increased the cost of a generation because of ballooned capacity payments and expensive fuel mix. In FY2022,

the utilization factor of 30,303 MW thermal power plants on take-or-pay was 46%, which means that consumers had to pay capacity charges for the remaining 54% of the unutilized capacity as well (NEPRA State of Industry Report, 2022).

- Lack of cost-effective planning resulted in direct deals with IPPs.
- The absence of competitive bidding in the power procurement process and long-term contracts have brought structural rigidity and hindrances to creating a competitive market and prices.
- Consumers are forced to pay a higher (non-competitive) price for electricity. has the highest cost of electricity in South Asia (Table 1.4).

Figure 1.12. Installed Capacity (MW)



Source: NTDC Electricity Marketing Data (2022) & NEPRA State of Industry Reports (Various Years)

Table 1.4. Cost of Electricity: Regional Comparison

Cents/ KWh	Residential	Commercial	Industry
Pakistan	1.3-15.4	12.4-15.9	11.8-12.5
India	4.2-11.2	8.4-11.9	10.9
Bangladesh	4.1-12.6	10.8	6.8

Source: Report on the Power Sector (2020)

- It is estimated that a per unit increase in price by Rs 1 would add to an additional loss of more than Rs 10 billion; as it affects the paying capacity of that in turn will increase poverty, theft and delayed or no payment, increasing arrears (Faraz, 2018).
- GENCOs also suffer from a lack of planning. GENCOs are running below their net available capacities because the desired maintenance and scheduled outages over the years are not in place as per standard industry practices. These plants' unproductive use of resources adds to the power sector deficit. It also denies the sector of relatively cheaper electricity (NEPRA State of Industry Report, 2019).
- Over the years, policymakers have focused on new projects rather than maintaining the available capacity, thus hurting their fuel efficiency, and putting costly electricity in the system.
- The top planning failure in Pakistan is the shortage of T&D networks. Investments in generation capacity are not complemented by equivalent investment in downstream T&D infrastructure.
- More than one-fourth of electricity is lost due to ruined networks, theft, and insufficient energy accounting.
- T&D capacity is much less than the installed generation capacity. The transmission network allows only 23,000 MW-peak, with close to 3% loss. About 10GWh of

generation cannot be evacuated due to system constraints.

- NTDC is the power planner. There is no integrated long-term plan. The focus has remained on generation plans but not on an integrated plan.
- There is a lack of coordination among various departments in the sector. The capacity needs to be doubled (55,000 MVA to over 100,000 MVA) by 2025 to transmit the available generation capacity. Yet, the target is difficult to achieve.
- NTDC is further not able to provide the needed transmission lines in the northern areas because of space constraints.
- There is no plan to increase electricity sales in Sindh, Baluchistan and KPK, where many areas are still not connected to the national grid.
- NTDC has not been able to upgrade its transmission voltage or induct newer technologies like UHV transmission lines, SVCs, and storage batteries to cater for the above constraints. More details in Chapter 7 to Chapter 9.

1.7. LACK OF COMPREHENSIVE POLICY

Under WAPDA, the power sector vision was "to provide continuous, standard, affordable power to the people of Pakistan." The vision lays down the policy, principles, and direction (implementation strategy) for achieving sustainable, reliable, and affordable electricity for the people of Pakistan.

- The Power Policies of 1994, 2002, 2007, 2015, and 2019 cater only to specific interests/subjects. Even the new Electricity Policy of 2021 is no different.
- All of these were/are crafted to meet the special interests of specific groups, not for the betterment of the consumers. All these policies have been successful in their intent yet, have led to the near collapse of the sector.
- All policies remained oblivious to the national requirements.

Box 1.2. Vision_ National Electricity Policy 2021

To ensure universal access to electricity through a self-sustainable power sector developed and premised on:

- *Optimal utilization of indigenous resources.*
- *Integrated planning approach.*
- *Efficient, liquid, and competitive market design.*
- *Affordable & environment-friendly outcomes for the consumers.*

The customers wish for continuity of supply _ no load shedding, proper billing at an affordable price, prompt provision of new connections and priority of supply complaints; none of this is happening now.

The requirements of the power sector manager (GOP), and the customers are divergent. The GOP wishes the power sector to operate so that there is no CD and no financial burden for the government. The National Electricity Policy 2021 cater for government demand only.

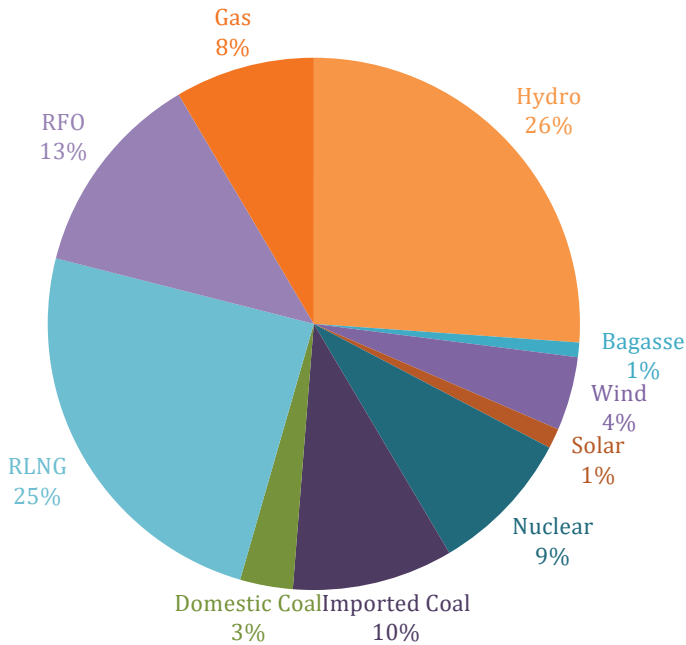
- The policy envisages full recovery of the supply cost (including inefficiencies) from compliant consumers. It allowed cross-subsidies and uniform tariffs to meet the GOP's socio-political objective. It belies any claim that the consumer-end tariff would be decreased soon.
 - It will increase the burden on the law-abiding consumers with no alternative option to avoid this tariff hike.
 - It will not have any positive impact on DISCO's recoveries. Under this, the blackmailing of KE will continue, along with the suffering for consumers in Karachi.
 - There is nothing in the policy to ensure continuity in supplies, accurate billing an affordable price, prompt provision of new connections and priority resolution of supply complaints.
- The generation mix (because of all previous policies) comprises hydel, thermal (oil-fired, gas-fired – including RLNG, and coal-fired), nuclear and alternative & renewable energy like solar, wind and bagasse power plants.
 - AREs capacities are being inducted without any stringent policy framework. The compatible built-up of transmission and distribution infrastructure is also lacking.

- Local gas resources are depleting with no significant new gas discoveries, yet the policy is talking about utilizing local gas resources.
- For those with no access to electricity, there are two options: to supply electricity to areas already connected to the grid and the rest through distributed generation (DG) or to connect the whole country to the national grid. These areas are mainly in the three small provinces_ Sindh, KPK and Baluchistan.
 - AREs and DG are recommended for these provinces in GOP policy frameworks.
 - AREs are best designed to support the national grid but cannot lead to a sustainable autonomous system for the starved population in KPK, Sindh and Baluchistan.
- Rural electrification has remained a goal, but no comprehensive policy guideline is available to guide grid expansion.
 - Villages get electrified each year, but the absence of system planning due to the lack of comprehensive policy results in the disturbance of LT and HT ratio, one of the root causes of technical losses and reliability issues.
- The power sector requires an all-inclusive power policy, catering to federation challenges, a national goal, which is missing, and subsequently lack of implementation strategies.
- Without goal-specific policy direction, the sector will remain directionless.

1.8. EXPENSIVE FUEL MIX: A PLANNING FAILURE

In Pakistan, there is no market for energy. It is the government deciding about future projects. While we also failed to develop an integrated energy plan. Due to the lack of long-term planning, its processes, and wrong decisions by government-owned entities, more than 40% of the generation is based on imported fuels. Any increase in international fuel prices or devaluation of the Pakistani rupee often leads to load shedding and worsening of the CD problem. In the 1990s, there was space to undertake long-term policy decisions. If the generous tariffs offered to IPPs were extended to hydro plants, our power sector would have been far better today (SBP, 2014).

Figure 1.13. Installed Generation Capacity FY2022



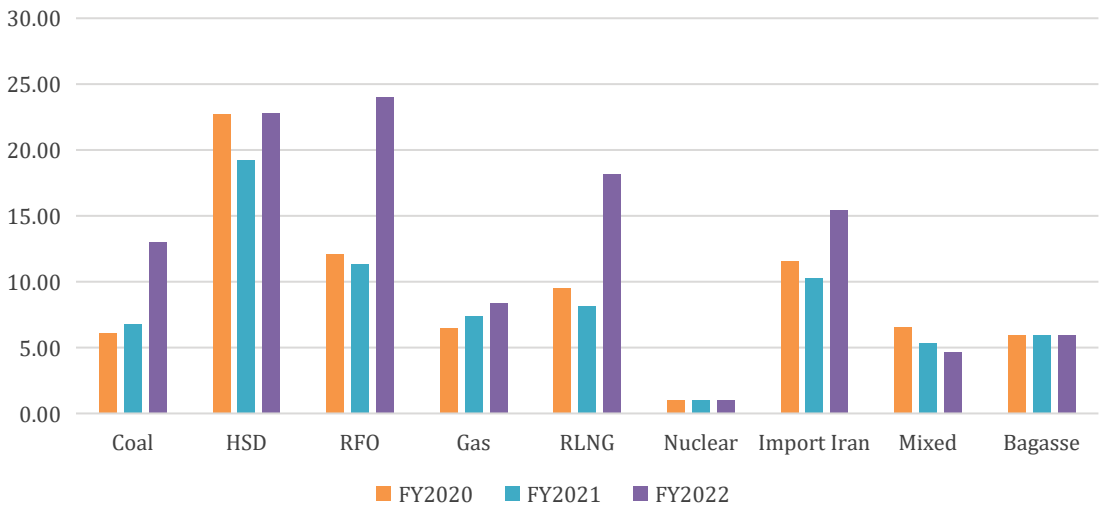
Source: IGCEP (2022-31)

- The dynamics of the electricity supply chain have changed significantly with the exhaustion of indigenous natural gas resources.
- In the Generation Policy 2015, preference was given to RLNG and coal, but not reducing dependence on imported fuels. All the new projects are increasingly dependent on imported fuels.
- Retirement of expensive furnace oil plants was planned in the recent past but could not be implemented because of constraints on foreign exchange reserves and rupee devaluation. The result is an increase in the generation cost.
- Share of oil in our generation mix has decreased from 47% in FY1998 to only 13% in FY2022. Our dependence on another imported fuel RLNG has increased from 0.7% in FY2015 to 25% in FY2022. Whereas, in FY2022, due to RLNG shortage, expensive and inefficient plants were forced to operate causing a financial impact of Rs. 19,332 million¹³.

¹³ NEPRA State of Industry Report (2022)

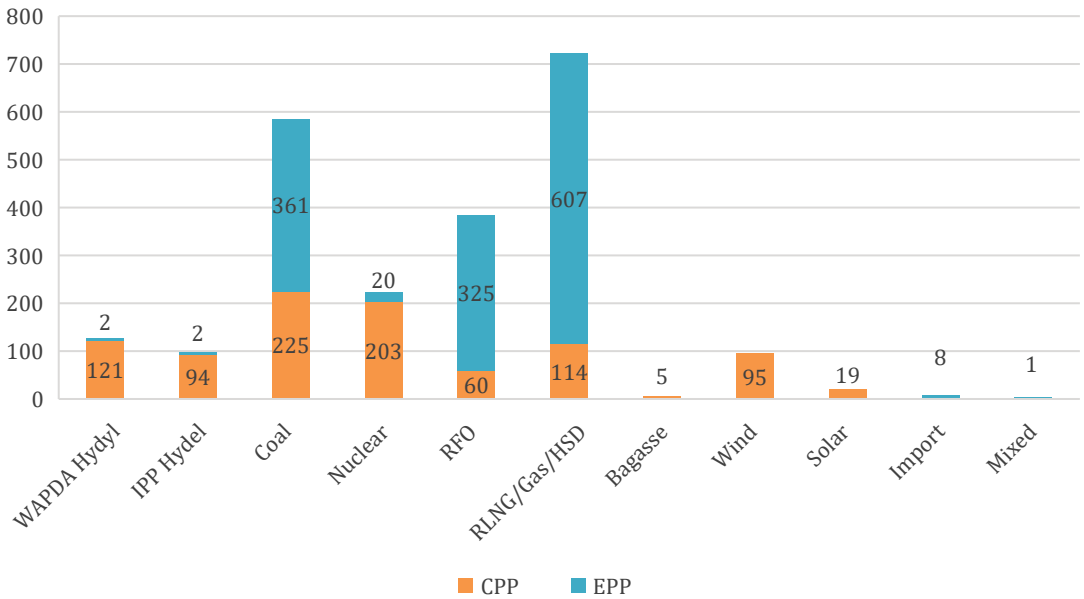
- Share of coal in the electricity fuel mix has increased from 0.5% in FY2014 to 13% in FY2022.
- Most of the new coal-fired power plants are fueled by imported coal, which has become extremely expensive after the rupee devaluation.
- Failure to add new hydro capacity in the system over the years and continued dependence on imported fuels resulted in an unbearable financial burden of subsidies and CD.

Figure 1.14. Fuel Cost (Rs/ KWh) in CPPA-G System



Source: NEPRA State of Industry Reports (2020, 2021, 2022)

Figure 1.15. Cost Invoiced by Generators Rs Billion (FY2022)



Source: NEPRA State of Industry Report (2022)

In our planning strategies, the utilization of indigenous resources has always been at the forefront, but unfortunately, these plans have not been timely implemented. We started Neelum-Jhelum from Rs. 18 billion in 2008 and completed it in 2018 at the cost of Rs. 510 billion (levelized tariff of Rs. 13.5 per unit). Rs. 510 billion is more than \$5 million per MW when countries around us are doing the same at under \$2 million per MW.

Wind and solar are quickly becoming the cheapest sources of generation technologies, yet the share of wind and solar energy projects is relatively small. There is no consistency in net-metering policy for households; solar on households has remained an uncertain policy, sometimes taxed, and sometimes taxes are relaxed.

Renewables are increasingly competing on an economic basis in energy markets globally. Due to the lack of energy market and comprehensive planning for the future, coal and RLNG plants will keep Pakistan's reliance on expensive imported fuels in the coming years. In Pakistan, geo-political factors and the urge for quick fixes stand in the way of improving renewables' competitiveness.

2. DISTRIBUTION CHALLENGES: WHY ARE DISCOS NOT DELIVERING?

DISCOs have yet to grow as an institution. The bureaucracy does decision-making on all matters; management and boards are ineffective; there is a weak distribution infrastructure, no funds, and no innovative processes. The DISCOs could not be improved until unprofessional bureaucracy is involved in its affairs.

Box 2.1. Chronology of Electricity Distribution Affairs

- In 1982, AEBs were established under WAPDA to provide more autonomy to the power distribution operations; allowed representation of provincial governments, elected representatives, industrialists, agriculturalists, and other interested groups on boards
- In the 1990s, big industrial and commercial outfits were set up. The electricity demand surged (growth of 9-10% consistently).
- Inadequate availability of capital led to a shortfall in generation capacity_ creating a demand-supply gap.
- Lack of investment in the upgradation/ expansion/ maintenance led to the deterioration of existing dated transmission and distribution infrastructure. This aggravates power shortages and unreliability in supplies.
- The overall operational and commercial inefficiencies in the power distribution sector created the need for restructuring.
- In 1998, with the reorganization of WAPDA (under the Power Sector Reform Plan), the distribution sector was restructured into eight public limited companies (DISCOs) (which later increased to ten) under the corporate law; they were placed under the PEPCO management.
- An independent BODs was appointed in each company.
- PEPCO centralized control over the unbundled companies' operations made boards and management of these separated companies ineffective.
- Under PEPCO, newly corporatized DISCOs moved away from the earlier designs, standards, procurement, disposal, transport, finance, etc., developed under WAPDA in its early days.
- In 2011, the GOP approved the dissolution of PEPCO, and the functions were first transferred to NTDC and later to CPPA-G.

1.2. SUPPLY RELIABILITY

- Pakistan's power sector has long faced multifaceted and complex challenges.
- Several of these, including high distribution losses, unreliable electricity supply and power outages due to a system and financial constraints, non-recovery of targeted revenue and the (significant portion) of mounting CD, is all because of the below-par performance of electricity distribution companies.
- The electricity distribution companies _ ten state-owned (DISCOs) and a privatized KE. (KESC – as incorporated in 1913), vary in efficiency and performance.

The vision of the National Electricity Policy 2021 is to ensure universal access to electricity through a self-sustainable power sector. The policy is aimed at making the power sector viable. It is premised on the efficient operations of the distribution system and timely recoveries from consumers

2.1. DISCO's MAJOR CHALLENGES

- (i) Technical and Distribution (T&D) losses_ a fraction of electricity lost due to technical (engineering) reasons and unmetered consumption or theft.
- (ii) Low revenue recovery ratio_ a significant fraction of bills unpaid by consumers.

These two major challenges are leading to subsequent issues for the distribution sector and for the overall power sector.

Technical and Distribution (T&D) Losses: Operational Inefficiency

- In FY2021, % losses were highest in PESCO region (38%), followed by SEPCO (35.5%), HESCO (28.2%), and QESCO (28%). Except for LESCO and MEPCO, the other three DISCOs have losses below 10% in Punjab.

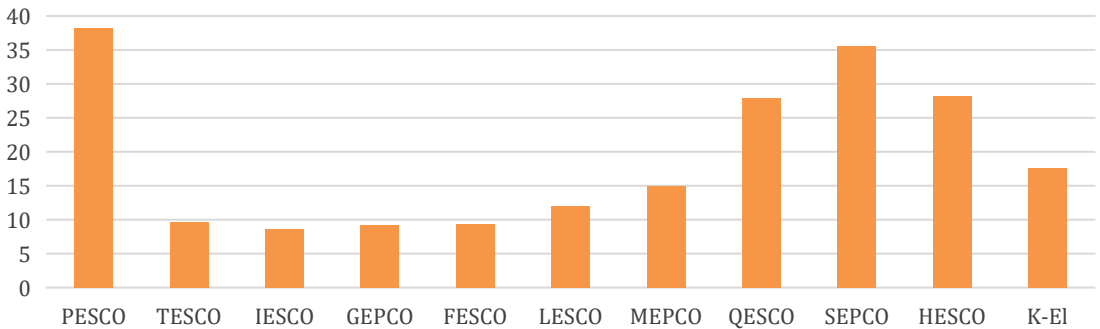
It's a myth that

- Distribution companies in Punjab are relatively better, and privatized utility performs better than state-owned utilities. In FY2021, MEPCO and LESCO have the third and fourth highest T&D unit losses (in million KWh, Figure 2.2) after

PESCO and K-El.

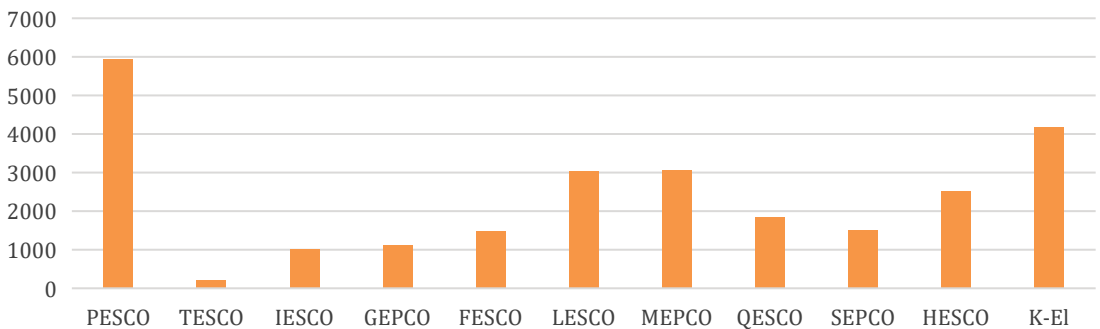
- Over the years, average T&D losses have declined in percentage terms, but in terms of KWh and subsequently in PKR, these have increased substantially (Figure 2.3).
- NEPRA uses T&D target as a tool to improve the operational performance of distribution companies. However, this strategy has not worked for most DISCOs. There is no significant penalty associated with utility mismanagement, leading to operational inefficiency (Malik, 2022c).

Figure 2.1. T&D Losses (%) in FY2021



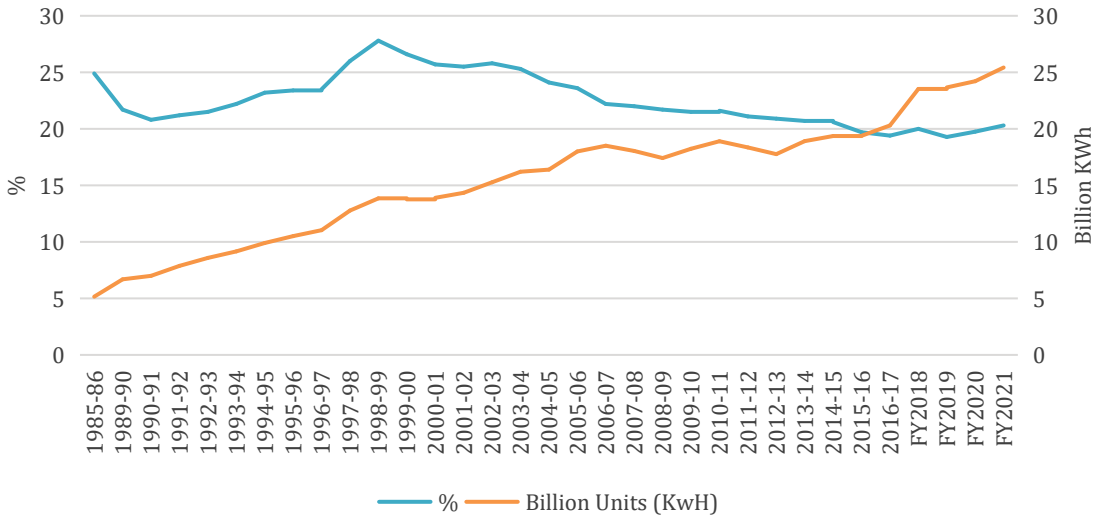
Source: NEPRA State of Industry Report (2021) & NEPRA Performance Evaluation Report: DISCOs (2021)

Figure 2.2. T&D Losses in Million KWh in FY2021



Source: NEPRA State of Industry Report (2021) & NEPRA Performance Evaluation Report: DISCOs (2021)

Figure 2.3. Transmission & Distribution Losses

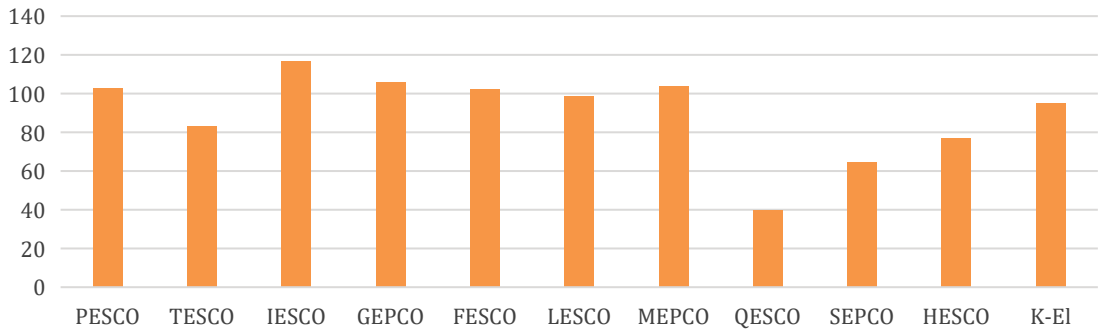


Source: NTDC Electricity Marketing Data (2022)

Low Recovery Ratio: Commercial Inefficiency

- Revenue recovery rates are relatively high for all DISCOs in Punjab but fall significantly for DISCOs in Sindh, Baluchistan and KP.
- More than 100% collection in PESCO, IESCO, GEPCO and MEPCO in FY2021 are due to one-time deposit of arrears (AJK and others) by the GOP.
- There is wide dispersion in T&D losses and revenue recovery rates even within each distribution company (Figure 2.6).
- Together, the lost electricity and unpaid bills translate into billions of rupees of losses yearly. Despite a significant improvement in bill recoveries in FY 2021, the receivables from DISCOs increased by Rs. 120 billion from FY2020 to FY2021, which accumulated as CD.

Figure 2.4. Percentage Recoveries in FY2021



Source: NEPRA State of Industry Report (2021) & NEPRA Performance Evaluation Report: DISCOs (2021)

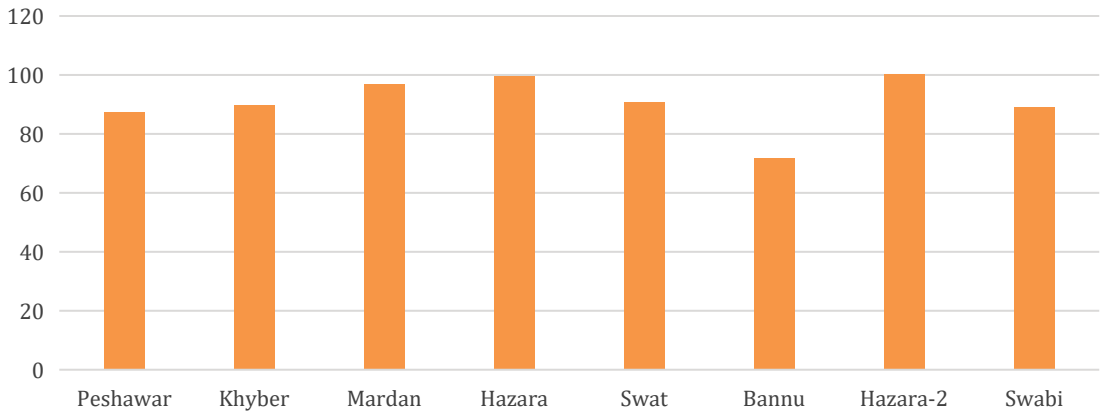
Figure 2.5. Recovery Loss in Rs. Million (FY2021)



Source: NEPRA State of Industry Report (2021) & NEPRA Performance Evaluation Report: DISCOs (2021)

- These losses are hindering a sizable investment in the upgradation of infrastructure. This results in unreliability of electricity supplies.
- None of the reform efforts in the past has been successful in improving service delivery. Instead, the experience is of an ever-rising cost of provision and never-ending load shedding.

Figure 2.6. Circle-wise % Recovery in PESCO (June 2021)



Source: PESCO Commercial Report (2021)

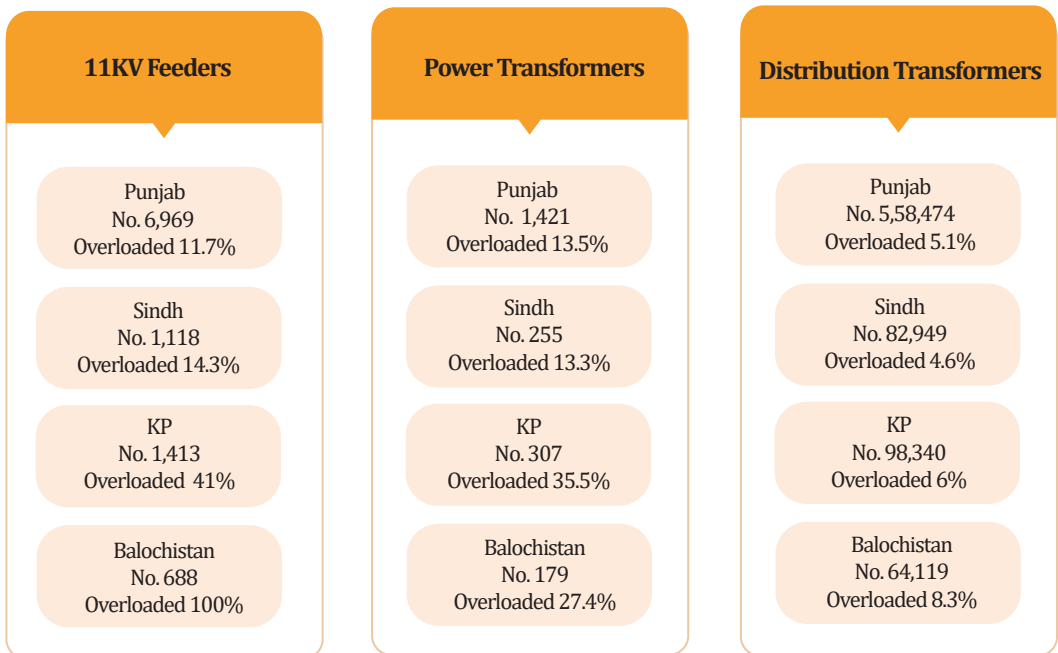
- Despite widespread theft of energy, there is a delay in the promulgation of an electricity act (drafted some five years ago), tells the importance accorded to this sensitive issue by the decisionmakers.
- Lack of financial resources and resistance from stakeholders are hindering
- moving towards smart energy solutions like pre-paid smart meters.
- Not only the failed writ of the state in several parts of Pakistan, including FATA, hinterlands of Baluchistan, some pockets in Sindh and Punjab, but the undisciplined power consumers is a huge threat to possible revival of the system.
- Reliable electricity distribution services primarily depend on the suitability of three major components including 11 kV feeders, power transformers (mostly 132/11 kV transformers) and the distribution transformers.

Table 2.1. Electricity Distribution Reliability

	NEPRA Target	PESCO	IESCO	GEPSCO	FESCO	LESCO	MEPCO	QESCO	SEPCO	HESCO	K-El.
SAIFI No.	13	193.7	0.05	24.78	35.53	34.66	471	97.96	441.04	137.1	28
SAIDI No.	14	14821	1.36	40.33	1252.7	3821.84	39733	8176.2	3893.3	7852.2	2565

Source: NEPRA Performance Evaluation Report: DISCOs (2021)

Figure 2.7. State of Distribution Infrastructure

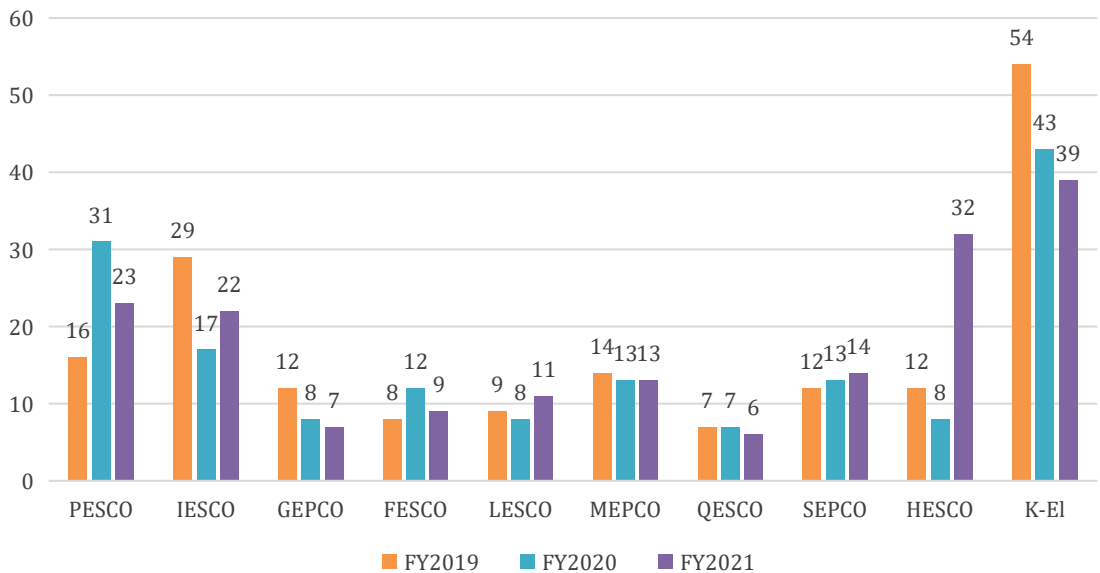


Source: NEPRA Performance Evaluation Report: DISCOs (2021)

Safety Policy

- High number of fatalities (Figure 2.8) shows that DISCOs have failed to comply with safety standards as prescribed in performance standards; reflecting their weak safety polices.
- In some DISCOs, shortage of skilled staff and work overload results in fatal accidents.

Figure 2.8. Number of Fatal Accidents



Source: NEPRA Performance Evaluation Report: Distribution (2021)

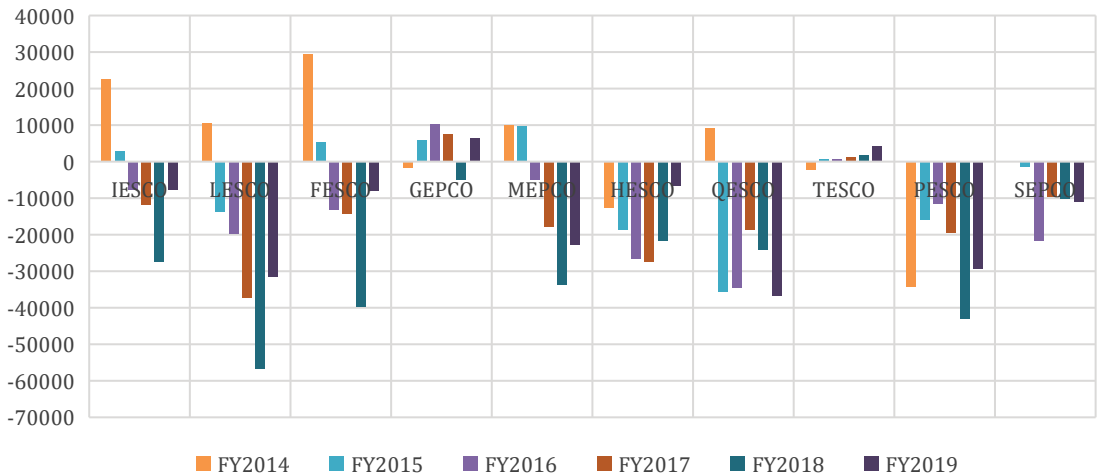
2.2. POOR ELECTRICITY DISTRIBUTION PERFORMANCE: MAJOR REASONS

Institutional Failing

- Over the years, DISCOs have not grown as an institution.
- There is confusion about whether DISCO is a corporate business or a government entity.

- The day-to-day operations are the same as in any government department.
- The interference of political elite or otherwise influential groups is common.
- DISCO employees /management, after corporatization, are company employees. But they are still treated as government employees (as they used to be in WAPDA days up to 2007). Management gets transferred quite frequently.
- No roadmap for HRD and towards the adaptation of smart meters, smart grid, and CTBCM. Capacity building of staff for emerging technologies like SCADA, AMI and GIS etc. is missing.
- Scarcity of qualified technical staff, e.g., lineman.
- There is a lack of commercial mindset at these DISCOs; no strategic planning to expand profits. No business model in these companies.
- Ten state-owned DISCOS, on average, recorded a net loss of Rs 143 billion in FY 2019. The net loss increased by 18 per cent between FY2014 and FY2019 (Figure 2.8).

Figure 2.9. Net Profit/Loss after Tax (Rs Million)

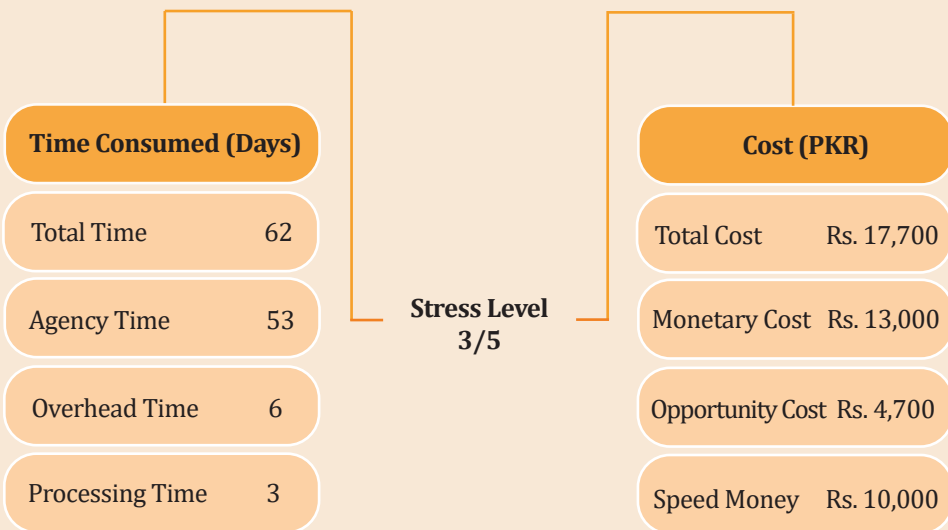


Source: Federal Footprint: SOE Annual Report (Various Years)

Box 2.2. Getting Electricity Connection

The consumer-centric approach is to the extent that hundreds of thousands of applications for new connections are pending because of bureaucratic delays. File processing by the officials at the DISCOs is a significant source of sludge in getting an electricity connection.

More than 600,000 applications are pending in the PEPCO area, while around 100,000 are in the KE.



Source: Haque, Faraz & Mustafa (2021)

The delays in getting electricity connection (Box 2.2) are in the presence of the enormous capacity charges paid by the CPPA-G, which get translated into an unwarranted increase in consumer tariff.

- An increase in billed demand for electricity (i.e., electricity sales) can reduce the burden of capacity payments on consumer tariffs.

Action Points

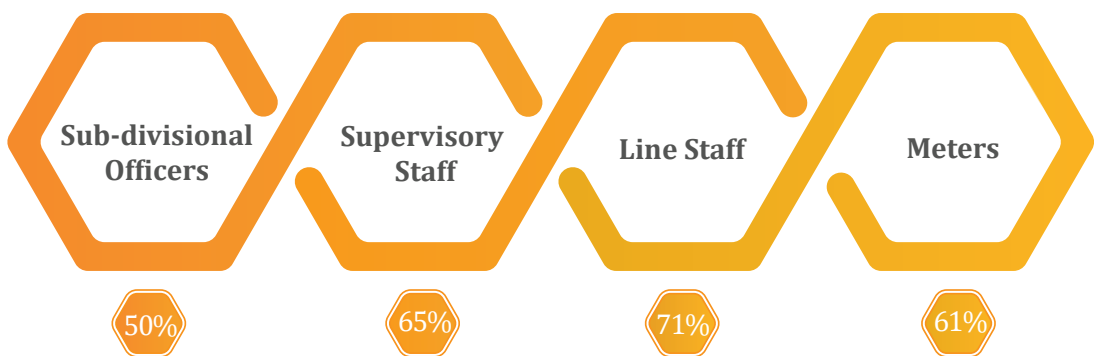
- *Facilitate a corporate culture in DISCOs with **a viable business model** as also envisaged in the National Electricity Policy 2021. Each company must have a business model based on its domestic market conditions.*
- *For increasing transparency and accountability, **a well-designed website for each DISCO.***
- *Minutes of each board meeting or at least major decisions should be publicly available. Their annual reports, as well as **financial statements, should be available for public scrutiny and in time.***
- ***The government should only be a policymaker.** Its only job is to improve the business environment via enforcing contracts, improving laws, and simplifying tax administration.*
- ***Professional and competitive management** with a clear corporate vision and business plans for organizing the utility on commercial lines is urgent.*
- *These professionals must have the capacity to develop a comprehensive revenue collection and theft prevention program in their respective companies.*
- *Need for **adaptability and training for emerging technologies** like smart grid, pre-paid meters.*
- ***For tariff petitions, a correct load forecast** is essential. It can be done by adopting technology and building the capacity of staff.*
- *No mercy for DISCO employees involved in facilitating theft or billing deficiencies.*
- ***Decentralize power sector for better management;** make companies accountable for their decisions_ operational and financial.*
- ***Revenue-based load shedding must stop.** It leads to more problems than any advantage for the power sector or even the federation. The non-compliant areas must be mainstreamed under some innovative ideas.*
- *Must provide new connections within 30 days of registering the requests.*

Organizational Structure

- After corporatization, DISCO headquarters (HQ) structures have broadened.

- Instead of decentralizing and empowering field offices, the HQs have taken many duties of the FCOs. Now HQs entertain power consumers for supply and billing issues.
- Over the years, the DISCOs organizational structure has been further weakened.
- It is starved of field staff, supervisory staff, tools and plants, modern equipment, access to distribution design parameters, and transport required to check power theft and recover bills.
- A DISCO organogram is more like a multi-business conglomerate than a power distribution utility.
- Privatization was planned in three years; therefore, no change in field formation was made—but, neither privatization nor any improvement in the field structure.

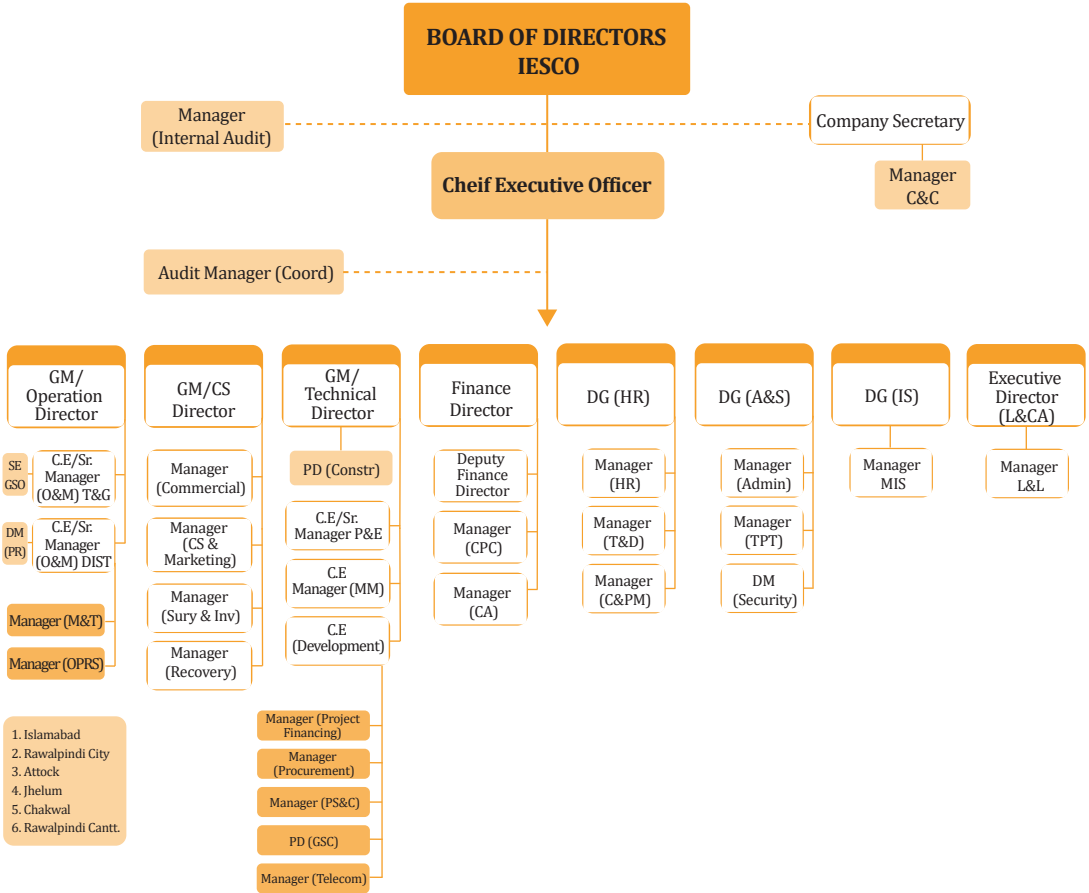
Figure 2.10. Shortages at LESCO



Source: LESCO (Online: www.lesco.com.pk)

Figure 2.11. IESCO Organogram

IESCO ORGANOGRAM



Source: IESCO (Online: www.iesco.com.pk)

Action Points

- *The organogram of the DISCOs needs to be corrected by **downsizing the head offices and strengthening the field offices.***
- *The **strengthening of HR at the sub-division level** is required.*
- *Sub-divisions and divisions must be merged at each circle office, which would convert itself into the primary business unit of the DISCOs.*

Decision-making without Power Sector Experts

- The sector experts to run the power sector's affairs at the top level have been completely ignored.
- The absence of sector professionals in the PD-MoE is a significant reason behind the weak governance and operational transgressions at the DISCOs. There is a lack of vision but lust for holding offices by bureaucracy.
- Their blind dependence on donor advice (who do not know ground realities) is responsible for an acute shortage of skills and capacity in existing employees_ both at the managerial and technical levels.
- The recent efforts to restore governance and strengthen the boards and senior management is no different.

Action Points

- *A serious effort is required to **rebuild and strengthen the governance, management, and technical skills and capabilities of DISCOs** through appointing/ involving power sector experts in DISCOs decision-making.*
- ***Fitness/ merit should be the lead criterion in promotions.***
- ***Training_ professional certification programs** must be held for officers of each department within DISCO.*

Board of Directors (BODs)

- Every DISCO has independent boards but the limited authority to make decisions. All decisions are made in the PD by the bureaucracy.
- A significant majority of DISCO board members are not power sector specialists.
- Even after so many years, the GOP has failed to develop a proper board member combination. As a result, no radical change has been realized concerning customer service delivery through improved technical and commercial performance.
- The BODs appointed in 2021 are inclined toward specific groups and mindsets (as explained in Chapter 1).
- They managed to block sector people with the expertise to bring about a change in a planned manner. These BODs made a failed attempt to induct competent CEOs of their choice from the open market. They were not even held accountable for the expenditure incurred on the hiring processes of senior management.
- In the last eight years, some DISCOs hired individuals in managerial positions, through these boards. But these left early as new appointees were unfit; their selection was not on merit. The situation de-motivated the existing cadre, and they could not adequately serve the clientele.

Action Points

To run DISCO affairs commercially requires an appropriate BODs. An independent/ apolitical board with sufficient capabilities to develop a business model.

- *A **suitable combination of experts**_ those who are aware of organizational (DISCO) culture, the geographical & socio-economic environment in which it operates, and the mindset and behavior of various consumer categories towards electricity usage.*
- *Board members should be chosen bearing in mind conflict of interest of industrialists what demand benefits from companies.*
- *Local people on the BODs for governance but no large users like industrialists or commercial people.*
- *Bring in academics and non-political people on board.*
- *Mandate listing of the DISCOs in the stock exchange with a limit of 5% maximum by one shareholder. Let the institutional investors come in and manage the business.*
- *Sell a certain percentage of shares to DISCO employees and give them representation on the board.*

Out-dated Distribution Infrastructure

- Under CPEC agreements, the system added a significant generation capacity without upgrading T & D infrastructure.
- Lack of continuous maintenance and distribution operations in the under-capacity system are the major causes of load shedding.
- A robust technical system for the economic dispatch of electricity is not in place.
- The distribution infrastructure is archaic_ mired in the 1960s technology.
- Lack of investment in the maintenance and upgradation of infrastructure has affected the quality and standards in the distribution network. These are deteriorating continuously. Thus, affecting supply security.
- DISCOs have failed to adhere to the prescribed standards required by NEPRA. On the other side, standardization, upgrading of systems, assurance of standard

service etc., remains a blind spot for the regulator.

- Billing is still at the centralized level, and conventional meters are used at the consumer end.

Figure 2.12. Pre-paid Smart Metering System



More details on pre-paid (smart) meters in Chapter 12.

Action Points

Revise distribution design and technical standards

- *DISCOs must be upgraded at the earliest (max 3-5 years, depending on specific up-grade modules).*
- *Technology Innovations like higher distribution voltage (33KV instead of 11KV), reduction in LT to HT lines ratio, smaller/individual transformers, smart metering system, provision of auto-reclosures, and control devices like sectionalizers are needed.*
- *Special modules in IT & AI; distribution SCADA, and allied tools must be introduced under a maximum of the 3-year program.*
- *Re-designing the distribution system_ from individual service cables to the provision of distribution boxes etc., duly sealed to ward off any chances of illegal abstraction.*
- *The condition of LT protection switching on distribution transformers would have to be re-introduced significantly when the voltage is increased to 33KV.*
- *Appoint CTOs in each DISCO.*
- ***No new connection without meeting technical standards; only those connections are provided, which can pay for smart meters, system upgrades through fixed monthly charges, minimum consumption guarantees, etc.***
- ***Move from a centralized billing system to decentralized billing system at the DISCO level.***
- ***Implement pre-paid smart meters linked to a decentralized DISCO billing system.***
- ***The consumer will pay for these smart meters.***

Through automation_ pay-as-you-go smart meters, and managerial and administrative improvement, it is possible to eliminate inefficiencies and losses.

- *Socio-economic obligations of the government only if compliant with technical standards.*
- *Due to price volatility, adequate funds must be ensured, as routine maintenance is becoming challenging.*

Only an affordable tariff in different geographical parts of the country can enable effective revenue collection and improvement of financial health for investment.

3. EXTERNALITIES AFFECTING ELECTRICITY DISTRIBUTION

Dealing with power distribution companies in isolation cannot alleviate its challenges. The overall profile of an area in which it operates plays a critical role in its performance.

3.1. VARIATION ACROSS DISTRIBUTION COMPANIES

Each DISCO has its dynamics concerning:

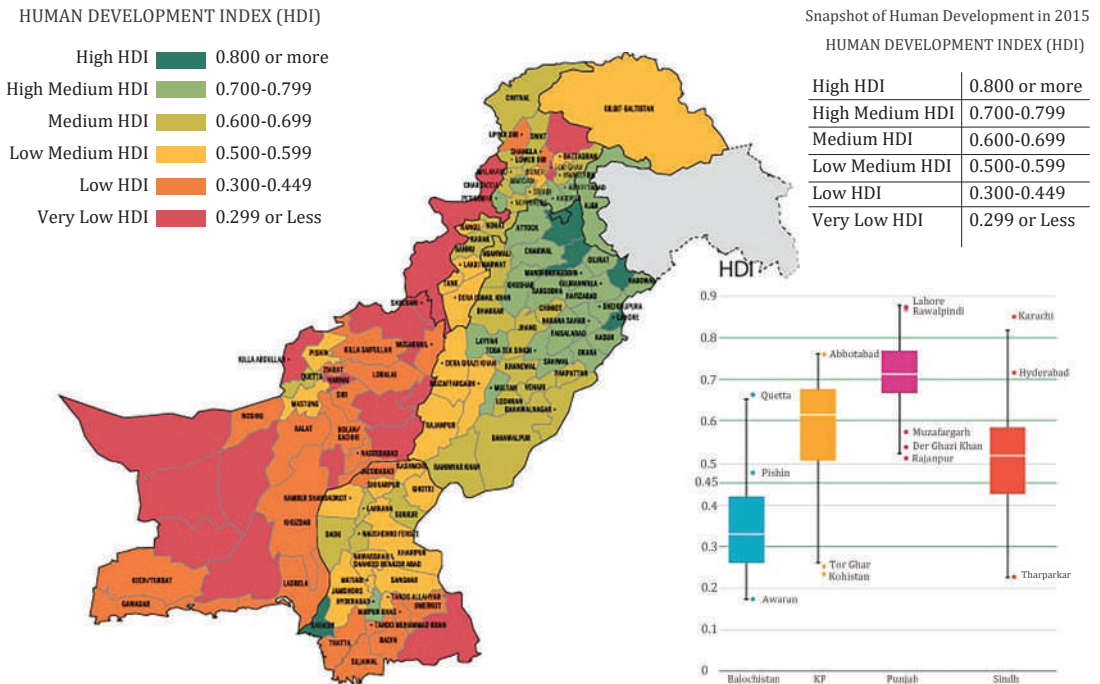
- Technical parameters like LT/HT ratio, Transmission/HT ratio, number & health of grid stations.
- Federal writ & provincial writ; and political will for the resolution of the issues of electricity theft and revenue recovery.
- Demography, payment culture, socio-economic status of the populace.
- Consumer / consumption mix.
- Role of the criminal justice system and law enforcing agencies in DISCO operating areas.
- Organizational culture of DISCOs and vision and mindset of senior management. Logistics, equipment, and technical staff availability.
- Influence of trade unions or officers' associations.
- Safety policy.

3.2. EXTERNALITIES

- Dealing with power distribution companies in isolation cannot alleviate its challenges. Understanding several related aspects can help in identifying solutions.
- The success of DISCO operations depends upon the human development index (HDI), per capita income and state writ in that distribution area.
- The level of power sector investments made in the vicinity of DISCO influences its operational and commercial efficiency.

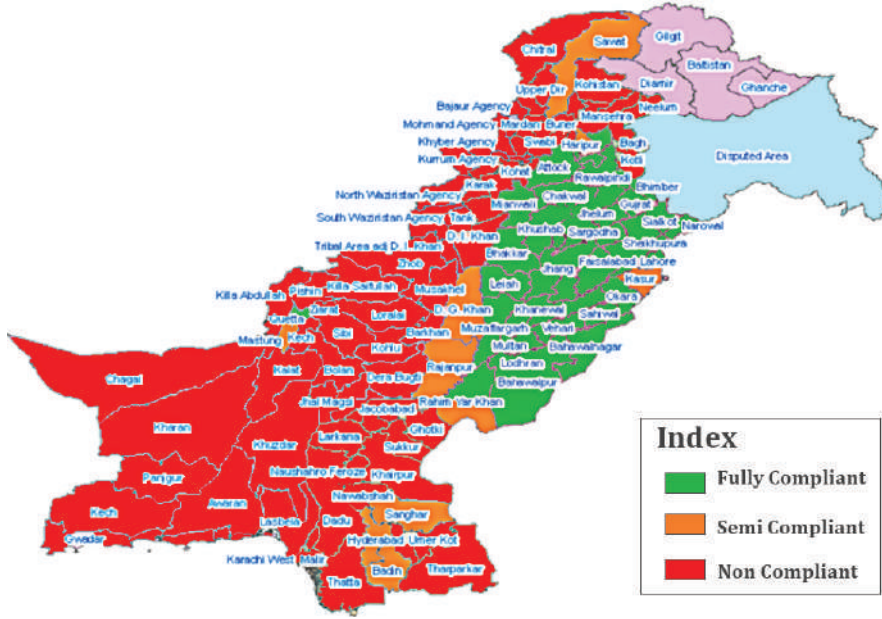
- Power sector operations are better in DISCOs in Punjab. It is not because of any effort of the Power Division or DISCO. It is because of the better HDI, per-capita incomes, the level of power sector investments made in districts falling within these DISCOs' geographical boundaries, and because of the better writ of the government in these areas (Figure 3.1 to 3.4).
- Once these facets are bettered/improved in Sind, KPK and Baluchistan, the power sector operations in these provinces will surely improve. Otherwise, the situation would remain the same.

Figure 3.1. District-wise Mapping of Human Development Index (HDI)



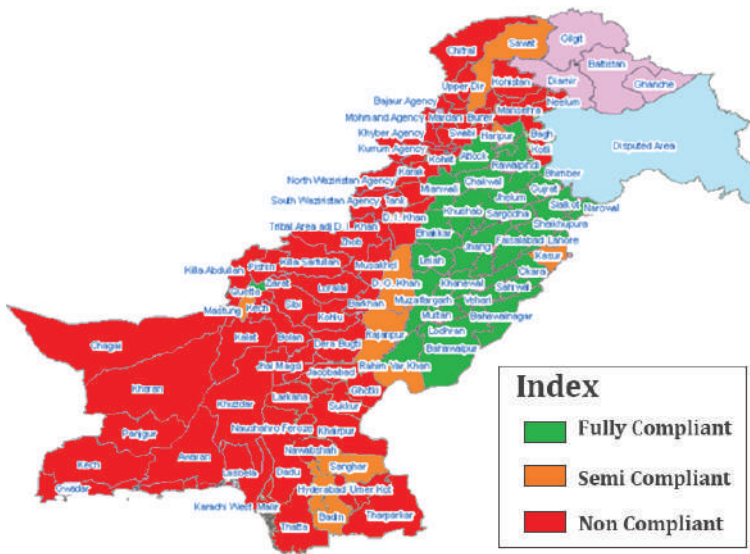
Source: UNDP Human Development Index (2015)

Figure 3.2. District-wise Mapping of Power Sector Operations



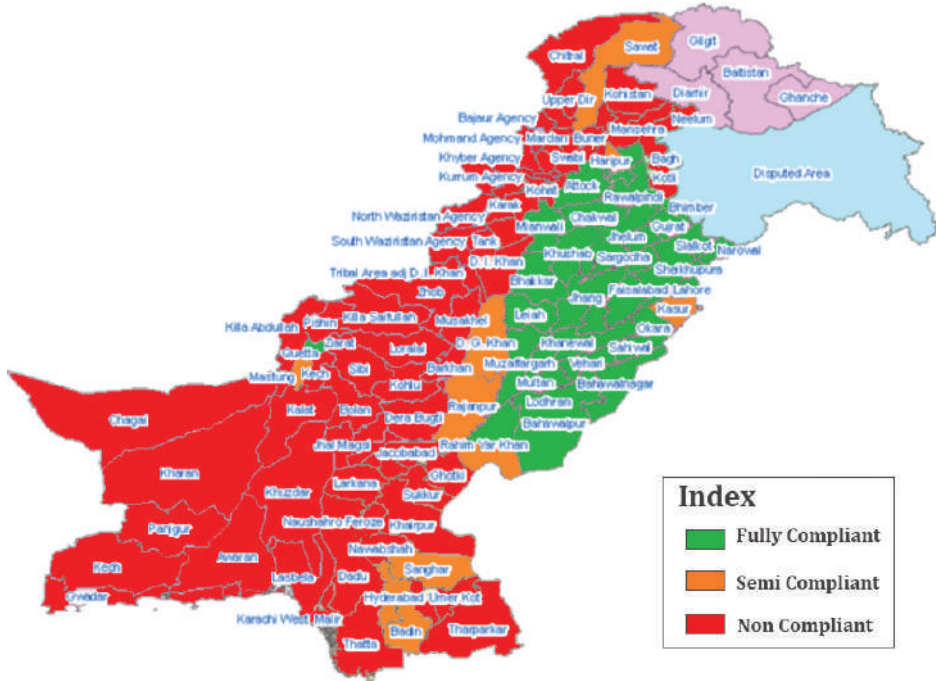
Source: PEPCO Statistics (2021)

Figure 3.3. District-wise Mapping of Per Capita Income



Source: Pakistan Bureau of Statistics (2021)

Figure 3.4. District-wise Mapping of Governmental Writ



Source: Pakistan Bureau of Statistics (2021)

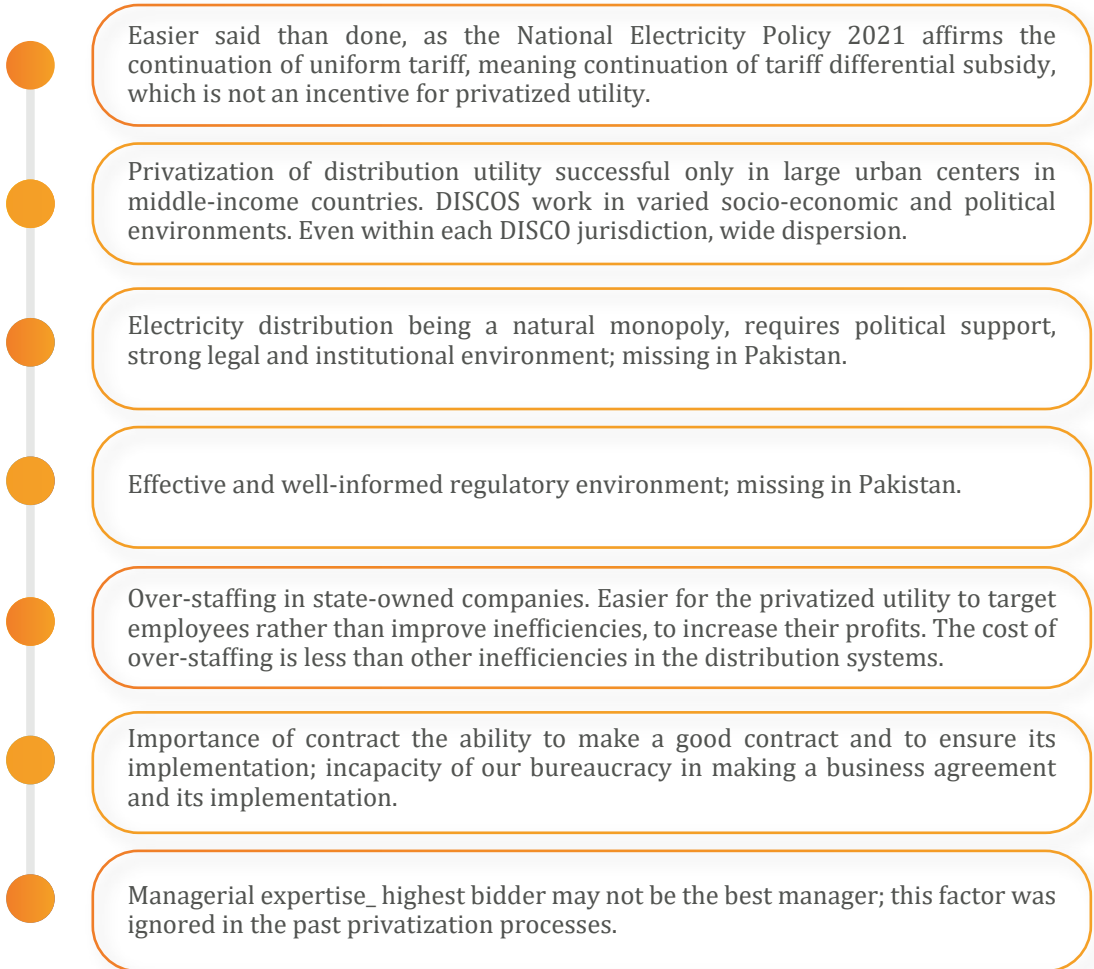
Key Takeaways and Way Forward

- The future strategy for each state-owned company needs to be thoroughly grounded in its service area's political, economic, social, environmental, and urban governance realities. The same strategy cannot be applied to every distribution company, as each works in a different environment.
- Secondly, for better administration of these companies, it is better to divide them into smaller units.
- An effective crackdown against defaulters in high-security risk areas like in PESCO, QESCO and even certain pockets in privatized KE, without law enforcement agencies' support is impossible. The provincial governments must support their respective distribution company in bill recovery, theft control and protection of utility staff.

4. PRIVATIZATION OF DISTRIBUTION COMPANIES: A FUTILE EXERCISE?

In Pakistan, as Stiglitz (2008) said, "the theoretical case for privatization is at best weak or non-existent". Privatization of a natural monopoly (electricity utility) does not guarantee efficiency.

Figure 4.1. Pre-requisites for Successful Privatization of Electricity Distribution



Source: Malik (2022a)

4.1. PRIVATIZATION OF ELECTRICITY DISTRIBUTION IN PAKISTAN: HISTORY

- The privatization of state-owned electricity distribution companies was a part of the 1990s restructuring plan. The aim was to ease pressures on government budgets, limit bureaucratic control and push for cost-effective profit-making utility.
- Karachi Electric Supply Company (KESC), now K-Electric (KE), was the first distribution company privatized.
- The privatization of KESC was initially intended to be the first in the broader privatization program for remaining distribution utilities. However, the plan was shelved because of the poor performance of KESC even after privatization.
- In 2013, the privatization of DISCOs again came under discussion as a solution to generate efficiency in the distribution sector.
- The Circular Debt Mapping Plan 2015 envisaged that the revenue generated through privatization would be used for clearing circular debt. But the plan was again shelved.
- Yet again, as per the Privatization Commission website, all state-owned distribution companies, excluding TESCO, are potential candidates for privatization.

Box 4.1. K-Electric (KE) Privatization

The process concluded in December 2005 when 73.5% of government shares were sold to Hassan Associates, Saudi Al-Jomaih Group of Companies and Kuwait's NIG, and US\$ 264.90 million was charged. The conglomerate guaranteed better services via professional management, new investment, technology, and employment benefits. It was agreed that the buyer would invest US\$ 500 million in the utility over three years, starting with US\$ 75 million in the first phase (Abbasi, 2012).

The decision was taken so hastily that the outstanding stock of Rs. 18.1 billion (as recoverable) was also handed over without the usual discount adjustments. The military government at that time bypassed routine procedures. KE privatization was viewed as illegal in political circles and challenged in the courts (Foster & Rana, 2019). In selecting a private owner, its credibility had not been investigated. Against the agreement, and even before due investments, the utility was re-sold to Abraaj Group in 2009.

As of now, under new management, the utility has partially improved its performance in terms of service delivery_ the service to high-end areas of Karachi has improved compared to low-end areas. From the consumer perspective, electricity tariffs are higher, but the service quality has not improved much. Instead of mainstreaming deviant power consumers, the utility still relies on revenue-based load shedding in areas with high AT&C losses.

In addition to contractual obligations, it is the job of the regulatory authority to set and enforce reliability targets and allow for tariff-based compensation to the privatized electricity distribution company. These are the missing links in the case of KE. The utility claimed that it is facing constraints in capital investments due to regulated tariffs, despite being privatized.

The privatized entity has refused to abide by its privatization covenants. Besides, it has refused to pay off NTDC (supplying more than 1000 MW each day) and SSGC (supplying a max. 280 MCFD of gas), leading to a default of about Rs. 400 billion at present. The utility wants this outstanding amount to be netted against its TDCs (subsidies) against the GOP. The GOP has been unable to get KE to sign the PPA. The earlier one expired in January 2015.

Besides, given the current tariff structure and subsidy policy, KE, since FY2007, has received Rs. 478 billion only under the tariff differential head. Before FY2014, KE also received government support to pick up payables for PSO and Gas companies. This indicates that the primary objective of minimizing the burden of subsidies through the privatization of KE has yet to be realized. Due to delays in tariff determination, disbursements of TDCs, and receivables from the government departments, the receivables from KE have gone up to Rs 225 billion. Thus, adding to the CD burden.

The city of Karachi has its dynamics_ weak governance and fragmented institutional structure affecting utility performance. The utility faces delays in tariff determination, delays in the disbursements of TDCs, and delays in receivables from the government

departments. Theoretically, it should have been relatively more straightforward for KE to make investment decisions to upgrade or replace distribution infrastructure as a privatized company. However, the company still needs regulatory approvals from NEPRA (Malik and Khawaja, 2021).

4.2. LESSONS FROM K-ELECTRIC PRIVATIZATION FOR OTHER DISTRIBUTION COMPANIES

- The electricity distribution utility (monopoly), despite being privatized, cannot operate without the support of Federal, Provisional, and Local Governments.
- The revenue requirements of the distribution utility must be funded through billing and on time. The subsidies, direct or indirect, must be paid up on time.
- Government consumers must pay the entire bill on time.
- The distribution companies cannot operate and deliver until the externalities affecting the efficiency of the utilities continue. That is if the culture of theft and non-payments of the bill remains prevalent in the service area.
- Explicit contractual terms are needed to guarantee that private operators invest in the distribution infrastructure. The expertise required to make and implement good privatization contracts does not exist in bureaucratic circles; bureaucracy may end up with the wrong decision.
- At the same time, any defiant distribution company operator can play havoc because of its monopoly power and the ability to blackmail the government.
- Any possible privatization is far away as a solution to the ever-increasing burgeoning CD.

4.3. PRIVATIZATION OF MONOPOLY

- The public sector has a social responsibility, while private operators aim to maximize profit. Society is an ultimate loser if both perform carelessly.

- Service efficiency and reduction in tariffs for consumers can be ensured only through competition.
- Privatization of a utility (natural monopoly) does not guarantee competition. The privatized monopoly increases profits at the expense of consumers and employees.
- The post-privatization monitoring (regulatory) mechanism has remained weak in Pakistan. The regulator remained busy determining tariffs rather than regulating a monopoly.
- A proper regulatory framework and contract enforcement are necessary for a company to abide by its commitments. In Pakistan, like most developing countries, weaknesses in the electricity sector's regulatory processes compromise the efficiency of both private and state-owned distribution utilities (monopolies).
- There are economic, social, and political costs associated with the privatization programs in Pakistan. Economic policymaking in Pakistan has continued to be a matter of rent-seeking between contending interests.

Experience of privatization in Pakistan indicates it was the privatization of state assets for the private parties by the private parties.

The KE experience suggests that the private sector can better manage distribution affairs than the bureaucracy. However, the management performs best in an effective regulatory framework with incentives/ penalties and supportive city dynamics and governance systems. Independent control of a state-owned company can also serve better.

Box 4.2. Case of North Delhi Power Ltd. (NDPL)

NDPL_ a joint venture between public (49%) and private ownership (51%) w.e.f. July 1, 2002, devised by the Delhi Government. It is the sole agency to distribute electricity to most of North and North-West Delhi.

Soon after the deal, NDPL chooses a team of performers to head each functional area. NDPL appointed a competent CEO with substantial management experience in the private power company.

In the transition, the Delhi Government provided financial support through subsidized power purchases for five years and a better specified multi-year tariff-setting regime based on more realistic loss targets. The subsidies were intended to avoid post-privatization tariff increases. It was a well thought out deal by the Delhi Government.

Indian Rs. 12.5 billion capital expenditure plan for five years was made. AT&C losses reduced from 53% to 20% and system reliability improved significantly. In 2021, NDPL AT&C's losses stood at 7.5%. The steps taken towards reducing this loss included: energy audit of the distribution network, rationalization and updating of billing database, installation of low tensionless systems in theft-prone areas, replacement of faulty meters, and aggressive enforcement activities. The company became cash-sufficient too. The focus in NDPL remained on quality, training, performance-based incentives and employee welfare, technology, and innovative systems.

No forced downsizing was adopted; instead, it offered an attractive voluntary retirement scheme. The NDPL ever introduced no revenue-based load shedding or outright power cuts. Because of the near-complete indigenization of generation fuels in India, the power tariffs have retained their earlier levels in India. Currently, no subsidy or cross-subsidy to any NDPL consumers, but some support payment by the government for specific electricity usage.

Sources: Saini and Bhatnagar, 2005; Official websites of power companies in India

- The future strategy for each state-owned company needs to be thoroughly grounded in its service area's political, economic, social, environmental, and urban governance realities.
- The same strategy cannot be applied to every distribution company, as each works in a different environment.

- Handing over management to the private sector while keeping the majority of assets in state ownership is an option. A similar arrangement was successfully adopted in NDPL in India (Box 5.2). With 49% government shares, the Tata Group (the main stakeholder in NDPL) never considers the utility a pure business¹⁴.
- Beyond that, there is strong resistance to change at the DISCO level¹⁵.

Action Points

- *Outright privatization may increase the financial burden on the government. At best, **slice the distribution companies into smaller units**. Then **a management contract of selected areas (urban)** and not the entire distribution sector.*
- *The GOP could do it through **a time-bound management contract or even a mid-term concession to an able management team supported by a credible financial entity**.*
- ***Pakistan Energy Council & NEPRA must lay down the pre-requisites for the envisaged management contracts**. First of such contracts may be given in a maximum of the coming six months.*
- *As mentioned earlier, mandate listing of the DISCOs in the stock exchange with a limit of 5% maximum by one shareholder. Let the institutional investors come in and manage the business.*
- *Under the Essential Services Act, the GOP must temporarily **bar Trade Union activities** in these entities (if not permanently). Otherwise, the envisaged management contracts will not work.*

¹⁴ In KE, 25% stakes are held by the GOP, and 2 to 3 Directors on the Board at various times. The governmental nominees either do not attend the meetings or participate half-heartedly.

¹⁵ Privatization or related plans to change the institutional setup in DISCOs create uncertainty among employees. These policies or reform plans face strong employee resistance, joined by the CBA and officer's associations.

5. GENERATION BLUES

The wrong policies under the grab of correcting mismanagement and random decision-making to correct power sector deficit resulted in the declining performance of public sector generation plants.

5.1. INTRODUCTION

Public sector generation plants (GENCOs) are running below their net available capacities. The timely maintenance and scheduled outages over the years as per standard industry practices have not remained in place. Lack of maintenance has increased their generation cost. Using similar fuel, these plants' EPP is higher than IPPs. The Framework of Economic Growth by PIDE (2020) reports that Rs 251.6 billion was lost due to inefficiency in these public sector generation companies (Table 5.1).

Table 5.1. Losses in GENCOs, 2010

Capacity Loss: Mismanagement	1,500MW	Rs 130 billion
Efficiency loss: Mismanagement on average	5%	Rs 8.6 billion
Extra use of fuel: Inefficient plants		Rs 103 billion
Leakage: Fuel Supply estimated		Rs 10 billion

Source: PIDE: Framework of Economic Growth (2020)

Table 5.2. Capacity Installed and Generated

GENCOs	FY2017		FY2021	
	Installed Capacity (MW)	Generated Units (GWh)	Installed Capacity (MW)	Generated Units (GWh)
I	1,024	3,593	880	199.04
II	2,402	8,079	1,790	4,824.29
III	2,293	6,861	2,061	1,777.26
IV	150	124	---	---

Source: NEPRA State of Industry Reports (Various Years)

- The total electricity generation of GENCOs during FY 2020-21 remained at 6,802.93 GWh compared to 7,907.85 GWh during FY 2019-20, showing a decrease of 1,104.92 GWh.
- NEPRA, in FY 2021, decided to convert the tariff of all old blocks of GENCOs from a ‘take or pay’ to a ‘take and pay’ basis_ to reduce capacity payment obligations (NEPRA, 2021).
- Over the years, policymakers have focused on new projects in the private sector rather than maintaining the available capacity, thus hurting their efficiency, and putting costly electricity in the system (Malik, 2020).

Table 5.3. GENCO's Efficiency and Utilization

GENCOs		Net Efficiency %		Utilization Factor %	
		FY2017	FY2021	FY2017	FY2021
I	TPS Jamshoro	28.42	27.37	58.04	0.88
	GTPS Kotri	27.06	0	33.51	0
II	Guddu 1-4	25.67	0	12.34	0
	Guddu 5-10	36.03	32.01	47.33	31.06
	Guddu 11-13	30.09	22.26	36.03	6.46
	Guddu 14-16	48.70	55.55	69.43	48.93
	Quetta Isolated	19.95	0	24.35	0
III	TPS Muzaffargarh	29.76	32.5	48.21	3.02
	GTPS Faisalabad	23.86	0	14.52	0
	SPS Faisalabad	28.40	21.01	12.27	1.62
	TPS Nandipur	39.62	46.53	38.52	33.73
IV	FBC Lakhra	18.34	0	22.68	0

Source: NEPRA: State of Industry Report (2021)

5.2. GENCOs: HISTORICAL PERSPECTIVE

Box 5.1. GENCOs Journey (1958 to 2022)

GENCO's journey started in 1958 after enacting the WAPDA Act 1958

- A structured expansion in generation from the late 1980s to the early 1990s_ the completion of 1350 MW TPS Muzaffargarh, the 1650 MW GTPS Kot Addu and the 850 MW Jamshoro TPS.
- With the support of the Planning Commission, Lakhra Coal Development Company was established as a joint venture of WAPDA, PMDC, and Sindh Coal authority. WAPDA was the lead partner with 50% shares.
- After ensuring coal availability, WAPDA built its 150 MW FBC (3x50 MW steam turbines) coal-fired power plant close to the Lakhra coal mine. The plant had many teething problems and could not generate power at a sustainable level. It was leased out but through a flawed process. The lease got challenged in the courts and cancelled eventually. The plant deteriorated during the whole legal process and finally shut down.
- But during the whole legal process, the plant deteriorated and finally shut down¹.

In 1987, through a presential order (one-page policy), the GOP restricted the public sector to hydropower projects and left thermal generation for the private sector. After the Power Policy in 1994, it was formally implemented.

- HUBCO (1292MW) in 1992, 16 more IPPs under the 1994 policy with a capacity of 31,00.5 MW were added to the generation system.
- KAPCO, with a capacity of 1,638MW, a public-sector power project, was privatized and converted into IPP in line with the 1994 Power Policy. The addition of private power plants led to surplus capacity in the system.
- The policy to bar the public sector from entering & owning thermal generation continued even after FY2006 when the surplus capacity converted into deficit.
 - Additionally, the lack of cash flows affected the timely renovation of existing GENCOs.
- Adding one hydro IPP (84MW) under the 1995 Power Policy and 15 more thermal IPPs with the capacity of 3,267MW under the 2002 Power policy could not reverse the situation_ the power shortage continues.
- In 2008, with a shift in policy, three power plants (in the public sector) were allowed_ Nandipur (525MW)², Chichu Ki Malian (525 MW)³ and the addition of gas turbines to Guddu Power Complexes (to increase its capacity to 1,762MW)⁴.

¹ PEPCO's Public Sector Generation Capacity Enhancement Plan (2010) did contain a renovation of this plant at a meagre cost of US \$9 million. The process withered away with PEPCO's demise in 2011 and with the setting-up of GHCL.

² It is a CCGT power plant run on dual fuel. It faced a series of delays during and after the launch of its commercial operations because of political and commercial disputes, court inquiries, audits, etc.

³ The power plant faced delays and later got shelved.

⁴ It is one of the most efficient public sector power plants. It is the National Grid's mainstay in the South and a potential candidate for privatization.

5.3. RANDOM DECISION MAKING

To correct the power sector deficit, the GOP (2013-18) added :

- Four RLNG_ combined cycle power plants in Punjab (Haveli Bahadur Shah (1,230MW), Bhiki (1,180MW), Balloki (1,230MW) and Trimmu (1,263MW)
- Two coal-fired power plants (CFPPs) were added, one at Sahiwal (1,320MW) and the other at Port Qasim (1,320MW) under CPEC

The four RLNG plants are located not only quite far from the Karachi or Gawadar port but are dependent on timely imports. The average plant factor is below 58% against the accepted minimum of 85%. In the case of RLNG shortage, the secondary fuel used is HSD. It means a high generation cost whenever there is a surge in the import price of RLNG or a deficit of RLNG. Besides, RLNG supplies must accommodate the loss or UFG of 7%, further compounding the issue of costs. Likewise, Sahiwal's CFPP should not have been allowed. It requires 1200Km of rail journey to transfer imported coal from the port to the plant site_ increasing the cost of electricity generation, apart from the environmental consequences.

- A non-professional approach at GHCL and mistakes in decision-making led to the continued national loss.
- Historically (in the early WAPDA days), all public sector generation plants were planned professionally regarding site and fuel selection.
- Similarly, all IPPs (under 1994 and 2002 policies) could have been located elsewhere, provided all the departments tasked to deal with investors had performed their duties responsibly. Unfortunately, the focus of these departments (i.e., PPIB) had remained on bidding only.
- None of the departments (PPIB, AEDB, NTDC, NEPRA, PEDO, PPDB, Sindh Energy Department & CPPA-G) meets its job pre-requisites.

¹⁶ There were delays in the commissioning of the IPPs in the pipeline.

Box 5.2. Solar Power Parks_ A Case of Quaid-e Azam Solar Power Park (QASPP)

There are prerequisites for setting up a Power Park, for instance, acquiring land, arranging transmission lines to evacuate power, soliciting approvals from local bodies etc. The private sector is more skilled in operating power plants in these parks. But they face difficulties unless all the prerequisites are facilitated/ provided by the government beforehand. It saves time and lowers costs. In 2012-13, the PPDB efforts for the QASPP came to a standstill as neither prerequisite was in place nor planned.

Likewise, the park's location is also important, where the government invites the right kind of technology and sets tariffs through competitive bidding. QASPP is not only erroneously located but managed inappropriately. QASPP is located in the desert of Lal Sohanra, Bahawalpur, where summer temperatures go up to 48°C. Higher temperature reduces the efficiency and life of the solar plant. Transmission infrastructure to transmit 1000MW is now put in place; still, due to heat factors and managerial issues, even after so many years, only 400MW can be produced and evacuated from this plant.

The bidding process was not as per international norms, thus resulting in high tariffs. Park is set in Punjab in isolation, with no design skills. The little bit of power generated is expensive and burdens the consumer.

In India, setting and operating power parks yield positive results_ affordable tariffs for consumers and the operations of plants at very high plant factors. The reason is proper planning; the government makes all prerequisites available timely.

Key Takeaways

Over the years, wrong policies, and random decision-making to correct the power sector deficit resulted in the declining performance of public sector generation plants. For instance, in recent years, wrong location and selection of fuel types highlight quick fixes without vision and planning.

In the pre-reform era, WAPDA always preferred site and fuel use in plant selection, i.e., location close to the load center and the fuel at the least cost with a guarantee of supplies. The RLNG power plants, if located near the two ports, would have curtailed costs to some extent. These plants could have been installed at the present site of the thermal power plant Jamshoro¹⁷, where evacuation lines are already available.

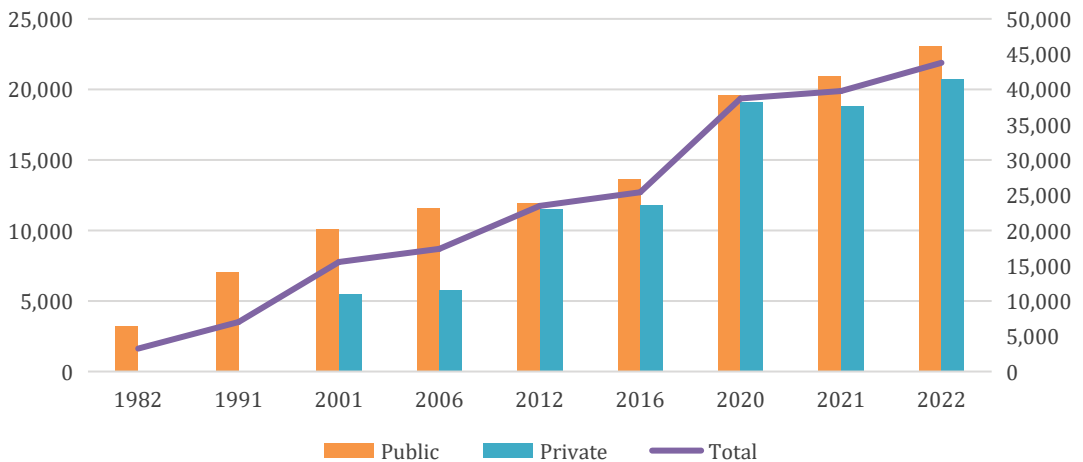
¹⁷ There were delays in the commissioning of the IPPs in the pipeline.

6. IPPS THAT CHANGED THE POWER ARCHITECTURE IN PAKISTAN

Every policy initiative has been influenced by one or the other donor agency, strategic partner country or interest group. Lack of transparency and an independent regulatory audit, IPPs are getting paid for the electricity they have not generated, increasing the cost of generation.

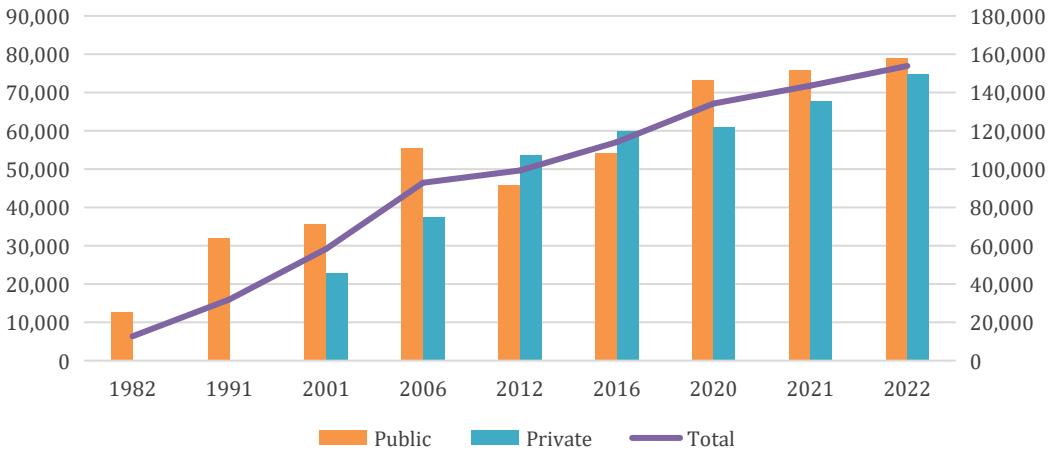
As of June 30, 2021, Pakistan’s total installed capacity stands at 39,772MW, generating electricity equivalent to 143,589 GWh.

Figure 6.1. Installed Capacity (MW)



Source: NTDC Electricity Marketing Data (2022) and NEPRA State of Industry Reports (Various Years)

Figure 6.2. Generation Capacity (GWh)



Source: NTDC Electricity Marketing Data (2022) and NEPRA State of Industry Reports (Various Years)

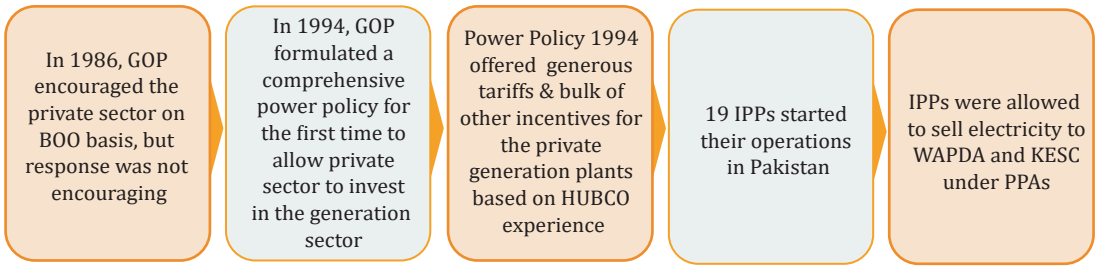
6.1. BEGINNING OF IPPS ERA IN PAKISTAN

Through a one-page policy paper in 1988, the GOP paved the way for private generation companies in the country. In 1992, the GOP prepared a strategic plan for the electricity sector restructuring. For generation capacity expansion and efficiency, the plan realized the role of the private sector.

Box 6.1. Hub Power Plant

The feasibility of the first private power project, HUBCO, with a capacity of 1292 MW, was completed in 1988¹⁸. In 1991, HUBCO became a Limited Liability Company for executing the project in Pakistan. In 1992, the plant signed an agreement with WAPDA to develop a 1292 MW power plant. The WB supported the project and helped arrange the finances. The global financial market cited this project as the first major private sector venture executed in any perilous developing country environment. HUBCO was the first private sector generation project that entered the system in 1997. Its generation license will expire in 2025

¹⁸ Signed by General Zia ul Haq.



In the 1990s, Pakistan opened its generation sector for the private investors under external pressures (WB) and vested interests of those in power, including powerful bureaucracy¹⁹. These projects did not meet the "least cost" generation test because of their small size, unsuitable location, and excessive reliance on oil and steam turbine technology instead of more efficient CCPPs. The advent of the first IPP (HUBCO)²⁰ led to unwarranted financial pressure on WAPDA while leaving nothing to re-invest to upgrade or maintain the existing generation system in the public sector²¹.

- Private sector does contribute to the expansion of generation capacity in Pakistan, the absence of cost-effective planning increases generation costs.
- Absence of competitive bidding for private generation projects and non-transparent procurement processes raised concerns about the potential for corruption.
- Sovereign guarantees offered by the government aggravate financial problems.
- The power sector became a major cause of the rise of public debt in the late 1990s.

¹⁹ The WB also got involved in arranging finances for HUBCO from the governments of France, Italy, Japan, United Kingdom, and the United States as co-financiers in the Private Sector Energy Development Fund of Pakistan. This fund along with the WB and the Import/Export Bank of Japan jointly developed an Expanded Co-Financing Operations Program to assist the international commercial debt funding by the provision of a partial guarantee. A significant portion of the offshore debt was also guaranteed by certain export credit agencies. A group of local banks led by the National Development Finance Corporation of Pakistan provided rupee debt (HUBCO, 2021).

²⁰ From 1985 to 1992, various policies were framed and announced to encourage and mobilize private participation, but only HUBCO came. Despite several concessions/facilities assured by the GOP, the HUBCO implementation progressed at a snail's pace.

²¹ During 1995-96, the Chairman WAPDA (a generalist civil servant) and the Member (Finance) did nothing but remained busy arranging money to pay HUBCO. This affected cash flows at WAPDA.

- Even to date, capacity payments to IPPs are one of the key reasons behind high electricity costs/ prices and rising CD.

6.2. WRONG DECISIONS AND IPP IRREGULARITIES

Pre-2015 Era

- After the detailed audit of HUBCO and other IPPs (commissioned under the 1994 Power Policy), the GOP started a criminal investigation in the late 1990s. Some sponsors were arrested, while others were forced to re-negotiate their PPAs. Protracted litigation by the HUBCO sponsors, which got settled in 2000 by the GOP/WAPDA through re-negotiated PPAs of all IPPs (sixteen with a capacity of 4,393 MW).
- Rates were brought down substantially for a few IPPs but remained nearly the same for the giant, HUBCO.
- HUBCO PPA retained its offending conditions and tariff, while the small IPPs viz. SEPCOL, Japan Power and Saba Power have been shut for the last twelve years because of financial losses.
- Electricity consumers paid the debt portion of these IPPs through tariffs but failed to get lower tariffs even after that.
- Power Policy 2002 attracted the Pakistan corporate sector instead of international investors.
- 2002 policy was meant to do away with the one-sided facilitation for the IPP sponsors²². Yet, it ended up with more facilitations for the private producers at the expense of the sector's future and consumers. It attracted plants with expensive fuel mix.
- In 2007, another policy was issued to counter all negatives of earlier policies, i.e., competition instead of the cost-plus formula for the IPP tariff. It was stillborn, thus, quickly taken back.

²² Signed by General Zia ul Haq.

Post-2015 Era

- 2015 Power Policy resulted in the induction of RLNG-fueled CCPPs and CFPPs. The five mega-plants were set in Punjab instead of around Karachi, increasing transportation costs – adding to the already bloated tariff.
- Four RLNG plants (1,250MW each) were set up with obsolete technology, ballooned costs, and were allowed through dubious bidding processes.
- CFPPs were also set at high costs (as per cost sheets submitted to and accepted by NEPRA), leading to the approval of high tariffs.
- In 2019, instead of inducting wind power, the GOP, through the PD, against its notification of moratorium to IPPs using imported fuel, allowed another RLNG plant (1,250MW) in Punjab.
- With the inclusion of RLNG plant, the space for other types of power plants – including renewable energy plants almost diminished²³.
- The 2015 policy sought bid-based lowest tariff; NEPRA accepted as many as 12 wind projects of 50 MW each based on cost-plus formula²⁴. The AEDB has not drafted the bidding process and allied documents/procedure(s).

²³ Wind Projects in Sindh (dozens of LOIs issued by GOS) were put on hold apparently for competitive bidding per policy.

²⁴The tariff allowed by the regulator is between 3.4 to 3.7 US cents on the levelized basis – against up to 13.5 cents given a few years ago. Costs of wind and solar plants have decreased substantially over the years.

Table 6.1. Power Policies and Impact on IPPs

Policy	Salient Features	Impact
1994	Investors free to choose site, technology & fuel; long-term PPA & FSC with GOP guarantee; bulk power tariff of US Cents 6.5/KWh for first ten years, levelized tariff of US Cents 5.9/KWh over life of the project (25-30 years) & a premium of US Cents 0.25/KWh in first ten years; two part tariff_ CPP & EPP, CCP to be paid on an annual plant factor of 60% on take or pay basis; exemption from certain taxes & import duties; & repatriation of equity along with dividends.	16 furnace oil & gas based IPPs, with capacity of 4100MW were added to the system. These IPPs invested Rs 51.8 billion & have earned more than Rs. 400 billion.
1995	Project on BOOT basis, GOP owner after 25 years; bulk tariff of US Cents 6.1/ KWh; exemption from certain taxes & import duties; & guaranteed foreign exchange conversion facility.	Insignificant response_ only one project with capacity 84MW was installed with long-term contract & GOP guarantee for 25 years.
1998	Competitive bidding & tariffs, two-part tariffs_ CPP & EPP; guaranteed foreign exchange conversion facility; restriction on imported fuels; & limited exemptions on taxes & duties.	Policy failed to attract new investments.
2002	PPA & FSC with GOP guarantees; hydro projects on BOOT & thermal projects on BOO or BOOT basis; two-part tariff_ CPP & EPP; tax exemptions & financial incentives; & no restriction on imported fuels.	13 IPPs with capacity 2934MW; IRR 15%; & project life 25-30 years; furnace oil & gas-based plants. These IPPs invested Rs. 57.81 billion & earned (so far) Rs. 152billion.
2006	Exemptions on taxes and import duties; permission to deport equity along with dividends; allows both cost-plus and upfront tariff regime. (In 2013, GOP expanded the 2006 policy to include bagasse, biomass etc.; and issued the Framework for Power Co-generation 2013)	24 Wind IPPs with capacity 1234 MW and 7 solar IPPs with capacity 430 MW were set up. 8 IPPs with capacity of 253.7 MW have attained COD under 2013 Framework. These IPPs have earned excess profits on account of incorrect IRR calculation (18.39% instead of 17%).
2013	Reliance on less expensive fuels; upfront tariff mechanism; one window operation to facilitate investors; whereas incentives given in 2002 remained intact.	-----
2015	Two-part tariff; PPA with GOP guarantee; hydro projects on BOOT (30 years) and water use charge @0.425/KWh to be paid to the province where the project is located; thermal plants on BOO basis_ both indigenous and imported fuels; three types of thermal projects_ through competitive bidding, through provincial recommendation, or based on international commitments.	7 IPPs with capacity 8253MW; IRR 15% to 17%; and project life 20-25 years; Imported coal and RLNG based plants. One imported coal power plant recovered 71% of its investment in two years of its operation, and the second one 32 % in the same period. These plants have been offered 17%IRR in US\$.

Similar stories are repeated in the history of private energy projects, whether under the 1994 Power policy, 2002 power policy or 2015 generation policy. There are always transparency issues in the selection of projects, the role of pressure groups (local and international), and political patronage. All the time, policymakers have chosen the path of tariff ceiling to attract investors rather than competitive bidding.

- All generation plants (except for renewables, e.g., wind and solar) are designed with capacity payments, but there is hardly any monitoring of actual capacity (as per capacity payments) and availability.
- There is no verification of IPPs claims of power supply and what they supplied.
- Lack of transparency and an independent regulatory audit_ IPPs are getting paid for the electricity they have not generated. This is increasing the cost of generation.

None of the policies could be termed as public policy formulated for the betterment of the people. All these were/ are Special Purpose Vehicles (SPVs) – crafted to meet the special interests of specific groups of raiders_ these were successful in their intent but led to the near-collapse of the Power Sector. The GOP unveiled the new Electricity Policy in 2021. It is no different from the earlier ones.

A comprehensive report was prepared by the committee led by the former chairman of SECP in 2020 on the power sector, focusing mainly on losses because of IPP irregularities (Box 6.2). Later, the government renewed PPA with 46 IPPs (Box 6.3).

Box 6.2. Power Sector Inquiry Report 2020 Findings & its Aftereffects

- Fraud committed by the IPPs under three groups viz invoicing errors, wrongful interpretation of the PPAs and blatant over-invoicing of plant costs.
- IPPs have skimmed the Power Sector by a whopping Rs.4.0 trillion during the last twenty years (Rs.200 billion each year).
- Report unearthed only 50% of the issues and suggested a detailed forensic audit of these IPPs.
- Even after the inquiry report, the tardy progress in remedying the situation is an issue of concern.
- GOP signed MOUs with the IPPs through Independent Power Plants Association (IPPAC)* and ignored the detailed forensic audit of IPPs.
- GOP has forgotten to tackle the 11,368 MW of IPP capacity** in the pipeline in the next ten years.
- IPP billing of the above projects would significantly impact the generation price in the coming years; compliant electricity consumers would still be at the receiving end & the
- IPPs will continue making un-due profits.

*IPPAC is not registered with any regulating agency

** https://www.ppib.gov.pk/upcomming_ipps.html

Box 6.2. Power Sector Inquiry Report 2020 Findings & its Aftereffects

46 IPPs have formally signed new agreements with the GOP, paving the way for a discounted tariff of Rs 836 billion in the next 12 years. As of February 08, 2021, Federal cabinet committees approved the payment of dues worth Rs. 403 billion in two instalments to these IPPs_ 40 per cent in a month (one-third in cash, one-third as Pakistan Investment Bonds (PIB) and one-third in five-year Islamic Sukuk) and the remaining 60 per cent in six months in similar three forms.

The present-day calculations of dividends for the next 20 years are Rs.770 billion or Rs.35 billion per year. Surprisingly, no refund is being contemplated for periods before signing any agreement with the delinquent IPPs. Rs. 403 billion (the current outstanding payables) is to be paid nearly upfront to the same IPPs. They are responsible for wrongful invoicing, incorrect interpretation of PPAs and outright fraud without any deduction.

Power companies are unhappy with the development as their future earnings decline after removing dollar indexation from their return on equity. From the power sector perspective, the agreement would not substantially impact tariffs and circular debt, as it covers less than 23% of the installed capacity.

- CPEC power projects (8,913 MW) commissioned and in the pipeline (7,028.7 MW) under the 2015 Power Generation Policy are not part of this agreement.
- The impact of dollar indexation would be on future earnings, while the projects commissioned under 1994 are either retired or about to retire in a few years.

6.3. ROLE OF SEVERAL PARALLEL ENTITIES

A combined ineffectiveness of NEPRA, the PPIB, the AEDB and the CPPA(G) has been the main reason for allowing windfall gains for the IPPs at the cost of consumers. Extra-billing by the IPPs under all heads up to Rs.200 million each year (based on the FY2020 exchange rate), i.e., 20% of actual costs and equivalent to Rs. 2 per electricity unit sold each year.

The investors successfully intimidated the PPIB, the AEDB and NEPRA to have their numbers accepted in the face of totally different data and figures being manifested elsewhere in the world²⁵.

PPIB & AEDB

- PPIB and AEDB are small and autonomous organizations with independent members on boards other than those directly related to the power sector.
- No hard-core professionals on these boards; these entities relied upon a POEs hired to scrutinize individual solicitations/projects.

Continuity in hiring depends on the PPIB / AEDB and the investors. As proved by the longevity of POEs, all the IPPs ended up with similar problems. For instance,

- The most common (as pointed out in the Inquiry Report) is the over-invoicing of projected costs (high energy price costs) of the IPPs.
- Serious issues in project loans_ as these are left to investors to arrange and structure; all the international loans are at the higher end of spreads.

O&M contracts are commissioned not by the OEMs themselves (as required in the PPAs); instead, are negotiated with set-ups accredited with the OEMs but independent.

- All these issues have not been accorded due importance, given that these have profound ramifications in the shape of high tariffs.

NEPRA

- Policies allowed unreasonably high profits to IPPs; excess payments have been made to power producers because of either misreporting by the producers and/or regulatory oversight (Report on the Power Sector, 2020).

- Profits generated were as high as 18.26 times the investment, and dividends were taken out as high as 22 times the investment (Report on the Power Sector, 2020).
- Though NEPRA is not involved in the review and approval of PPA, it determines the generation tariff that will apply to a power plant, and the PPA must follow. Section 3(6) of NEPRA Licensing (Generation) Rules, 2000, allowed NEPRA for additional terms and conditions for a good cause. It is the lack of regulatory oversight that today Pakistan's power sector is in a "capacity trap."

CPPA (G)

- The CPPA(G) below-par working further adds to the excessive charging by the IPPs.
- Most of the issues relating to wrongful and incorrect invoicing by the IPPs, even interpretation of PPAs and specific clauses leading to increased IPP invoicing, are the main reason for extra charging by the IPPs; unfortunately, have escaped the audit and check by the CPPA(G). All this happened because the CPPA(G) processes and clearance of IPP billing / invoicing have never been put up to any audit by the AGP.
- The CPPA(G) remained oblivious to the various clauses of the PPAs, their true meanings, the requirement to be vigilant, and the obligations of a clearing house.
- CPPA(G) board is no different from other entities.

Recently, a plan has been prepared to install 10,000 MW of solar plants at the GENCO sites, in certain high-load feeders, rooftops of government departments etc., to reduce the fuel import bill. Preference to GENCO sites is given as the transmission and other ancillary infrastructure is already in place. In the last approved Integrated Generated Capacity Expansion Plan 2021-30, 22,182 MW is already committed for the period, and this 10,000MW solar project was not part of these.

Are we heading towards another haphazard decision? Does the economic viability of such a project in those sites is evaluated? What type of investment will be in these solar plants? The answers to these questions are yet to be known.

Pakistan's Power sector needs private investment but without concessions, exemptions, and government guarantees.

Action Points

- Whatever has been agreed with the IPPs, the right way would be to immediately commission the required forensic audit, followed by recoveries without any relaxation.
- As an interim measure, the presently signed MOUs must be implemented on the fast track.

Private auditors cannot ensure complete and the needed transparency of operations. The private sector management can manipulate these auditors by doling out dividends.

- Therefore, post audit (within 3 to 6 months of the clearance of any IPP invoice) by the AGP should be made compulsory.
- All power projects from 1994 onwards, primarily the CFPPs at Sahiwal, Port Qasim, Hub Chowki, Gwadar (in the pipeline) or in Thar (through local coal), must be tackled with the same brush. All of these are heavily over-invoiced and privy to undue benefits.

In future

- Moratorium on IPPs in the short-term, including the proposed solar projects of 10000 MW.
- The process of replacing solar capacity with the existing candidate projects on fossil fuels must be through a thoughtful approach and after gauging its effectiveness.
- In the future (long-term), no sovereign guarantees, and all investments must be based on competition, the financial dynamics of the sector, and through a comprehensive planned process.
- GOP should only acquire the new generation capacity through tariff bidding. It could be done if the capacity in the pipeline is corrected, and the competitive bidding documents are in place.
- To strengthen energy functions under the existing institutional setup will not lead to sustainable solutions.
- So many parallel sector entities with limited capacity cannot safeguard people's interests _ needs to reduce the number & strengthen the remaining. No need for PPIB, AEDB or even CPPA-G; shut down these while consolidating NEPRA (more details in Chapter 12).

7. POWER CONTROL AND ALLIED ISSUES

The ability of power systems to ensure a continuous supply of electricity to customers in the event of a disturbance is crucial. NTDC is not fully compliant with industry standards. Codes of conduct on the safety, reliability, stability, integrated operability, and efficiency of the electric power system are weak.

7.1. LOAD DISPATCH CENTER (LDC): HISTORY

Under WAPDA, the power system proliferated with thermal power plants in the south and hydel power plants in the north.

LDC was established at Kot Lakhpat, Lahore, for transmitting electricity.

By 1975, WAPDA Grid System spread from Peshawar to Hyderabad, connecting all generating stations to the load centers through 66 kV, 132 kV and 220 kV transmission lines.

PLC was formed, which provided direct dialing telephone communication with major power plants, grid stations and Kot Lakhpat Load Dispatch Center.

In 1975, RCC was set up in Hyderabad to connect KESC Grid with WAPDA Grid to form the National Grid.

LDC Kot Lakhpat and RCC Hyderabad remained unautomated; PLC or conventional telephone communication conveyed operating instructions to power plants and the grid stations, and the health of the transmission network was assessed through frequency meters.

Modernization in early 1980s: with an increase in energy demand and generating capacity (addition of Mangla and Tarbela hydro plants), WAPDA moved towards computerized control centers.

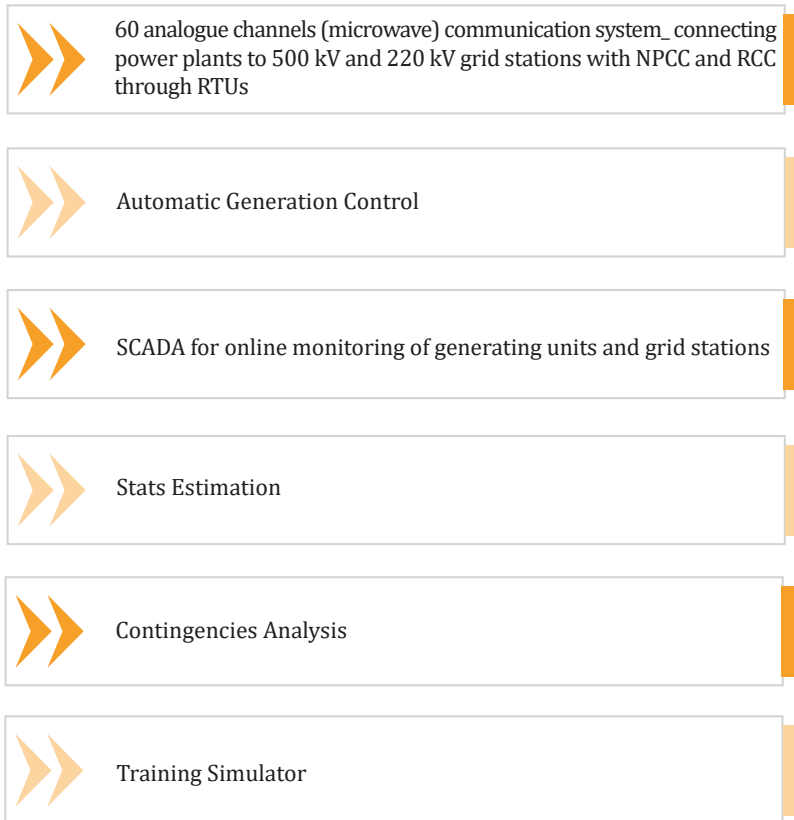
In 1991, NPCC and RCC North were established in Islamabad, and a RCC South at Jamshoro near Hyderabad; halting load dispatch operations from Kot Lakhpat.

NPCC controlled generation plants and 500KV and 220KV transmission networks.

RCCs controlled 132 kV and 66 kV networks: network up to Multan under RCC North and beyond that under RCC South.

Several facilities were provided under the upgraded project (Figure 7.1).

Figure 7.1. Facilities under the Upgraded Project



7.2. TRANSMISSION CONSTRAINTS AND ECONOMIC MERIT ORDER


NTDC became a Public Limited Company on November 06, 1998, under the Companies Ordinance 1984 (now Companies Act 2017); started its commercial operation in 1999 and got a license from NEPRA in 2002 for thirty years. NTDC transmission network is spread all over the country except the area served by KE.


Table 7.1. Transmission Infrastructure Owns and Maintains by NTDC


	TYPE	Nos	CAPACITY
Grid Stations	500/220/132 kV	18	
Transformers	500/220 kV	46	25,500 MVA
Transformers	220/132 kV	34	6,700 MVA
Grid Stations	220/132 KV	48	
Transformers	220/132 kV	133	26,680 MVA
Transmission Lines (circuits)	500 kV	51	7,238 km
Transmission Lines (circuits)	220 kV	159	11,281 km
HVDC Transmission Circuits	±660 kV	2	836 km


Source: NTDC Annual Report 2021

Figure 7.2. NPCC has been Performing as System Operator (SO); SO is Responsible for:

- 

Short-term operational planning (one year ahead to real-time maintenance schedule); coordination (generation & transmission), real-time operation, & control, generation scheduling, ancillary services schedule
- 

Ensures system's integrity, security and quality of supply, compliance with emission requirements and sufficient generation capacity to meet the system demand
- 

Evacuates power from generation plants to the distribution companies through NTDC's EHV network
- 

Dispatches load on economic dispatch criteria

Figure 7.3. Power System Managed by NTDC

23 WAPDA Hydel Power Plants having installed capacity of 9,389MW	6 GENCOs Thermal Power Plants having installed capacity of 4,651 MW.	6 IPPs Hydel Power Plants having installed capacity of 485 MW.	33 IPPs Thermal Power Plants having installed capacity of 17,309 MW
6 PAEC Nuclear Power Plants having installed capacity of 3,635 MW	9 IPPs Bagasse Power Plants having installed capacity of 364 MW	4 IPPs Solar Power Plants having installed capacity of 400 MW	36 IPPs Wind Power Plants having installed capacity of 1,835 MW
51 Transmission Lines (circuits) at 500 kV	18 500 / 220 /132 kV Grid Stations	2 HVDC Transmission Circuits at ±660 kV	2 Converter Stations having 4,800 MVA capacity
159 Transmission Lines (circuits) at 220 kV	48 220/132 kV Grid Stations	1,310 Transmission Lines (circuits) at 220 kV	1,016 Grid Stations (132/11 kV)

The operation of the available power plants, as per the EMO, is critical to avoid high electricity costs. In various instances, the operation of power plants violates EMO. In FY2021 (as in the past), the transmission network could not transmit the available power from efficient power plants to load centers. In FY2021, a verified amount of Rs. 3.94 billion was payable to the WPPs on account of NPMV²⁶. In FY2022, the total payment to renewable plants on account of NPMV was Rs. 1.17 billion, and the financial impact due to system constraints was Rs. 3,670 million (NEPRA State of Industry Report, 2022).

NTDC still requires a more extended period to fix the existing constraints which are causing the operation of power plants in violation of EMO. As reported in the NEPRA State of Industry Report, 2021, due to an inadequate transmission system, NEPRA extended the term of the generation license of some power plants despite the availability of unutilized ‘take or pay’ power generation capacity in the CPPA(G) System.

²⁶ The intermittent nature power plants (wind) enjoy the priority dispatch condition. Non-evacuation of available power from these plants makes them eligible for payment on account of Non-Project Missed Volume (NPMV).

Box 7.1. Transmission Constraints

- Constraints like over-loading of transmission lines, insufficient transformation capacity of power transformers, outages of transmission lines, etc., have been identified as the main reason for the under-utilization of efficient power plants.
- Not the financial resources, but non-professional boards, temporary CEOs, and the non-availability of the national power policy are all responsible for transmission constraints.
- NTDC cannot fully deliver the needed power to the distribution companies and accept and transmit ARE of the requisite level. NTDC is further not able to provide for the needed transmission lines in the northern areas because of space constraints.
- It has not been able to upgrade its transmission voltage or induct newer technologies like UHV transmission lines, SVCs, and storage batteries.
 - In foggy areas, replacement of all disc insulators with polymer type or application of RTV coatings to reduce tripping of main lines in the winter season are held up/delayed.
 - No re-designing of the system for installing shunt reactors to energize during the low load period so that NPCC does not need to open 500kV lines to control high voltages due to low system load. It also compromises system contingency/redundancy, ultimately causing system collapse.
 - There should be enough VAR absorption during the minimum load period. IPPs are reluctant to do so as they don't want their machines to run in highly excited mode. NPCC cannot keep a check on those IPPs because real-time data is not available; If real-time data is available, there is no penalty in PPAs for the IPPs if they don't support the system (provide/absorb VARs).

7.3. UPGRADATION OF NPCC

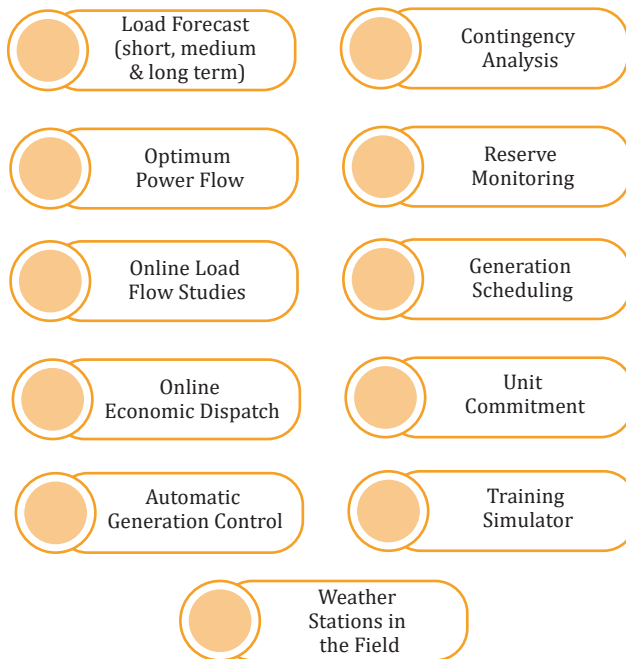
To upgrade the Load Dispatch System (LDS) at the NTDC, LDS Phase-II was signed in 2010²⁷. It included:

- Replacement of SCADA system in NPCC.
- Upgradation of telecommunication network, including installation of OPGW on transmission lines.
- Installation of new digital RTUs at 500 kV and 220 kV grid stations and power plants.

²⁷ Similar system was installed by ESKRA of the Southern African Power Pool – a system supplying power to 15 countries of Southern Africa.

LDS Phase II also included software facilities comprising an operating system, software maintenance tools and database management, as illustrated in Figure 7.4. LDS Phase-II became functional in 2014 after achieving substantial completion; pending works were addressed through a punch list.

Figure 7.4. Data Management Opportunities Included in LDS Phase-II

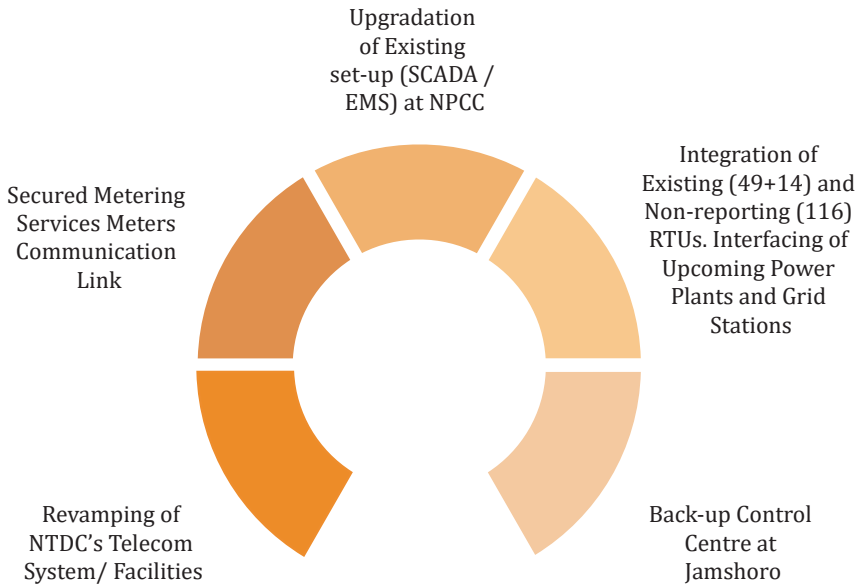


In 2021, LDS Phase-III was executed (Figure 7.5)²⁸ to facilitate the transition from a single-buyer regime to a CTBCM. It is envisaged to accommodate various new RLNG, coal, and renewable energy (solar, wind and small hydro) projects. The LDS system is expected to help improve grid visibility and automation and enable seamless integration of renewables.

The project is scheduled to be implemented by FY2025. Its timely completion would resolve some of the transmission constraints.

²⁸ The contract has been given to a consortium comprising China Machinery Engineering Corporation (CMEC) and Hitachi ABB Power Grids (formerly ABB Switzerland Ltd.). The total contract award cost is equivalent to PKR 17,097 million.

Figure 7.5. LDS Phase-III Project



7.4. SCADA AND THE DATA EXCHANGE PORTAL

Box 7.2. SCADA

- In power system operations and control, SCADA is the most effective tool to overview all network elements regarding their operating state
- Data acquired through the SCADA system can be used for real-time operational decisions, typically through EMS mathematical tools and ex-post trade settlements.
- In the absence of SCADA, real-time monitoring and the best decision-making through EMS models is impossible; the optimality of decisions taken in real-time is compromised.
- The data collected through SCADA is an essential input for medium- and long-term planning exercises. Otherwise, the quality of the operator’s decision will not be optimal.

- Currently, the settlement period is one month for the consumer / demand-side billing in the power system. Relevant entities (NPCC, NTDC, DISCOs and CPPA (G)) collect data for making a monthly settlement at the end of each month, structure it, prepare settlement statements and billing / invoicing the power sector entities.
- In the competitive market structure, e.g., CTBCM, the energy and capacity settlement period for supply and demand-side participants will be one hour. Availability of all relevant data sets on hourly resolution in a structured format will be necessary.
- It can be achieved only through custom-built IT applications and software. The data exchange portal is essential for operations and settlement of transitioned electricity market.

Box 7.3. CTBCM and SCADA System

- CTBCM is based on the principles of transparency and reliability, which depend on the quality of data related to all elements in the power market, e.g., generation, DISCO demand and consumption, day ahead capacity submitted by IPPs, fuel mixes, weather-based forecast for wind and solar power plants and many more.
- The success of CTBCM is possible with a fully functional SCADA system. By the time, SCADA (LDS Phase-III) is matured, the data required by CTBCM will be provided by NTDC's SMS Project (using GSM, being an unreliable media and an obsolete methodology). Thus, compromising both transparency and reliability.

SCADA and allied EMS_ are compulsory for optimal operational decision-making in Pakistan. Even in a fully functional SCADA system, a data exchange portal_ for logging and maintaining the operational decisions will still be needed. SCADA system can log if a unit is desynchronized from the grid. If the unit is under forced outage, scheduled outage or is on standby, SCADA cannot know the desynchronization. The system must log into some data portal.

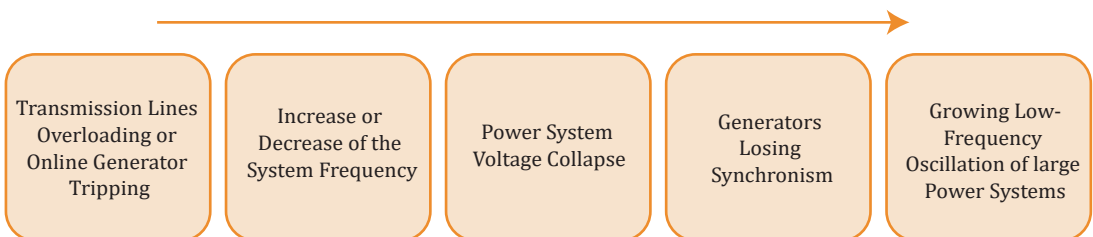
7.5. POWER BREAKDOWNS IN THE NTDC SYSTEM

- In Pakistan, the power system is spread over vast geographic areas; the chances of faults and failures are high.
- Unpredictable defects and cascading events often lead to a blackout.
- As the energy demand grows, the power system operates close to the boundary of steady-state stability, which can easily push the system into a dangerous situation.

Figure 7.6. Causes of Power Blackouts



Some recent tripping’s revealed shortcomings in the system. Generally, a blackout usually starts as a single system failure, which can, in turn, lead to cascading failures. From the time of the disturbance until the system collapses, the primary physical phenomena of concern are mainly:



NEPRA inquiry of major breakdown (January 09, 2021) revealed serious lapses on the part of NTDC, CPGCL and KE, which caused the breakdown and delayed power restoration. During supply restoration, several IPPs could not synchronize their power plants with the system within time.

Figure 7.7. Analysis

<i>i. Imbalance in Generation and Non-availability of Spinning Reserve</i>	<i>i. Transmission Constraints</i>
<ul style="list-style-type: none"> Seasonal variation in generation makes the system extremely vulnerable. In winter, hydel generation in the North is nominal due to water shortage; power generation in the South flows to the North to meet the load requirement in the North and Center. Hereafter any generation loss causes the frequency to decline quickly from the tripping limits of generators; thus, cascade tripping of generators leads to a blackout. AGC is available on major hydel plants Tarbela, Mangla and Ghazi Barotha. Due to the minimum load in winter on these plants, the frequency control of the system becomes weak In some cases, the spinning reserve is also not maintained as per the Grid Code. The reason is the minimum availability of hydel generation and non-provision of tariff for the open-cycle operation of the gas turbine to increase generation immediately to remove the mismatch between generation and load demand 	<ul style="list-style-type: none"> In summers, transmission constraints are experienced due to the non-availability of contingency and operation of transmission without N-I contingency. Major breakdowns occurred due to system disturbance in 500 kV and 220 kV transmission lines (Table 7.2) and tripping in unstable power swing mode, which caused a separation of the South and North Zones. The separation of North caused cascade tripping, which resulted in an imbalance of power generation and connected load in both Zones. The power system in South Zone experienced overvoltage and over frequency due to excessive generation compared to the connected load. In North Zone, generation is less than connected load experienced under frequency situation; result both zones plunged into darkness*.

**The power system in the South Zone experienced overvoltage and over frequency due to excessive generation compared to the connected load. In the North Zone, generation is less than connected load experienced under frequency situation; result both zones plunged into darkness.*

Table 7.2. Major Power Breakdowns in FY 2018 to FY 2021

Date	Details
August 1, 2018	Lahore_ tripping of 220 kV Bund Road Grid Station
August 12, 2018	Tripping of NTDC's 500 kV and 220 kV transmission lines in the South: High humidity & pollution affected power supply (PS) to KE from national grid (NG) & generation from 1320 MW Port Qasim Power Plant and WPP in Jhimpir & Gharo.
September 24, 2018	Same as above
October 2, 2018	Tripping of NTDC's 500 kV and 220 kV transmission lines in the South: High humidity & pollution affected PS to KE from NG & generation from 1320 MW Port Qasim Power Plant.
October 4, 2018	Same as above
October 25, 2018	Tripping of NTDC's 500 kV and 220 kV transmission lines in the South: High humidity, pollution & smog affected PS KE from NG & generation from 1,320 MW Port Qasim Power Plant.
November 12, 2018	Same as above
January 25, 2019	Tripping of 500/220 kV transmission lines in Guddu, Shikarpur, and Multan region due to extreme weather caused by dense fog/smog and pollution/contaminated layers on insulators caused by a variety of sources, i.e., sea, salt, industries. It also caused tripping of HUBCO, Port Qasim, and Guddu Power Plants, resulting in a power failure to large parts of Sindh (NTDC & KE networks) & Baluchistan.
January 09, 2021	Tripping of 500 kV and 220 kV transmission lines due to faulty breaker at Guddu; isolation of system in North and South regions_ complete system collapsed (country plunged into darkness) because of cascaded tripping.

Source: NEPRA State of Industry Reports (Various Years)

7.6. DELAYS IN SYSTEM RESTORATION AFTER BLACKOUTS: REASONS & SOLUTIONS

REASONS	SOLUTIONS
<i>Non-availability of Black Start Facility²⁹: Power plants are without Black Start Facility except Tarbela, Mangla, and Warsak in the North and KAPCO in the Center.</i>	<i>Availability of a Black Start Facility at gas turbine power stations, with an approved tariff on open cycle operation, can facilitate the rapid restoration of the system.</i>
<i>Noncompliance of Power Plants: In the restoration process, system parameters frequency and voltage vary abnormally outside the normal limits in the initial stage of restoration. Therefore, power plants hesitate to participate in the restoration process, causing delays.</i>	<i>Power plants need to be made more compliant to respond quickly.</i>
<i>Improper Communication System: Absence of proper and well-maintained communication facilities causes a delay in restoration.</i>	<i>PLC, mobile phone, wireless communication system, and landline are necessary for field formations and operator control room staff.</i>
<i>Non-availability of Trained Staff: Training simulators are not available; therefore, no drills occur. Staff with minimal experience restore the system, causing delay.</i>	<i>Trained staff must be readily available in the system operator control room, power stations and grid stations. The team should be trained_ by conducting drills regarding restoring the system on a training simulator.</i>
<i>Non availability of Synchronization Devices</i>	<i>All key grid stations and power stations must have synchronizing devices, i.e., Synchro Scope and Synchro Check Relays. When required for coupling the islands/systems, these should be in working conditions.</i>
<i>Improper SCADA System: The SCADA system is available on primary power systems and not on secondary systems; many power plants and grid stations are not integrated with SO control rooms. Oral communication causes a delay.</i>	<i>Fully operational SCADA system should be made available to restore the whole power system quickly.</i>

²⁹ Black start is the ability of generation to restart parts of the power system to recover from a blackout. This entails isolated power stations being started individually and gradually reconnected to form an interconnected system again. <https://www.nrel.gov>.

Way Forward

NTDC must comply with industry standards and uniform codes of conduct on the safety, reliability, stability, integrated operability, and efficiency of the whole or a material part of the electric power system. The ability of power systems to ensure a continuous supply of electricity to customers in the event of a disturbance is crucial.

- Comprehensive grid studies for steady-state and transient stability and reliability, considering the renewables and future energy plans up to 2040, are critical.
- Transmission system issues reflect a lack of integrated planning. Immediate measures are required to address the inadequacies of the transmission network.
- Timely completion of the LDS phase-III projects grid strengthening, and modernization is significant.
- Usually, machinery and equipment take priority in cost allocations. Prioritize capacity building and training of staff; capacity building of system operation staff at NPCC is vital.

8. ASSET MANAGEMENT AND PROCUREMENT IN POWER SECTOR

The critical issues in the procurement and assets management processes in Pakistan's power sector stem from the weak regulatory and operational framework. Organizational structures are less oriented toward delivery; lack procedures, techniques, resources, and most importantly, the inconsonance of rules and regulations at different levels.

8.1. POWER SECTOR PROCUREMENT PROCESS AND CHALLENGES

- The procurement in the power sector is mainly through NTDC. In FY2021, around Rs 56 billion was spent under the heading.
- The procurement of Rs 60 million and above is by the MP&M department in NTDC.
- Federal Public Procurement Regulatory Authority (PPRA) Rules 2004 (amended to date) are followed³⁰.

Some of the significant power sector procurement and supply chain related matters, which require immediate attention for bringing positive developments, are discussed in Table 8.1.

³⁰ If financing is done by the International Financial Institutions (IFIs), their guidelines and regulations are followed. PPRA Rule 5 stipulates that in case of conflict between PPRA and IFIs guidelines, the latter shall prevail to the extent of such conflict. Pakistan has nearly always been on the maps of various IFIs. They choose projects as per their preference.

Table 8.1. Power Procurement Challenges

<p>Unrealistic Project Charters</p>	<ul style="list-style-type: none"> ● Functional offices prepare PC-1s: they work in silos, with little knowledge of PSDP, MLDA programs, SDGs etc. ● Project concept papers usually lack information on ground realities, including complications associated with financing arrangements, acquiring land, etc. ● Unrealistic Timelines in PC-1, time get lapsed even before commencing the procurement process (most of the time) ● Delays even after the approval of PC-1.
<p>Financing Uncertainty</p>	<ul style="list-style-type: none"> ● Projects are approved without securing financing (in the majority of cases). <p>The IFIs select the project after the approval of PC-1 (at least from CDWP).</p>
<p>Corporate’s Priority</p>	<ul style="list-style-type: none"> ● Mechanisms/SOPs for determining the priority for procurement/ projects do not usually exist. ● Work is executed urgently as a firefright rather than a proactive requirement and project management process.
<p>Absence of Dedicated Project Manager</p>	<ul style="list-style-type: none"> ● Absolute responsibility in the form of a designated project manager/process owner is absent; resultantly, lack of coordination leads to inefficiency in managing scopes and schedules.
<p>Need Assessment/Inventory Planning</p>	<ul style="list-style-type: none"> ● No mechanism exists. ● Operational requirements are rarely consolidated and translated into inventory and management plans. ● Most entities do not procure or publish their annual procurement plans, indicating their lack of background work and planning. ● Plans are kept hidden due to a lack of certainty of needed financial resources and lackluster human behavior.
<p>Non-uniformity of Bidding Documents</p>	<ul style="list-style-type: none"> ● Inconsistency (regarding document types, evaluation/qualification criteria & contract mode/type etc.) in the procurement documents. <p>It creates confusion for the market/industry participants and doubts about process transparency.</p>
<p>Non-consideration of Market Conditions</p>	<ul style="list-style-type: none"> ● Pre-market surveys are often not conducted; bidders' alliances and suggestions are not obtained; documents are not improved from time to time. ● More attention to compliance matters and transparency requirements while compromising the critical purpose of obtaining the best product and value for money. <p>Primarily quality-oriented firms refrain from participation, leading to severe complications/issues at a later stage, i.e., in the evaluation, award and contract management process and at a cost of quality work.</p>

<p>Absence of a Pre-qualification Regime</p>	<ul style="list-style-type: none"> ● Pre-qualification mechanism is entirely missing due to stringent regulatory requirements in the public sector. ● No permanent process, pre-qualification is allowed on a project-to-project basis; it becomes extremely cumbersome.
<p>Non-Standardization of Documents and Disregard of Tailoring Needs</p>	<ul style="list-style-type: none"> ● Standard procurement documents do not exist. ● Where there are standardized documents, they are with strict indigenous instructions to follow, and not tailored enough to attract competition. <p>Simple procurement is hurt when the rigorous process of some standard document is used.</p>
<p>Conflicts between PEC and PPRA</p>	<ul style="list-style-type: none"> ● Confusion for public sector organizations regarding which standard, practices, or procedures to follow: PPRA or PEC. <p><i>The confusion is hampering the development of best practices and organizational processes.</i></p> <p>Additionally, PEC uses a very obsolete version of the FIDIC Conditions of Contract issued in 1987 rather than a version of 1999 or 2017.</p>
<p>Focus on Cost & not Quality</p>	<ul style="list-style-type: none"> ● Misunderstanding in companies that procurement is all about achieving least cost. The result is, vendors attempt to meet minimum cost requirements to win contracts, compromising quality. It led to an ouster of European manufacturers/ suppliers from the Pakistani market. <p>E.g., NTDC replaced its earlier 2nd and 3rd generation equipment with a newly painted version of the same generation; in 15 years, NTDC has regressed_ into an outmoded transmission company.</p> <p><i>Focus should be on the quality of the product in the evaluation criteria to bring value for money.</i></p>
<p>Delays in Processes</p>	<ul style="list-style-type: none"> ● Engineering departments evaluate bids, resulting in extreme workload and delays. ● Evaluation with strictest interpretations, delays ongoing procurements, creates complications in the award process, and discourages reputed bidders/firms. <p><i>A project procurement timeline reveals that from the preparation of PC-1 to the project's actual start, the time involved is at least three times more than the stipulated time.</i></p>

<p>Lack of Change Culture</p>	<ul style="list-style-type: none"> ● Bureaucratic norms, procedures and the continuous interference of accountability forums hamper the reform process. ● With time, procurement processes have become more bureaucratic_ even a most qualified leader becomes non-responsive to minor deviations. ● No significant progress in implementing Enterprise Resource Planning systems for procurements or in e-procurement initiatives.
<p>Outdated Specifications and Type Testing Requirements</p>	<ul style="list-style-type: none"> ● Power companies lagged in adopting innovative solutions (digital protections, insulation coordination, etc.). ● No change in specifications; type test requirements are also not standardized.
<p>Inventory Turnover</p>	<ul style="list-style-type: none"> ● No SOPs exist for determining minimum inventories, inventory turnover, trigger points, lead times, etc., creating complications. Often, disproportionate procurements of inventory, i.e., unnecessary buildup or lack of critical stocks.
<p>Disposal of Inventory</p>	<ul style="list-style-type: none"> ● Inventory disposal and the maintenance of existing stocks are chronic challenges. ● Un-useable inventory remains pending for a long time creating a burden for the organization in terms of stuck financial capital and inventory keeping costs.
<p>Resource Constraints</p>	<ul style="list-style-type: none"> ● Acute shortage of skilled professionals/experts in procurements and overall project management frameworks. ● Over time, necessary expertise has not been developed in the relevant field due to a lack of incentives to pursue a specific area. ● Lack of skilled staff_ planning, preparing the necessary documents, tendering, and contracting are all taken up superficially. ● Other functional departments, part of the procurement cycle, also suffer from human resource shortages, leading to delays and complications.

Way Forward

- Procurement of equipment and services (consulting and non-consulting) consume almost the entire development budget of DISCOs & NTDC. Solving underlying issues are critical for progressive development of continuously evolving processes.
- Coordination between the functional departments, deputation of dedicated project managers, improving project management practices, developing PMOs and SOPs etc., is a starting point toward the reform process.

Innovative thinking, proactive problem solving, and an efficient and effective procurement process can turnaround power sector entities' performance.

8.2. LACK OF ASSET MANAGEMENT SYSTEM IN NTDC

Asset Management is a set of systematic and coordinated activities and practices that improve the performance and quality of the electricity grid. It ensures that the grid operator manages its critical infrastructure cost-effectively by optimally controlling the assets over their life cycle.

Box 8.1. Global Asset Management System

- Over the past decade, power transmission and electricity utilities worldwide have undergone a significant business and regulatory change. Most have embraced competition and commercialization concepts.
- Some government-owned companies have moved towards corporatization and full privatization.
- The focus has shifted from engineering excellence toward commercial performance; the term “Asset Management” has become the new business ideology for these companies.

NTDC has its Asset Management Department, but it does not conform to international standards in the true sense³¹. It is inefficient and ineffective for several reasons, as listed in Table 8.2.

³¹ Huge loss of power transformers and related equipment in recent years.

Table 8.2. Reasons behind Weak Asset Management

<p>Poor Preventive & Condition Based Maintenance</p>	<p>SOP formulated by the technical services group of NTDC for preventive and condition-based maintenance are not followed.</p> <p>The health of the costly electrical assets deteriorates and ultimately fails.</p> <p>Corrective mechanism does come into play but after causing a huge cost impact.</p>
<p>No Proper Asset Management Database</p>	<p>No complete database or adequately maintained registers of_ previous test results and history of equipment for evaluation, interpretation of test results, and formulation of run-refurbish-replacement strategies.</p>
<p>Shortage of Skilled/Trained Manpower</p>	<p>Significant shortage of skilled and trained crew, especially for the maintenance of transmission lines, gas insulated substation, major switchyard equipment like transformers, shunt reactors, etc.</p> <p>Repairing work of damaged equipment like transformers is outsourced, which causes substantial financial loss.</p>
<p>Shortage of Maintenance Tools & Plants (T&P) and Testing Sets</p>	<p>Shortage of major T&P and testing sets for switchyard equipment testing, and live line/deadline maintenance.</p> <p>Testing sets are used on a pool basis; sometimes, some major maintenance tests are skipped.</p>
<p>Insufficient Logistics Support</p>	<p>Insufficient logistic support (e.g., cranes, trucks, and live line washing units) required to attend major breakdowns in grid stations and transmission lines in diversely spread and huge NTDC transmission network delays the rehabilitation of the system.</p>
<p>Geographical Information System (GIS)</p>	<p>In enterprise asset management, GIS provide a wealth of information; NTDC lags in this area despite colossal capital investment in its network.</p>
<p>Non-Availability of Shutdowns</p>	<p>Shutdowns for preventive maintenance have suffered due to the shortage of power supply and to ensure power system continuity in essential areas.</p> <p>When shutdown is allowed, the time is insufficient to complete proper maintenance work.</p>
<p>Unplanned Procurement & Inventory Issues</p>	<p>Asset management is dependent on procurement to acquire and dispose of assets and obtain spares and services to improve availability; NTDC, with no proper mechanism to assess requirements, leads to disproportionate procurements of inventory.</p>
<p>No Expert/ Intelligent Systems</p>	<p>To protect significant assets (e.g., power transformers), there is a need for expert systems to continuously monitor the equipment's health like online Dissolved Gas Analysis (DGA) and online Partial Discharge to avoid any unforeseen events, otherwise, it damage equipment before its age.</p>
<p>System Constraints Causing Collapse</p>	<p>Major blackouts in the last decade were mainly due to the non-redressal of system constraints (details in Chapter 7).</p>

Action Points

- Intelligent Power Network Stability systems with strong telecommunication media should be installed to replace the under /over frequency schemes.
- Major equipment replacement work, extension requirements, and rehabilitation works need to be reviewed and prioritized in the light of power system planning studies, substation and transmission line constraints and system stability.
- Re-design transmission systems; the ring-main systems (missing in current system) allow shutdowns on affected areas without disrupting the whole system.
- For a well-developed asset management framework, there is a need to understand and include available techniques in the strategic planning of the power industry. (Organizations like ISO, BSI, EPRI and CIGRE have developed guidelines for asset management in the power industry)
- A progressive development, i.e., continuously evolving processes, are required to develop the asset management system.
- Both policymakers and the regulator should address the critical issue of asset management meticulously_ a short, mid, and long-term asset management plan is needed.

9. POWER PLANNING: FAILURES OF THE LAST THREE DECADES

The people, process, and technology drive the enterprise forward. In Pakistan, due to the skewed planning process and the lack of involvement of the professionals in the decision-making process, power sector organizations have become insensitive to the importance of the planning process. The problem is not where to go but how to get there.

9.1. INTRODUCTION

After the appropriate policy instruments, the first prerequisite for keeping the lights on across the country under all conditions is prudent system planning. It involves considerable time, capital, and potentially severe economic risks for the electricity utility and the economy. Under power sector reforms in the late nineties, NTDC was mandated to plan power systems for the whole country, excluding Karachi and its adjoining areas under KE.

Our planning strategies in the past have focused on expanding generation capacity, with little attention to improving the transmission capacity, energy mix, energy efficiency and distribution planning. Without any doubt, planning for increased electricity generation capacity is a vital component of electricity planning; other elements are equally important.

9.2. DISTRIBUTION PLANNING: A MISSING LINK

Distribution Planning Under WAPDA

WAPDA set up departments for power planning, design & standards, contracting, constructing & operating the power sector. Plans were developed to expand the power system in the minimum possible time and expenditures. Standards and design departments probed international standards; then stretched the system while assuring the safety of both men and material.

- The standards were specified to replace copper with aluminum as the preferred metal for the conductors and cables. Various protection schemes were also tweaked on the LT and the HT sides; the distribution system was designed to operate with high tension protection efficiently.
- Distribution engineers (under the USAID program) were trained from the American Electric Power (AEP), United States. These professionals were provided with the latest distribution controls and allied equipment.

WAPDA was able to craft and issue several: product descriptions (designs), specifications including the standard design instructions, technical instructions, and standard operating procedures³². Planning resulted in fast-tracked development and an unprecedented expansion of the modern distribution circuits in the country.

Distribution Downfall

The gains started dwindling by the mid-1980s, with WAPDA leaning first towards transmission and later to generation wings. Administrators (not even managers) were posted as an alternative to engineers or engineering managers in the distribution wing. The distribution system slowly became outdated.

- Same distribution voltage as evidenced in the early 1960s.
- Distribution transformers (including their size and capacities) remained stuck in the 1910s design and configuration.
- The energy meters retained their original Ferranti's principle until the introduction of electronic meters in the early 1990s.
- The electronic or digital meters retain their physical parameters as earlier electro-mechanical versions.

In 1990, the local industry was encouraged to enter the engineering domain.

- The earlier technology transfer stagnated, and the locals took over from the migrating international manufacturers. Even the blatant assemblers were accorded the label of original manufacturers.
- Clumsy installations block the urban landscape.

³² These documents numbered hundreds and could answer any call for utility-related works. The army management of WAPDA (during 1998-2004) acknowledged that the procedures in WAPDA are so detailed that even the Armed Forces cannot match.

- Underground distribution installations in some parts of major cities are an exception.

Consequently,

- LT lines remained without the system's modern clamps/conductors / T-off hardware.
- Instead of adhering to technical instructions where 19 specific items are specified for single-phase connection, only the service cable and the energy meter are issued and installed.

Because of the below-par design planning of the distribution systems, the supply to customers is sub-standard_ bouts of low and high voltages, electrocution and other accidents, and millions of interruptions all over the country.

Why is Distribution Planning not a Priority?

From 1994 to 1998, the financial viability of WAPDA became dubious due to the induction of an IPP, HUBCO, and other related obligations. With deficiency on the financial and technical fronts_ the distribution system planning lost its priority. Even after the corporatization of WAPDA entities, no distribution planning could be undertaken (from 2011 to 2018); the GOP focused on adding generation capacity.

From 2018 onwards, with the help of multilateral donor agencies, DISCOs set up their planning and development offices. At present, some rudimentary services are provided by these offices.

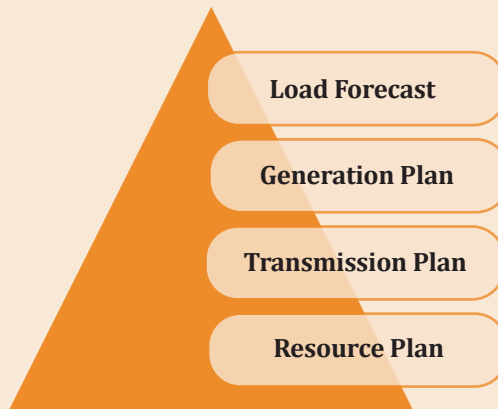
- Because of the unnecessary interference of the PPRA, the DISCOs have always avoided any private contractual help for planning purposes_ which is fundamental for apt distribution design modules.
- P&D departments in DISCOs are more like post offices, and no actual planning takes place.
- No effort/ plan to improve the distribution systems to face new realities and the ongoing economic crunch

The same old 1960s design carries on, but with more dilution and deterioration.

9.3. ISSUES IN PLANNING PROCESS AT THE NTDC

Box 9.1. Planning Process Fundamentals

- The planning process begins with the load demand forecast using econometric/ statistical tools for the plan period.
- Based on the load forecast, a generation plan is formulated. A generation plan is an optimization exercise of projects with varying sizes, types, technology, location, and energy source to meet the load forecast.
- Plan also proposes alternate options/ possible actions through sensitivity analysis to take care of any variation in the study assumptions.
- A high voltage transmission system is planned primarily to evacuate the electric power generated from various sources located in different parts of the country. It is developed through a diverse and complex technical analysis of the power system.
- Transmission planning and generation planning are performed iteratively to achieve an optimal output due to the dynamic nature of the power system.
- Technical analysis is followed by commercial analysis, which includes financial and economic aspects to finalize the mode of investment for the transmission projects.



In the last three decades, the lack of comprehensive planning allowed non-competitive generation projects to be commissioned on a quid pro quo basis.

In 2005, NEPRA approved a Grid Code to govern the development, planning and operation of the National Electricity Grid. The Grid Code had partially defined the planning process for Pakistan's power sector.

However, the intent and implementation of the Planning Code, a sub-code of the Grid Code, were miles apart. The Planning Code of the Grid Code establishes the planning process to be followed to plan the power system. Unfortunately, it was only recognized and complied with fourteen years after the promulgation of the Grid Code through the IGCEP 2040.

Box 9.2. Power Sector Expansion Plans

- Liefticnk Report 1967
- RESPAK Model 1988
- Energy and Nuclear power Planning Study for Pakistan (ENPP 1994)
- National Power Plan (NPP 1994-2018)
- Energy Security Action Plan (2005-2030)
- Pakistan Integrated Energy Model (Pak-IEM) 2007
- National Power System Expansion Plan (NPSEP 2011-2030)
- Least Cost Plan (LCP 2016-2035)
- Indicative Generation Capacity Expansion Plan (IGCEP) 2040.
- Indicative Generation Capacity Expansion Plan (IGCEP) 2047.

Box 9.3. Grid Code 2005

The Grid Code 2005 states that each year the NTDC shall prepare and deliver to NEPRA a Ten-Year Indicative Generation Capacity Expansion Plan (IGCEP) or NTDC Plan covering a 0-to-10-year timeframe. The NTDC plan shall be based on a twenty-year Load Demand and Energy Forecast. It shall be prepared according to a Loss of Load probability (LOLP) methodology established under this Grid Code and NEPRA Transmission Performance Standards rules.

The NTDC Plan shall be used as an input to prepare NTDC's Transmission Expansion Plan (TSEP). A detailed Transmission Investment Plan shall be prepared based on the NTDC Twenty-Year Load Forecast, Indicative Generation Capacity Expansion Plan (IGCEP or NTDC Plan). At the same time, the Transmission System Expansion Plan (TSEP) will also be based on Annual System Reliability Assessment and Improvement Report (ASRAIR).

In the past, several generation expansions plans, with input and assistance from foreign and local consultants, have been framed (Box 9.2). In most of these plans and load demand forecasting studies by NTDC:

- Planning for generation expansion was based only on peak demand forecast, which is sometimes misleading.
- There was a lack of spatial forecasting in most of these reports.
- Planning was done for the existing consumers, not those who are unserved or underserved.

That is why investments to increase generation capacity are separate from equivalent investments in downstream transmission & distribution infrastructure. The IGCEP 2021 was the first-ever generation plan approved by the regulator (NEPRA). NEPRA directed NTDC to submit the TSEP for approval with the next iteration of the IGCEP. However, the draft of the next IGCEP 2022 is submitted to NEPRA for approval but work on TSEP is still underway. Delays in TSEP reflect the working capacity at the NTDC. IGCEP 2021 could have been more flawless, and so is the draft IGCEP 2022.

9.4. FAILURE OF LAST THREE DECADES

9.4. FAILURE OF LAST THREE DECADES

- During the last three decades, power system planning and implementation of the planning process have not remained the preferred approach.
- Since the early 1990s, Pakistan's capital-intensive power sector has experienced a tumultuous and unsustainable journey, ignoring research-based planning input for policy making.
- Generous terms/ incentives were offered to investors in the 1994 power policy without paying any attention to the planning or economic and financial analysis performed by the engineers of WAPDA through the National Power Plan 1994.
- A similar trend was followed in the subsequent power policies of 2002, 2006 and 2013. 2013 saw the CPEC entry into Pakistan. The GOP introduced another power policy in 2015* to combat severe load shedding, reduce constantly rising circular debt, and attract CPEC investment in the power sector, followed by the promulgation of the Alternative and Renewable Energy Policy 2019.
- Established in 1958, WAPDA quickly laid the firm foundation of the present power sector infrastructure. The early nineties saw the potential beginning of ignoring research-based planning input for policymaking.

In pursuit of a sustainable sector to supply reliable electricity at affordable prices to the consumers, all interventions have made the power sector of Pakistan an unbridled hydra-headed monster - complex and uncontrollable rather than sustainable.

Power planning is undertaken in a fragmented way by the NTDC, CPPA(G)_ with its control through Power Acquisition Request (PAR), the Planning Commission on the Integrated Energy Plan, and now by the PP&MC.

Table 9.1. Factors Affecting Power System Planning

FACTORS	COMMENTS & RECOMMENDATIONS
Lack of Processes	<p>To build and sustain a compliance culture to achieve the objectives of the prevailing policies and the regulatory framework, power companies must adopt a 5-step strategy; the importance of IT cannot be underemphasized: Develop step-by-step processes indicating related parameters, responsibility, sequence, etc.; Document the developed processes along with process maps; Communicate among the concerned professionals; Implement the whole program, including the procedures and processes, in a received, updating policies/regulatory framework for all future iterations.</p> <p>It must be an ongoing process to ensure continuous improvement</p>
Brain Drain	<p>In 1994, a planning (experts) team was established comprising Ph.Ds. from different disciplines of the power sector to work alongside a team of international experts to develop the National Power Plan. However, public sector culture and weak remuneration structures could not sustain the engineers' knowledge base and expertise.</p> <ul style="list-style-type: none"> • NTDC management must get sensitized to this challenge and hire qualified professionals to strengthen power system planning. • Monetary incentives and appreciation (additional marks in Performance Evaluation Reports) would help
Insufficient Capacity & Lack of Formal Capacity-building Opportunities	<p>Many positions are lying vacant for a long time due to the ban on new hiring & priority to other departments, hindering performance. Limited available staff get overburdened and lackluster and look for transfers to other departments.</p> <p>At NTDC, except for transmission planning, there are no formal training/capacity-building programs for load forecast, generation planning, and resource planning.</p> <ul style="list-style-type: none"> • Undertake regular training programs and other networking initiatives based on each planning component. • Capacity building at the individual as well as at the institutional level. • Foreign training should be organized in a well-planned manner focusing on relevance, broader participation, and impact.
Posting of Professionals in Planning Department as Transit Lounge	<p>Professionals (even in senior positions) with no aptitude for planning are tasked to work in the planning department on a short and long-term basis.</p> <ul style="list-style-type: none"> • NTDC management must be sensitized to the strategic importance of the planning process and the power system planning department.
Obsolete Software and Delayed Digitalization	<p>Obsolete software has remained in use for critical applications such as medium-term demand forecast and generation optimization.</p> <p>Lack of automation of the historical data (in NTDC custody) and digitalization of input data for demand forecast, generation optimization and resource planning has been the primary cause of inconsistent reporting/information.</p> <p>Although PLEXOS and PSR Suite have been procured to replace WASP*, it is still insufficient. More needs to be done to digitize input data for better demand forecast, generation optimization and resource planning.</p>
No R&D Activities	<ul style="list-style-type: none"> • NTDC must incorporate R&D activities through an exclusive and cohesive program to contest prevailing challenges (i.e., copy-paste culture).
Average Performance Concerning Regulatory Compliance	<ul style="list-style-type: none"> • Proactive compliance with the regulatory framework (Grid Code 2005, Performance Standards, etc.) can undoubtedly improve precision and the planning function of NTDC.

* Apart from other limitations, WASP could not distinguish renewable energy as a unique source.

Key Takeaways

With a team of hardcore engineering experts and distribution system planning, an exemplary electricity distribution system was developed in the early years of WAPDA. In our planning strategies, the focus has remained on the generation capacities, ignoring the distribution sector.

In NTDC, the need for planning and compliance of planning with data-driven decisions has been realized in recent years³³. The significance of data-driven and analytical recommendations from professional/ technical experts is increasingly appreciated. IGCEP 2021 (although not flawless) approval is the first step toward unbiased and analytical decision-making. Yet, the damage done in the past is not easy to revert in the short term.

But no progress on the distribution and transmission side. DISCOs are responsible for assuring the financial viability of the whole power sector. The missing distribution planning and the resultant non-up gradation of design features, standards, etc., do not allow the DISCOs to achieve their goals.

Our policymakers' lack of informed long-term vision has cost Pakistan dearly. Fragmented planning at the individual departments; the problem is not where to go but no clarity on how to get there

Moving Forward

- Fragmentation in power planning must change and go over to the Planning Commission. In the past, the broad energy sector objectives were stipulated in Pakistan's five-year plans (prepared by the Planning Commission) in a well-conceived and coordinated manner.
- These plans should be prepared after systematic consultations with all stakeholders, including deliberations in Parliament and the Council of Common Interests (CCI).
- Planning should be like a process completed with a detailed implementation plan and prepared after in-depth research by local people and not by donor agencies.

³³ The decision-makers and international donor agencies are keen on investing in planning departments - enhancing the capability of the engineers and professionals, equipping them with state-of-the-art tools and software and empowering them to participate in the decision-making process.

- An integrated and coordinated power sector planning is required. This approach must include accurately forecasting demand, adding generation capacity, improving and expanding transmission and distribution infrastructure, increasing efficiency, bringing costs down, and ensuring sustainability.
- Policymakers/ planners should understand the complex economic, political, and environmental interrelations and energy systems' uncertainties. Coordination should not be limited to the energy sector but serious consultation with other sectors.
- It is time that NTDC builds its professional and institutional capacity, launches its formal R&D component, and encourages its professionals to contribute to this proactively. The planning and development department in DISCOs must be revitalized by employing professionals to provide substantial input in the integrated planning framework at the Planning Commission.

10. REGULATORY AFFAIRS AND CONSUMER-END TARIFF DESIGN

The tariff structure in Pakistan is not based on regional and consumer-specific long-run marginal costs. It is used as an instrument to achieve political and socio-economic objectives. Besides creating financial difficulties for the government, the tariff structure also generates inefficiencies in the system and misleads investment decisions in the supply system.

10.1. ESTABLISHMENT OF NEPRA

The National Electric Power Regulatory Authority (NEPRA) was established under Section 3 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (NEPRA Act No. XL 1997) to regulate the provision of electric power services in Pakistan.

- The objective was to improve the efficiency and availability of electric power services while equally safeguarding the interests of consumers, investors, and operators; and to promote competition and deregulate power sector activities where competition exists.

With the foundation of NEPRA, all regulatory powers of WAPDA were transferred to NEPRA. To create a legal basis for developing a competitive electricity market, the NEPRA Act was amended in 2018.

Box 10.1. NEPRA Major Regulatory Obligations under NEPRA Act No. XL 1997

- Grant of licenses, approval of power acquisition programmes.
- Determination of tariff, terms and conditions and rates.
- Prescription and enforcement of quality-of-service standards, approval of operating codes and investment standards.
- Industry structure/privatisation including the transition towards a competitive market where feasible.
- Consumer rights and obligations_ complaint redressal.

Under NEPRA, except for tariff determination and the grant of licenses, the power sector operated without the requisite grid & distribution codes, consumer service rules, performance standards, commercial procedures, and other regulatory prerequisites for many years³⁴. In those years, the power sector was operated under WAPDA's detailed regulations_ inclusive of technical specifications, procedures, and related handouts.

NEPRA accepted the tariff structuring processes of WAPDA only temporarily. NEPRA announced Tariff Standards and Procedure Rules in 1998, to deliver separate tariffs for the generating plants (both in the public and private domain), NTDC, and distribution companies.

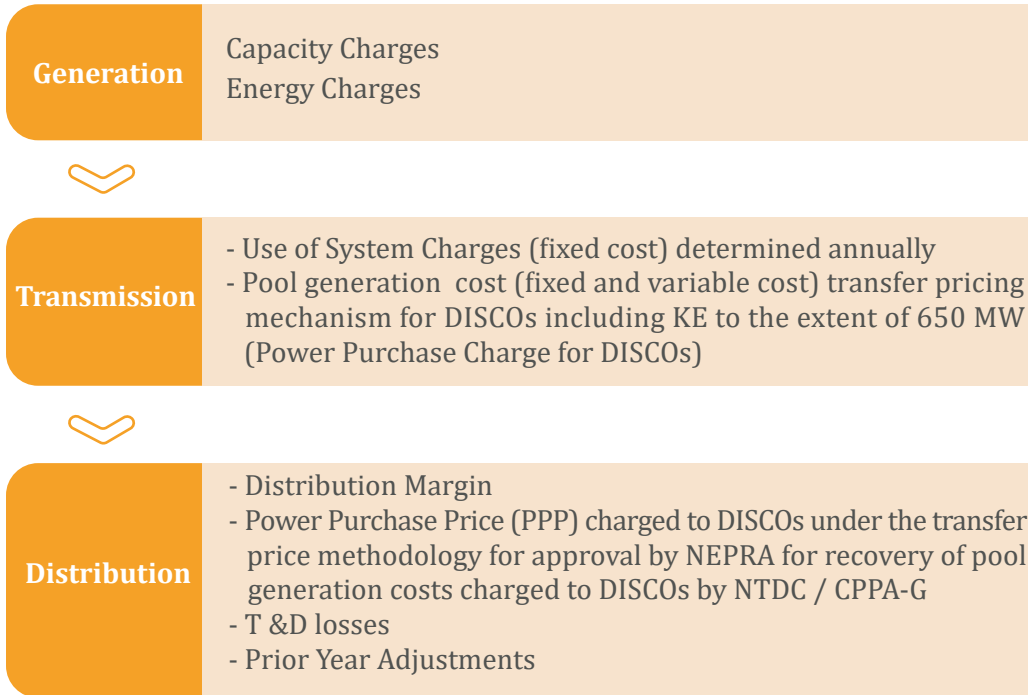
All the remaining requisite rules, regulations, and technical details were announced after a few years. Details of regulatory framework at NEPRA to date, are listed in Appendix Fa. In terms of performance, NEPRA has failed to perform its duties effectively as an exclusive power sector regulator over the years (Box 10.2).

10.2. TARIFF DETERMINATION

- Under Section 7 (3) of the NEPRA Act, 1997, NEPRA has the power to determine tariff rates/ charges and other terms and conditions for supplying electric power services by generation, transmission, and distribution companies.
NEPRA Tariff Standards and Procedure Rules (1998) provide guidelines for process and parameters for setting tariffs

³⁴ In its early years, NEPRA adapted procedures from its counterpart in India and the United States. The US has distinct state regulators_ all-powerful, over-seeing sectoral operations and has assured the needed balance between the utilities and their consumer base.

Figure 10.1. Tariff Structure



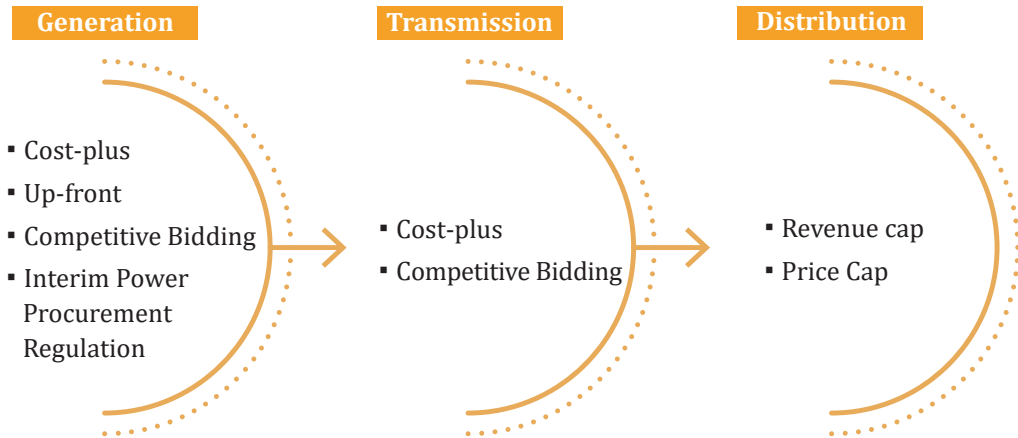
Box 10.2 NEPRA Performance

- The overall de jure performance at NEPRA is better than the de facto performance.
- A regulatory system with several necessary qualities for the power sector is put in place however, a significantly poor regulatory performance in practice.
- The regulatory reform required to transition towards a competitive market has historically been resisted in Pakistan. NEPRA is equally to be blamed for not developing market competition over the years. NEPRA, an autonomous organization (by law), didn't make serious efforts to improve regulatory and operational infrastructure in the power sector.
- NEPRA has been unsuccessful in developing and pursuing a regulatory framework to guarantee reliable, efficient, and affordable electricity.
- Effective regulation creates a balance in the interests of all stakeholders. When investors achieve fair returns, consumers receive quality service, and governments are not allowed political exploitation. NEPRA failed to create this balance.
- No effort on the part of NEPRA to revise consumer tariff methodology to make it competitive and affordable for the end-consumers.
- Privatization was not directly the function or responsibility of NEPRA, not even after the amended Act 2018. But under law, NEPRA was supposed to facilitate the process to bring efficiency in the sector and help ensure competition where feasible. The privatization process remained slow. KE was privatized in 2005 but is still treated as a state-owned utility by the regulator; the same rules are applied, and it operates in a regulated environment.
- NEPRA adopted an inconsistent approach in approving the PPAs; the public sector projects were considered to operate without PPA, or their PPAs were not per standard documents.
- Licenses were granted without observing the criteria in the rules, regulations, and prudent utility practices.
- Monitoring the licensees (compliance and performance) against standards and prudent utility practice was not carried out.
- Provisions of grid code, distribution code, commercial code, tariff guidelines, consumer service manual etc., were largely ignored in regulating the power sector. The enforcement mechanism remained fragile at NEPRA.
- Determinations of the Authority are general and without due detailed analyses.
- The generation licenses were granted without considering the actual demand in the system, fuel mix and availability, financial cost of interconnections, etc.; it impacted the sector enormously.
- Modifications in generation licenses, especially of GENCOs, were made without considering their inefficiencies and adverse impact on the sector.
- Delays were observed in tariff determinations, power acquisition requests, review motions, etc.
- NEPRA's job as a regulator was to resolve all the power sector problems, including system losses, rising costs, high tariffs, and generation capacity challenges. Again, the outcome of regulatory oversight_ the CD, emerged for the first time in 2006. Since then, it has been there and rising. NEPRA has not done anything to control this debt from rising. Increasing costs of generation, sector inefficiencies, anomalies in tariff methods, and delays in tariff determinations are responsible for the CD. If NEPRA had played an effective role, the power sector scenario could have differed.
- The regulator makes no serious efforts to improve its overall capacity.

Source: (Malik, 2022c)

On receipt of tariff petition, the process is followed as elaborated in Appendix Fb. Tariff determined by NEPRA is forwarded to the federal government under Section 31(4) of the NEPRA Act for notification in the official gazette

Figure 10.2. NEPRA Tariff Regimes



Anomalies in Tariff Determination

- Over the years, the regulator has not allowed prudent cost (Figure 10.3). Tariff determinations were made, but the laid down criteria for determining tariffs was not followed strictly.
- While determining the tariffs, the projects in the public sector were treated differently and allowed to pass on their inefficiencies to consumers.
- In the generation tariff, the BOOT tariff was applied to the BOO regime_ a payment of 80 percent plant cost in the first 10-15 years. The 15-18 percent returns on equity with return in dollars despite substantial cost incurred in Pakistani rupees caused huge capacity payments.

- Higher outages and higher capital costs were allowed making capacity purchase prices higher (Sohail, 2014).
- For IPPs, the up-front tariff regime under Up-front Tariff (Approval & Procedure) Regulations, 2011, is generally applied. But regulator incapacity to determine upfront tariff often results in higher tariff calculation³⁵. This is one of the reasons, for the inflated cost of electricity generation in Pakistan (Malik, 2022c).

Figure 10.3. Anomalies in Tariff Calculation

- Actual heat rate/efficiency of GENCOs plant is more than NEPRA determined heat rate; additional heat rate consumed per unit produced is not covered in any tariff.
- Increased pay and allowances due to hiring employees in GENCOs, NTDC and DISCOS beyond NEPRA-determined staffing cost, and is not covered in any tariff (generation, transmission and DISCOS).
- NTDC tariff is set on 2.5% transmission losses, whereas actual losses are much higher. As a result, the cost of excess transmission loss is not recovered from any tariff, which ultimately adds to the circular debt.
- Late payment surcharges paid by CPPA-G to the IPPs resulting from the inability of the DISCOs to pay for the power cost on time are also not covered in any tariff-setting mechanisms.
- Network loss is more than NEPRA-determined T&D loss for most DISCOs. It ranges from 0.04% to 17% among efficient performing DISCO to worst performing DISCO. The cost of excess loss above the NEPRA-determined loss level is not recovered from any tariff; it is added to CD.
- Poor revenue collection by the DISCOs due to which liabilities of the power sector towards power cost is not being paid. This poor revenue collection adds to the CD and leads to load shedding.
- Prolonged stays on fuel price adjustments granted by the courts and impact of court decisions that delayed payments to DISCOs.

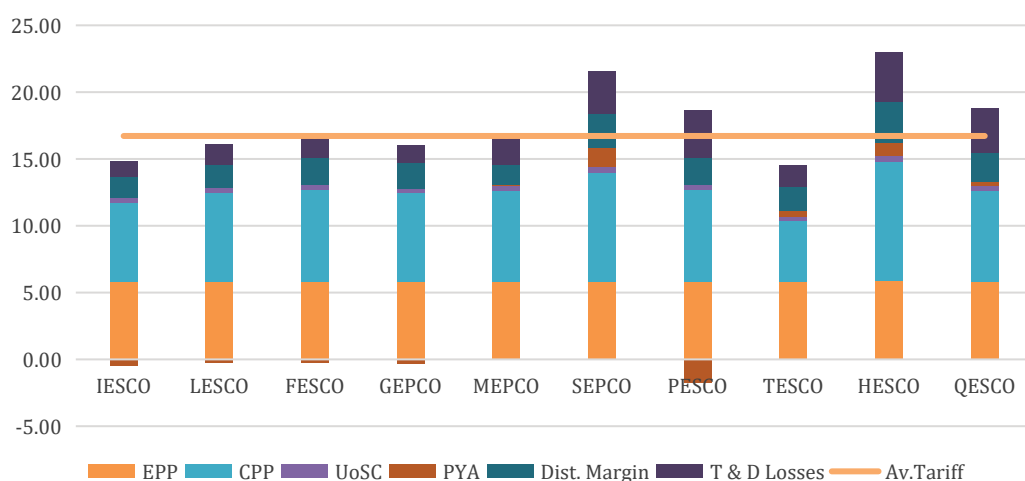
10.3. CONSUMER-END TARIFF

- NEPRA determine consumer-end tariffs for each DISCOs separately. NEPRA determines consumer-end tariffs to recover the entire supply chain costs.

³⁵For instance, imported coal power plants (under CPEC) had been built at \$1.4 million per MW and a tariff almost double to a similar coal plant tariff under construction in UAE by the same Chinese company at the same time. The reason was the upfront tariff system of NEPRA. NEPRA estimated a high tariff.

- In deciding the average sale price, NEPRA considers the annual revenue requirement of DISCOs which includes all the costs involved. The main factors in the annual revenue requirements include power purchase price³⁶, net distribution margin³⁷, T&D losses, and prior-year adjustments³⁸, as illustrated in Figure 10.4

Figure 10.4. Consumer-end Tariff (Rs/KWh) FY2020



Source: SROs 182(1)/2020 to 190(1)/2020 (February 12, 2021)

- NEPRA is not autonomous in its decisions on consumer-end tariffs. The GOP continues to exercise considerable control over it. Thus, affecting NEPRA's effectiveness in determining/ regulating consumer-end tariffs as per the actual cost of service (under Section 31 (3h) of the NEPRA Act).

³⁶ It includes the generation and transmission costs of the power a DISCO has projected to purchase.

³⁷ It is the difference between gross margin and other income of DISCO. Gross margin includes O&M costs, depreciation and returns on the asset base of DISCO. Other income refers to remuneration of deferred credit, meter and rental income, late payment surcharge, profit on bank deposit, sale of scrap, income from non-utility operations, commission on PTV fees and miscellaneous incomes.

³⁸ It is the gap between the projected and the actual cost in the previous year, built into tariffs for that year. This adjustment is for the difference between the projected and actual electricity units purchased by DISCOs; the difference between the projected and actual distribution margins; the difference between actual and notified previous year adjustment; the difference between projected and actual other income; and the difference between the projected and actual consumption mix.

- Although no formal condition or rule allows the Ministry to reverse NEPRA's decisions, major decisions, i.e., tariff rates, are subject to Ministry approval. The regulator determines tariffs and can only recommend what the Ministry notify³⁹.
- The tariff which the GOP notifies reflects the political and socio-economic objectives.

Uniform Tariff

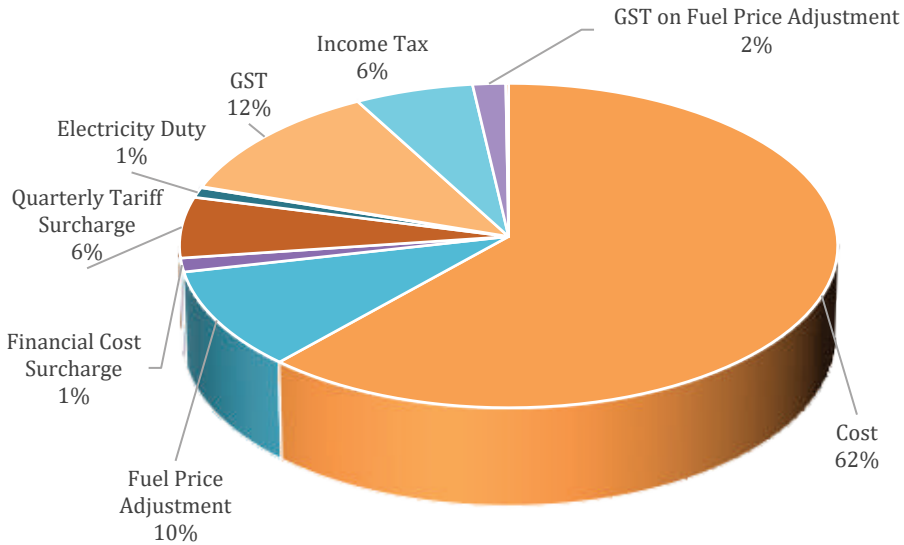
- Under the NEPRA Act 1997, the tariff so determined was different for each DISCO because of its distinct characteristics: the difference in annual revenue requirement and T & D losses.
- NEPRA used to make its valuation of cost and revenue requirements, determine the average sale price of each DISCO, set tariffs for different slabs of various categories of consumers for each DISCO, and send its recommendation to the GOP (PD).
- The GOP notified the final tariff for different consumer categories but the same across all DISCOs. The GOP notifies the uniform tariff after adjusting for subsidies. Before the amendment to NEPRA Act, the minimum consumer-end tariff for a particular consumer category among all DISCOs was adopted for application across the board to all DISCOs.
- After the amendment to NEPRA Act, NEPRA is determining a uniform tariff for distribution licensees wholly owned and controlled by a common shareholder based on their consolidated accounts. It compromised the inefficient behavior of some of the DISCOs. The GOP notified the final applicable tariff after adjusting for subsidies.
- The repeated build-up of equalization surcharges to ensure uniform rates has compelled honest consumers to switch to alternate sources. Potential industrial consumers have set up their captive plants, and residential consumers are shifting to individual solar systems / micro-grids. This is sparing existing power capacities and increasing capacity payments.

³⁹ The Act binds the Authority to do so.

Electricity Tariffs as Mean of Collecting Taxes/ Surcharges

- Several surcharges levied by the GOP are also included in the consumer-end tariff by NEPRA under Section 31(1) of the NEPRA Act 1997. This section deals with the acceptance of the various directives/advisories of the GOP, provided these do not clash with the basic principles of the Act. For instance, financial cost surcharge of Rs 0.43 per unit (for debt surfacing of circular debt parked in PHPL),
- Neelum Jhelum Surcharge of Rs 0.10 per unit,
- Sales tax @ 17%, TV fees of Rs 35 per meter and electricity duty @ 1.5%; sales tax is also charged on fuel price adjustments.
- These are charged irrespective of units consumed.
- It increased costs to compliant consumers; surcharges can also result in more inefficiency in the distribution system. It reduces DISCO's incentives to improve and control costs.
- In the case of the Neelum-Jhelum project, the surcharge shifts utility business risks away from investors and puts extra pressure on consumers.
- The consumer-end tariff has become a means to collect taxes, i.e., as an agent of the FBR. It is unique, as the most developed world does not cater to such collection(s).
- The proliferation of these surcharges generally shifts risks away from utility operators/ investors and onto consumers.

Figure 10.5. Electricity Bill Dissection



**Random Residential Electricity Bill for June 2022; Income tax is not charged from tax filer*

Tariff Accommodating Inefficiencies

- The tariff break-up suggests that the customer is billed for all possible expenditure(s) in the power sector, including inefficiencies, e.g., high transmission & distribution losses and low recoveries, wrong billing, mismanagement, etc. The power sector is plagued with inefficiencies that see no reduction; so is the upward trend in consumer-end tariffs.
- Apart from monthly fuel price adjustments, NEPRA also allows for quarterly adjustments in the determined tariff of DISCOs. It is made when DISCOs do not use the allowed energy quota and ask for a quarterly adjustment. Instead of regulating DISCOs (regulatory failure), the burden is transferred to the consumers. The tariff increase on this account is responsible for a hike of about 50% during the last two years.

Cross-subsidy within and across Sectors

- For the end-consumer, the current tariff structure is uniform throughout the country; it distinguishes between residential, commercial, industrial, agriculture, and other customer categories, further divided by consumption level (tariff slabs), load, or time of use.
- The system of electricity subsidies and cross-subsidization across sectors and different geographical regions_ DISCOs, and the inability to pass on the actual cost to some consumer categories is of great concern.
- A tariff structure in which charges are not recovered from all consumer categories indiscriminately, besides creating financial difficulties for the government, also creates inefficiencies and misleads investment decisions in the supply system.

Box 10.3. Power Sector Subsidies

- The Government of Pakistan provides several subsidies to the power sector. The most significant portion of this subsidy is for inter-DISCO tariff differential. Out of Rs 366.4 billion of electricity subsidy in FY2021, 55 per cent (Rs 201.8 billion) was for inter-DISCO tariff differential, and about 2 per cent (Rs 7.5 billion) was for Agriculture tube wells.
- Since FY2007, the government has paid over Rs. 3.4 trillion subsidies to the sector, out of which about 75 per cent are for the uniform tariff policy.
- Due to fiscal constraints, the government cannot manage this subsidy amount in time, consequently adding to the sector's deficit (that is, circular debt).
- The consumer tariff notified in February 2021 created a financial gap of more than Rs 180 billion, to be covered through direct subsidies by the government. This is apart from tariff hikes due to fuel and other adjustments.
- These subsidies and price structures discourages inefficient companies from improving their performance. If a different tariff is charged in each DISCO_ it will create pressure on companies like SEPCO, HESCO, PESCO and QESCO to improve, but companies like IESCO,

The provision of different tariffs for each distribution company based on its peculiar circumstances was conceived in the NEPRA Act 1997. Initially, the burden to make the differential tariff uniform for all consumers in Pakistan was on the Federal Government.

However, afterwards, the GOP introduced the mechanism of cross-subsidization across DISCOs. This approach is against the spirit of the reforms plan introduced in the early 1990s and the Companies Act. Additionally, it is against the efficiency requirement in the power sector.

Figure 10.6. Residential Tariff Slabs (Rs/ KWh)

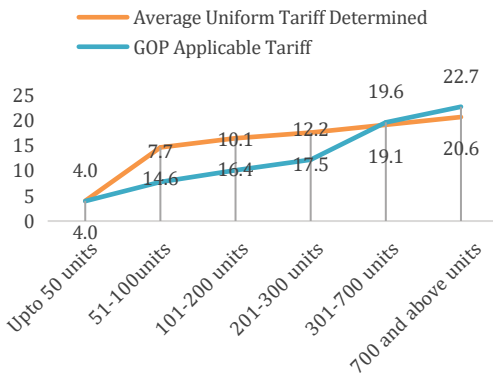


Figure 10.7. Agriculture Tariff (Rs/ KWh)

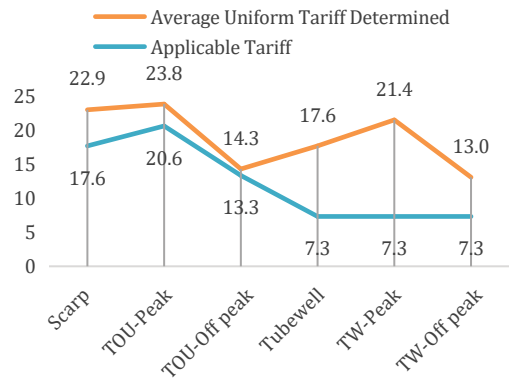


Figure 10.8. Industrial Tariff (Rs/KWh)

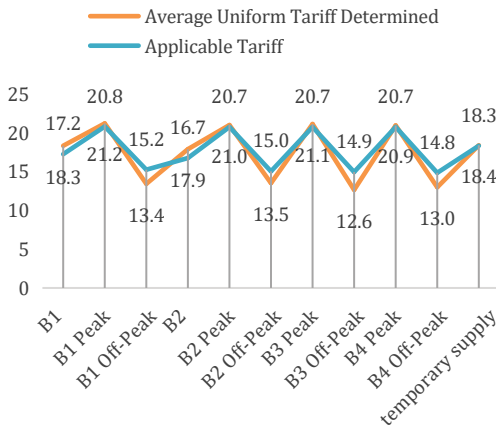
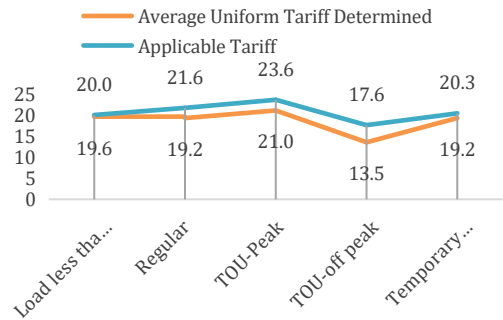


Figure 10.9. Commercial Tariff (Rs/ KWh)

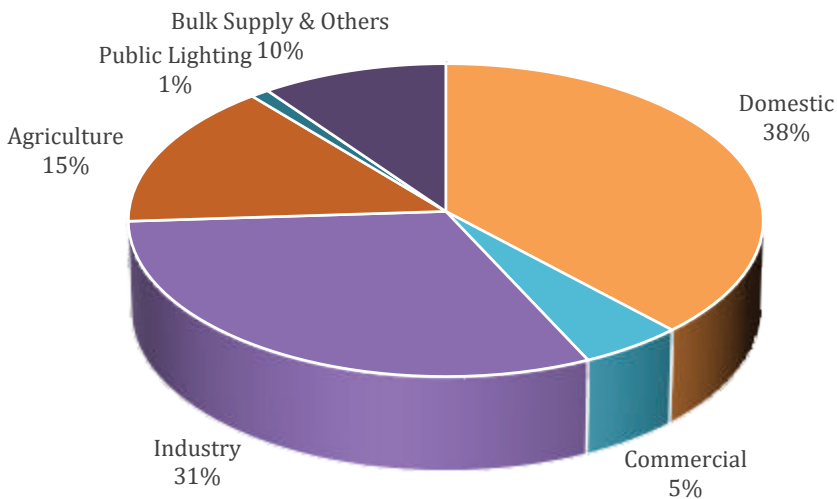


Source: SROs 182(1)/ 2020 to 190(1)/2020 (February 12, 2021)

10.4. LOAD SUPPRESSION TARIFF (INCREASING BLOCK TARIFF) MODEL

- About half of the total electricity consumed is in the domestic sector. The tariff structure is progressive for domestic consumers. It is expensive at higher consumption levels (Figure 10.6).
- Since 2013-14, the tariff structure has moved from all slab benefits to only a previous slab benefit. The residential consumers are given the advantage of one last slab⁴⁰.
- For residential consumers, the price of electricity is greater than the supply cost in the higher slabs
- The load suppression model for the consumer-end tariff was designed to constrain usage and ensure that the high-paying domestic and commercial consumers subsidize the low-end users or the marginalized consumers of electricity.

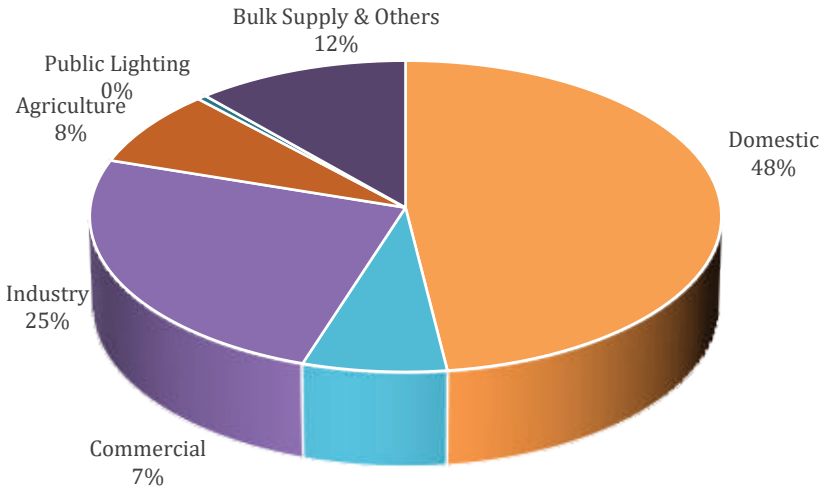
Figure 10.10. Electricity Consumed by Sectors (% share) FY1995



Source: NEPRA State of Industry Report (2021) and NTDC Electricity Marketing Data (2022)

⁴⁰ In September 2022, the one-slab benefit is also removed.

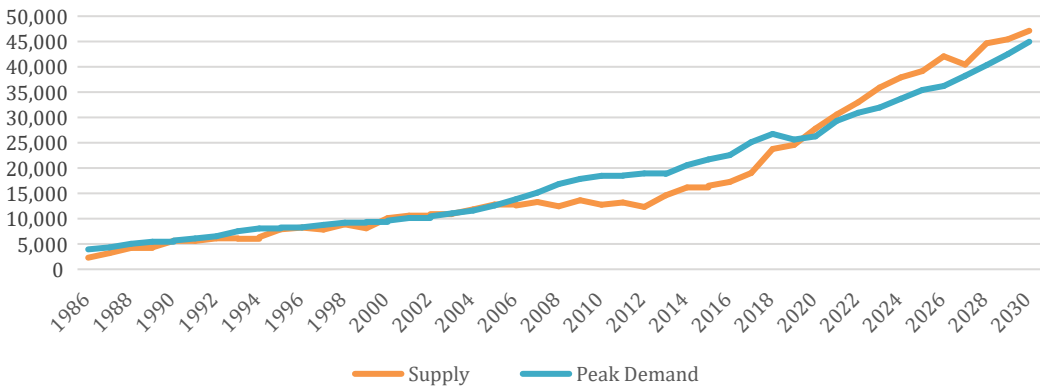
Figure 10.11. Electricity Consumed by Sectors (% share) FY2021



Source: NEPRA State of Industry Report (2021) and NTDC Electricity Marketing Data (2022)

- Even though NEPRA now regulates the power sector, the earlier tariff structure, inherited from WAPDA, has been retained.
- The inherited load suppression model went well until the sector operated in deficit mode. However, it is unsuited for the energy surplus regime (Figure 10.12).

Figure 10.12. Peak Demand and Supply (MW)



Source: NEPRA State of Industry Report (2021) and NTDC Electricity Marketing Data (2022)

- WAPDA designed the load separation model of tariff to provide for the socio-economic obligations of the state. Pakistan’s earlier thought process was towards being a welfare state⁴¹. In those days, the concept of cross-subsidies was considered kosher. The recurring energy crises further compounded the situation (Box 10.4).

Box 10.4. History of Energy Crisis in Pakistan

- **First**, an energy crisis erupted before the commissioning of Mangla Dam in 1968.
- **Second**, it started in the early 1970s and continued till the commissioning of Tarbela Dam (four units of 700 MW) in 1977. Both Mangla and Tarbela dams led to a robust hydro-based energy generation that satisfied rising demand, but only for a few years.

From 1960 to 1973_ DBT, i.e., high rates for initial units and lower on succeeding units. In the 1960s, 60 % of the electricity was produced from hydro sources; therefore, initial units were expensive to cover the capacity price.

- **Third**, energy demand soared, which the existing generating capacity could not match. Thus, leading to energy crises in 1984 and onwards. The crunch saw the unveiling of the 1994 power policy and the induction of IPPs
- **Fourth**, it started in 2005 and ended in 2017 (in terms of sufficient installed capacity).

These crises ensured that the demand had to be suppressed. Thus, the tariff structure based on the concept that the more you use, the more you pay was applied, against the worldwide principle of reduced rates for bulk sales. This tariff model continued against its basic principle between 2000-2004 when power was in surplus. Even after 2018’s power glut, the model continued.

Over the last twenty-five years, the fast urbanization trend along with the subsidized electricity tariffs have increased the share of domestic consumers while denting industrial usage (Figure 10.10 and Figure 10.11). Some de-industrialization is obvious. But primarily, high electricity tariffs for industry have led to the advent of Captive Power Plants. These have become a competitor to the institutionalized power sector of Pakistan. Besides, the availability of alternative energy sources has led to the reduction in industry usage of grid electricity in the presence of high tariffs and shortage of grid electricity in the latest energy crisis phase.

⁴¹ In line with the earlier socialist leaning period.

Glitches in Current Tariff Structure

- Load suppression (increasing block) tariff formulation goes against the fundamental spirit of a regulated sector whereby the cost of service for each category of consumers makes up the tariff.
- There are six tariff slabs for household category, which in itself is exemplary and leads to the inefficient use of electricity.
 - For those who consume up to 300 units of electricity, the applicable uniform tariff is much lower than the NEPRA determined uniform tariff.
 - Most of the time, any increase in tariff is only applicable to those who consume 300 plus units.
 - As per the tariff notification of February 12, 2021, 67 per cent of domestic consumers use electricity up to 300 units, while the remaining 33 per cent consume electricity above 300 units in Pakistan. In other words, 67 per cent of the consumption is below the weighted average cost of service.
 - This government policy is meant to insulate the poor and the lower middle income (0-300 units) from the tariff hike.
 - It is difficult to determine whether those consuming up to 300 units are deserving or not⁴².
- Uniform tariff policy is counter-productive, as it leaves no attraction for efficient DISCOs to further improve or remain efficient and offers no incentive for the poor and loss-making DISCOs to reduce losses and become efficient.
 - As per National Electricity Policy 2021, the uniform tariff policy will continue_ meaning the continuation of tariff differential subsidy. A uniform tariff policy is no incentive for a privatized or a state-owned corporate entity.
 - The ultimate objective of CTBCM is to generate competition among market players to benefit consumers in terms of service quality and pricing. There will be no competition when accounts of inefficient and efficient DISCOs are treated as one, and the uniform tariff is charged.

⁴² About 46 per cent of the population is not connected to the national grid in rural areas. In urban areas, poor and lower-middle-income households that presumably consume (0-300 units) reside typically in congested localities. However, there are apprehensions that crowded areas mean more power theft (through meter-tempering) and line losses. .

- No realization at the government level that an increase in tariffs expands the black hole in the power system_ halting efforts to reduce aggregate transmission and commercial losses present. Any tariff increases lead to a higher financial gap.
- In 2021, T & D losses were equivalent to Rs 473 billion, Rs 402 billion were recovered through tariff, and a financial loss of Rs 71 billion was added to CD. Power sector loss from low bill recovery was Rs 39 billion in the same year. Unless or until tariffs are not allowed to cover the actual cost of service to consumers, the power sector will continue to face financial difficulties, and the CD will continue to rise.

Pakistan is among the top thirty countries globally with relatively high tariff rates. A complete revamping of the present consumer end tariff is needed. Linear Tariff, as illustrated in Box 10.5, is an option adopted in several countries.

- As Clause 31 of the NEPRA Act specified, cross-tariff subsidies should have been shunned, as rightly contained in the original NEPRA Act, but it did not happen. Subsidies are a part of the state's socioeconomic or political obligations, which must not burden the high-end domestic consumers, commercial consumers, and industrial categories. It is against the independence of NEPRA.
- Better performing DISCOs and compliant consumers cross-subsidize inefficient DISCOs and consumers involved in illegal electricity use.
- DISCOs in Punjab only allowed technical losses in tariff calculation. Still, their consumers are burdened with the extra cost of electricity due to bad governance in DISCOs in other geographical areas.

Box 10.5. Linear (Flat) Tariff and Different across DISCOs

Based on data from Tariff Determination of February 12, 2021, total revenue is estimated for NEPRA determined uniform tariff, GOP applicable tariff, and for a flat (linear) tariff, i.e., the weighted average across DISCOs. Maximum revenue is generated if we apply a linear (flat) rate which (in this case) is the weighted average across DISCOs, without any subsidy. However, the flat (linear) tariffs may not be a win-win situation for all (e.g., poor households) but will reduce tariff-related distortions and inefficiencies. Empirical literature highlights that direct cash transfers, compared to electricity subsidies, have proved to be a better welfare alternative for low-end consumers.

Revenue Generated using Different Tariffs											
Sector	Sales across DISCOs		Total Revenue Generated (Rs Billion)								
	GWh		NEPRA Determined Uniform Tariff	Govt. Applicable Tariff	Flat (Linear) Tariff (Weighted Average across DISCOs)						
Residential	48948		828.61	650.57	816.94						
Industry	25857		371.42	411.11	431.55						
Commercial	7117		121.66	137.97	118.78						
Agriculture	10405		166.01	79.15	173.66						
Single Point	3327		49.53	69.13	55.53						
Gen. Services	2575		43.9	50.24	42.98						
Public Lighting	287		5.46	5.92	4.79						
Res. Col.	59		1.24	1.22	0.98						
Total			1,587.83	1,405.31	1,645.22						
Revenue Generated using uniform and different Flat (Linear) Tariffs Across DISCOs											
(Rs Billion)											
	IES CO	LE SC O	FES CO	GE PC O	ME PC O	S E P C O	PE SC O	T E S C O	HE SC O	QE SC O	Total
Flat (Linear) Tariff (Weighted Average across DISCOs)	161.11	369.68	229.19	168.65	277.92	58.43	187.50	28.56	73.14	91.04	1,645.22
Flat (linear) rate different across DISCOs	137.94	354.18	223.28	158.55	281.09	75.48	189.97	24.88	100.65	102.77	1,648.79

Source: Malik and Urooj (2022)

Action Points

- **Notify differential tariffs for each geographical market** (DISCO), that is, tariff determination based on service cost.
- Recover the total service cost from all consumers; no cross-subsidization across sectors or regions or high-end consumers.
- **NEPRA must be empowered** to play its role as specified in Clause 31 of the NEPRA Act. NEPRA should eliminate all kinds of subsidies and cross-subsidies from the tariff.
- NEPRA needs to **simplify processes to minimize delays**.
- NEPRA needs to build its capacity to work and cope with sector challenges and market forces while meeting its obligations as a regulator.

The tariff (and its components) calculation expects technical and administrative analysis with innovative technical and commercial performance tools. The power sector can only improve if the actual cost of a power supply reaches every consumer

- **NEPRA must consider technical analysis or use specific parameters to identify challenging areas** (with poor law and order situations) for controlling theft and bill recovery.
- **For recovery of capacity payments**, there is a need to **increase sales/ consumption by reducing prices** significantly and making grid electricity attractive to productive sectors (service provision is cheaper for the industry than domestic consumers) by offering them lower tariffs.
- Transitioning from a deficit regime to a surplus one requires **changing the load separation model of power tariffs to a linear tariff regime for increasing efficiency and revenues**.
- We have a social protection system. There is no need to subsidize electricity. All the socio-economic and political obligations of the government must be duly budgeted.
- Simplification of consumer-end tariff where a consumer pays only for the cost of electricity and does not become an agent of FBR.

There is a stark difference in electricity usage between day and night. Likewise, seasonal variation in electricity usage is high in Pakistan. Summers and winters differ in demands of anything between 8,000 to 13,000MW.

- Regulator must reconsider the present TOU tariffs by catering for at least four different segments of the day and then for the four seasons – specifically, the high summers and the winters.

11. COMPETITIVE TRADING BILATERAL CONTRACT MARKET (CTBCM)

The electricity market is complex; it requires careful planning and a design developed keeping in view the ground realities. In Pakistan, the power sector has certain peculiarities. Establishing a donor-designed power exchange market in the current scenario seems impracticable.

11.1. PREFACE

In November 2020, NEPRA approved a detailed design and implementation roadmap for the CTBCM prepared by CPPA-G through an international consultant (MRC Consultants and Transactions Advisor) with the support of the Asian Development Bank. NEPRA gave 18 months to CPPA-G for its preparation and implementation.

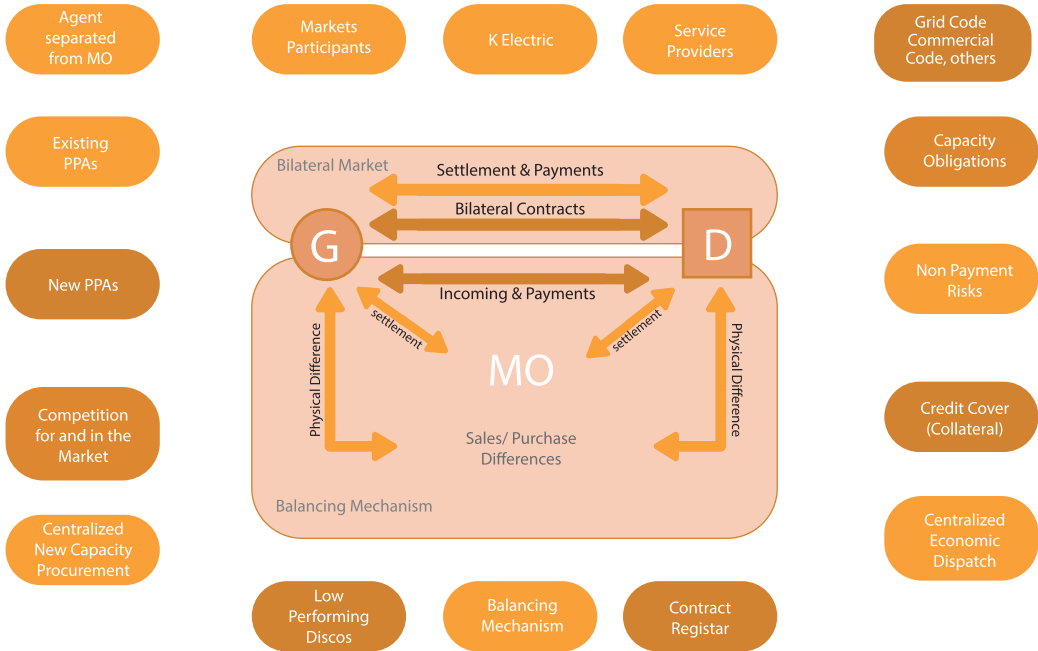
- Under this model, existing PPAs between IPPs and NTDC/CPPA-G (on DISCOs' behalf) will be converted into bilateral contracts between each IPP and DISCOs.
- The model envisages that all future contracts for the sale/purchase of electricity will be bilateral between the parties: sellers - generation companies and buyers - distribution companies or bulk power consumers

11.2. CTBCM PRIMARY COMMERCIAL FEATURES

- Demand participants (DISCO, KE, Suppliers, and BPCs) will sign contracts directly with generators (traders) to cover their energy needs and capacity obligations.
- At the start of the wholesale electricity market, there will be two types of contracts: pre-existing PPAs and new contracts signed under the new market framework: the Supply Contracts.
- New capacity procurement for DISCOs will be done through centralized competitive tenders or an auction.

- An Agent will aggregate the capacity and energy required by each DISCOs and run the procurement for the total requirement.
- For the bilateral contracts, the settlement, invoicing, and payment will be made directly between the PPA partners, e.g., the generator and traders on one side and DISCOs, suppliers and BPC and any other buyers on the other side.
- There will be a balancing mechanism to settle deviations between contracted and actual amounts. Settlement of contract deviations in the balancing mechanisms will be done by the MO.
- The market will include mechanisms to address non-payment risk. The bilateralization of existing contracts will not change the guarantee that is part of the existing PPA.
- For DISCOs that cannot provide the required guarantees (for bilateral PPAs) or credit cover for participating in the balancing mechanism (e.g., DISCOs with a history of low collections and low payment records), the Government could provide a guarantee or credit cover.

Figure 11.1. CTBCM



Source: CPPA-G (www.cppa.org.pk)

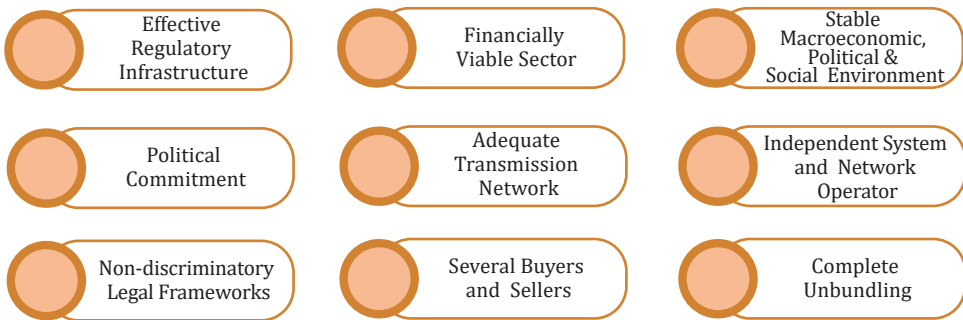
11.3. CURRENT MARKET STRUCTURE: SINGLE BUYER MODEL

The power system operates as a single-buyer model where the CPPA-G buys power from GENCOs, IPPs, WAPDA and other producers, pools it, and sells it to all the DISCOs.

- The single-buyer model, instead of motivating efficiency, transmits inefficiency to consumers through increasing tariffs.
- The single-buyer model is considered the second-best alternative to comprehensive restructuring, providing time for a smooth transition toward fully competitive wholesale markets. Nevertheless, it is a risky transition; rigid contracts with IPPs can deter participation in a subsequent competitive market.

- The inflexible long-term PPAs, built around take-or-pay clauses, deter the evolution of competition. The plants operating under the agreements will have no incentive to participate in a competitive market. To minimize short-run production costs, they cannot be dispatched on a merit-order basis, as is currently happening in Pakistan.

11.4. WHOLESALE MARKET FUNDAMENTALS



The electricity market is complex. It requires careful planning and implementation because of its complexities, technicalities and inelastic demand and supply. Otherwise, a market can collapse even with abundant resources, e.g., California’s Power Market in 2000 (Box 11.1).

Following is a brief depiction of all the peculiarities of Pakistan’s power sector that impede the establishment of a fully operational power exchange. Due to these, the quick induction of CTBCM modules is suspect.

- A reliable payment chain is crucial for a market to function. The creditworthiness of all, particularly distribution utilities, is critical. Presently, the power sector is not fully solvent and is in deficit.

- The payment culture is not disciplined, and there is an inability at part of the demand to pay in advance.
- In the CTBCM, because of take-or-pay long-term PPAs, the distribution companies would be required to provide credit cover for future power procurement. It is not possible, given the current poor balance sheets and structural weaknesses of the DISCOs. If buyers, that is, DISCOs, are financially unsound, the envisaged wholesale and retail power market will not be able to function.

The only chance (almost negligible) is that CTBCM would stay in Punjab, where DISCOs have relatively better balance sheets. For others, if the government is going to provide credit cover/guarantees, what is the point in having such a market?

- Due to inflexible long-term PPAs, it is not easy to free volume from signed PPAs for power exchange. All demand is already contracted by take-or-pay capacity, i.e., the buyer pays the total fixed costs, including their returns, procuring energy at their regulated variable cost. Therefore, participation of the demand is not foreseen in voluntary exchange and increases the cost of purchasing by paying the market-clearing price in power exchange.
- The benefits of competition are unlikely to pass to end-users if market power is concentrated in the generation or distribution sector.
- Though the state-owned CPPA-G is an independent MO, it has a clear bias favoring DISCOs; a non-discriminatory governance structure is impossible.
- Demand forecasts are not mature enough for ex-ante imbalances settlement.
- The electricity act in Pakistan does not allow the self-dispatch of plants.
- Transmission constraints, which will restrict the self-dispatch at various nodes. Readjustments will be difficult; in most cases, the contracts will not be dispatched.
- As per the NEPRA amended Act 2018, distribution will be separate from the electricity supply by 2023, which requires new standards/rules/regulations. Regulatory requisites are not in place.
- DISCOs do not have the capacity and understanding of the market.

Box 11.1. California Electricity Market Crisis (2000)

Reasons:

- Shortage of Generation Capacity_ market manipulation by generators, increase in input costs, regulatory uncertainty, and slow environment review process.
- Bottlenecks in Related Markets_ constraints on related infrastructure and markets, including natural gas pipelines, the market for pollution permits, and the electricity transmission system.
- Wholesale Generator Market Power_ allegations of market manipulation.
- Regulatory Mistakes_ retail prices were capped, but utilities were forced to buy expensive wholesale power instead of short-term price controls on wholesale markets. Excessive reliance on the spot market and the division of regulatory authority increased the opportunities and incentives for strategic manipulation of the markets.
- Faulty Market Design_ overall, the design was complex, relying much more on market forces. The electricity market works entirely on the supply side while ignoring demand-side management.

Outcome:

Increase in wholesale electricity price. Retail prices were frozen. Utilities lost millions of US\$ per day, and their debt increased rapidly, as much as US\$ 50 million per day.

Sources: Borenstein (2002) and Weare (2003)

11.5. DISTRIBUTED GENERATION (DG) AND WHEELING OF POWER

DG is a norm in electricity markets globally. DISCOs are creating hurdles in allowing "wheeling" and "net-metering" regimes, which are supposed to bring competition to the sector. As in the draft National Electricity Plan, 'wheeling' would only be allowed as any viable proposition after billing all so-called stranded costs, etc.

Instead of approving the B2B sale of power arrangements, a new scheme, CTBCM, is being hyped as the new panacea of all ills. CTBCM might create due ripples in the power market, but the main issue that will still need to be solved would be power wheeling. As the PD is presently managing the sector (DISCOs), it considers 'wheeling' a distinct threat to its viability. Thus, it would keep dragging its feet and put all possible obstacles in the path. The case of net-metering is no different⁴³.

⁴³ An amendment in NEPRA Distribution Generation and Net-metering Regulation, 2015, is planned to favor DISCOs. After this amendment, the currently applicable national average power purchase price of Rs. 19.32/kWh will be replaced with the national average energy purchase price of Rs 9/kWh. This move will disincentivize net-metering consumers.

The 'wheeling of power' for the BPCs must force its way (against all obstacles – including that created by the PD) in 2-3 years. That would be the precursor for the power market. Because of this facility, the small BPC population of the country would have their energy costs reduced, along with the availability of standard supplies. 'Wheeling of power' allows open access to all market participants on a non-discriminatory basis and attracts new investments.

Key Takeaways

Establishing a power exchange market in Pakistan in the current scenario seems impracticable. Nevertheless, the Federal Government, CPPA-G and NEPRA are implementing the CTBCM⁴⁴. The statement by Chairman NEPRA that he envisages only baby steps to implement CTBCM is a pointer towards the sectoral confusion moment⁴⁵. Moreover, the timeframe given for its implementation is over, yet the implementation of CTBCM is not in sight.

As in the amended NEPRA Act, if the accounts of poorly managed and efficient DISCOs are treated as one, the tariff will continue to be uniform across the country (National Electricity Policy, 2021). There is no point in spending time and energy on CTBCM. The proposal is counterproductive as it leaves no attraction for efficient DISCOs to improve further or remain efficient and offers no incentive for the loss-making DISCOs to reduce losses and become efficient.

The energy sector will lose its monopolistic status (in favor of consumers) only if the amended NEPRA Act is implemented in letter and spirit. That is the complete separation of 'wire' and 'retail' business. Small new retailers would enter the system using DISCO' wire' to distribute electricity, creating competition. DG and net-metering offer retail competition provided it is allowed unhindered.

⁴⁴ Competitive wholesale market with a balancing mechanism was supposed to start in April 2022. Now, the process is underway under a USAID project.

⁴⁵ Chairman NEPRA's statement, carried by the Express Tribune of 19/10/2021.

Recommended Path

- *The market should start with bilateral contracts keeping transmission constraints and participants' capacities in mind. When demand and supply balance and the market attain more maturity, establish an electricity trading platform.*
- *All DISCOs should be allowed to purchase energy on a short-term contract and acquire generation assets falling inside their territorial jurisdiction and outside.*
- *Start with the 'wheeling of power' – electricity transmission from a producer to a user in the same balancing area or from one location to another. NEPRA should facilitate 'wheeling' by discouraging the hurdle creating entities.*
- *Wheeling needs to be supported by drafting priority requisite policies and plans at the governmental level.*
- *On the generation side, negotiate PPAs with IPPs to free at least 50 per cent of their capacity to be traded in the market.*
- *The electricity market requires legal, regulatory, financial, and human capacity at every level - build this capacity first.*

12. FUTURE ARCHITECTURE OF THE POWER SECTOR

The sector is mired in 1960s technology in content and design. It lacks coordinated planning and policymaking. There is mismanagement, weak governance, and an ineffective regulatory regime. Immediate corrective measures are required to move from stagnation to a developed system in the 21st century. A regional grid is seen around the corner, linking Pakistan with the Central Asian Region, Afghanistan, and Iran. There is a strong possibility that the rest of the Indian sub-continent may also become a part of this grid. Before we look into the future, we must come out of the stale system.

12.1. MANAGERIAL REFORMS

Human Resources Management (HRM) and Human Resource Development (HRD) are compulsory for a successful entity. Currently, because of recruitment issues (intermittent instead of regular), both HRM and HRD are hit. There is a perpetual scarcity of staff. The planning cannot be undertaken when the public sector companies are neither government entities nor governed by the Corporate Companies Act.

There is a disconnect between the Public Sector Corporatized Entities (PSCES) and WAPDA (the original provider of HRD modules). Thus, the development of the PSCE's staff is compromised. This aspect needs special attention to be resolved.

- To resolve this issue between WAPDA and the PSCES: upgrade, rather quickly, the Training Institute(s) of WAPDA, considering the present-day requirements.
- Secretary, Power Division, and MDs of all relevant organizations should be competent power engineer(s).
- Professional BODs should be authorized to hire CEOs having experience in distribution and expertise in managerial affairs.
- CEOs should be given all administrative, technical, and financial powers to run the DISCOs without government interference.

- The BODs should necessarily and pre-dominantly comprise sectoral professionals and non-political people, while the number of GOP nominees should be minimum.
- GOP nominees should not dominate the BODs' decision-making.

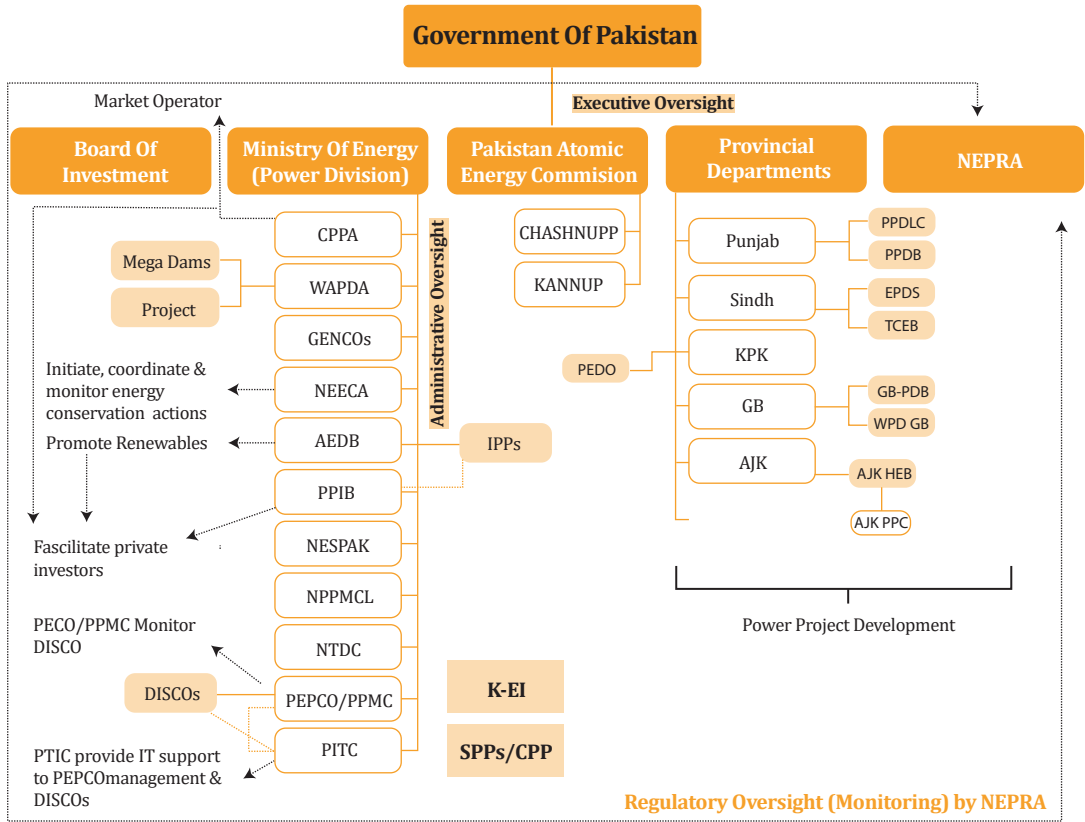
More details on senior management challenges are in Appendix C.

12.2. RE-ORGANIZE POWER INSTITUTIONS & REDUCE GOVERNMENT FOOTPRINT

Regarding governmental support for power sector operations, only a little change is expected as the governments in Pakistan will remain mired in usual governance issues without leaving any time for the utilities. The generalist is expected to stay at the Ministry of Energy beyond 2030.

- The first module that needs change is reducing the government footprint and ultimately moving the government out of the power sector (latest) by 2030.
- The second is effective regulatory infrastructure.

Figure 12.1. Power Sector Institutional Profile



Source: (Malik, 2022b)

Currently, more than 20 institutions, excluding distribution and generation companies, are directly involved in the power sector. There are several institutions with overlapping functions (Figure 12.1). The existence of several institutions is questionable.

- What's the point in having PPIB and AEDB in the presence of the BOI and NEPRA?
- At least three organizations, NEPRA, CPPA-G and PEPCO, now PP&MC, are responsible for monitoring and regulating the management and operations of distribution companies.

By law, DISCOs are independent corporate entities with independent boards. Its operations and reforms (if required) are the responsibility of company management and the board. No other institution (PP&MC or CPPA-G) needs to manage, monitor, or regulate its financial, commercial, and operational affairs. Let DISCOs grow independently_ financially, and administratively outside the umbrella of PEPCO or PP&MC. In other words, from donor influence_ all government departments are running under the technical assistance of donors like WB, ADB and USAID.

Likewise, in future, CPPA-G will act as a MO and SO, but only when the wholesale market is functional. NPCC (NTDC) has been performing duties as a SO, and in the past of MO, why CPPA-G? So many parallel sector entities (including NEPRA) cannot safeguard people's interests.

- Shutting down a few and merging the remaining twenty-plus free-float entities operating now into a single National Energy Authority could bring about sanity and coordination in the energy sector.

A unified (NEPRA + OGRA) energy regulator is on the cards (as in the draft Energy Plan). The need for more experts to staff the unified regulatory authority would remain an issue. It will take another five years for the new entity to graduate.

On paper, the regulators are designed to be independent, to monitor and regulate the energy sector, but presently, their efficiency depends upon the ministry concerned. If it continues, then the future of independent regulation is bleak.

- The job of the GOP is to monitor the effectiveness of a regulator, not interfere. Yet, the authority must be held accountable if not performing effectively.
- About the regulatory regime, it is critical to suggest that the future would like to see the creation of provincial regulator(s) as the distribution of power would ultimately have to become a purely provincial subject with a national grid.

The most complex and therefore requiring strong political will is restructuring policy institutions to reverse the unchecked fragmentation that has occurred over the years in the power sector. Cutting down these institutions and consolidating the remaining can streamline the energy sector more effectively.

12.3. ALL-INCLUSIVE POWER POLICY & COORDINATED PLANNING

Pakistan's Power sector needs an all-inclusive national power policy, which allows the country to move forward in quest of the laid down goals of financial viability with no sector losses and no financial burden for the government. On the contrary, for consumers, which allows for reliable supplies at affordable prices.

We need a power policy considering federation challenges, a national goal and subsequent planning and implementation strategies.

Without goal-specific policy direction, the sector will remain directionless, and it would not be possible to make the industry profitable. An all-inclusive national power policy is possible with professionals' input and approval from the CCI (see Box 12.1) and the parliament. Getting the policy fundamentals right is critical. Otherwise, a positive initiative in a negative policy environment tends to generate a negative effect rather than simply no effect.

Energy planning has to be done holistically and not through whimsical projects. Pakistan's power sector needs coordinated planning to realize an optimal power generation mix from imported fuels and indigenous resources. In Pakistan, policymaking, in particular energy policymaking, has always remained under the influence of pressure groups within the system and international financial institutions. It has caused enormous damage to the sector by approving and sanctioning investments in inappropriate projects or endangering essential projects.

Box 12.1. 18th Constitutional Amendment and Electricity

After the constitution of Pakistan amendment in 2010 (by the 18th Constitution Amendment Act, 10 of 2010), the rules of business of the federal and provincial governments have to be taken note of while making a policy and planning in the power sector. At the time of preparation of the reforms plan in the 1990s and the promulgation of the NEPRA Act, the subject of electricity in Pakistan was on the concurrent list.

However, since the 18th amendment, electricity has become the subject of federal legislation. It has been placed in the Federal Legislative List (Part II) for consideration and decision by the Council of Common Interests (CCI). The provinces are empowered to levy electricity consumption taxes and determine the tariff for its distribution within the province. But it did not remove the federal powers to do the same because the exercise of such powers by the provincial government is not mandatory but optional.

A federal government can legislate to the maximum extent of its powers. However, the federal legislature cannot legislate without substantial consultation with the respective provincial governments. The CCI is empowered after the 18th Amendment Act to do substantial consultations

The root of the CD challenge can be traced back to the early 1990s when long-term and unviable contracts were made with private investors on the advice of the WB without probing their long-term impact. The same mistake was repeated over the years, trapping the sector and economy.

To overcome the governance and financial problems, the government, under pressure from international financial institutions (e.g., WB and ADB), started the reform process in the sector. After over three decades, progress has yet to be achieved; the sector is worse off, facing even more challenges. Once again, the WB and ADB are providing technical assistance to the power sector. It is time to let the local people do the necessary reform.

12.4. ESTABLISH A POWER COMMISSION

For a sustainable power sector, deep structural reforms are crucial. For informed policy advice on these reforms and to monitor the restructuring process, the GOP should establish an independent Power Commission. The Commission should comprise hardcore power sector professionals, i.e., renowned generation, transmission, distribution engineers, tariff, and regulatory experts for developing and issuing power sector advisories. There should not be any political appointees. The advisories of a Power Commission should be made mandatory for the Power Division and PSCs, to implement. The Commission would prepare a sector progress report and present it to the Parliament bi-annually for discussion and review. The Commission would be formed initially for one year. The time may be extended provided noticeable positive outcomes, otherwise dismantled (details in Appendix D).

12.5. POWER SECTOR REVENUE RECOVERY PLAN

The power sector has been held hostage by continuously increasing financial losses due to high technical and administrative losses and low bill recoveries for the last fifteen years. Apart from being unable to effect full targeted recovery of the current bills, the earlier build-up is added to each month. The reason being the recovery activity is never comprehensively taken. The emphasis remains on preventing the build-up of the default figure alone, which is also not achieved; a negligible amount gets recovered from the earlier defaulters.

- A plan to recover Rs. 300-500 billion in the next six months must be prepared and implemented. After that, a similar plan for the remaining amount in the next 12 months. Later, the DISCOs should be made to fend for themselves.
- The government must set targets before the plan is implemented.
- The current legislation is deficient. Thus, the Power Commission (with the support of power sector entities) would draft a summary to recommend changes in the Electricity Act of 1910 (ratified by the Parliament) to strengthen the recovery process_ enabling the DISCOs to recover legitimate revenue on the fast track and without protracted legal processes.
- Senior power sector professionals (maximum two for more problematic DISCO) must be hired for six to twelve months, with an extension on a need basis.
- Their job would be to implement and monitor the recovery roadmap on the ground.
- Based on the quantum of receivables, the Commission would set the targets for these experts for each DISCO (20% to 25% of all defaulters).
- The CSDs would be responsible for the DISCO recovery. The experts would oversee the recovery process.

More details are in Appendix E.

12.6. TECHNOLOGY AND POWER SECTOR

Power companies in Pakistan face a range of challenges that can only be handled by transforming their operations and business models. They must develop/ modify their business models to adapt to changing global environments and local needs.

They need to develop a marketable approach targeting different consumer categories and providing them with high-value and competitive services. Besides, ensuring infrastructure up-gradation and management to become resilient against environmental and socio-political challenges.

Power companies need to rely on IT and adopt innovative managerial techniques. They must undertake technological changes at the earliest.

- Solutions such as pre-paid metering must be brought to the fore for commercial and operational efficiency and to cut down expenditures⁴⁶.
- AMI, up-to-mark distribution/power management systems, specifically SCADA and 4th generation communication modules, will assist in utility operations if implemented timely. Two-way communicating AMI can help the power system update operations, assuring the customer of proper billing. On the other end will assist energy efficiency and conservation levels.

Box 12.2. Conventional Vs Smart Pre-paid Meters

Conventional electricity meters only have one-way manual communication between the users and the utility providers, requiring personnel to record the consumption manually and issue a bill. That leads to inefficient billing, loss of data and human errors.

Smart meters can eliminate the role of physical personnel on the ground for monitoring and meter readings. It can increase load management ability during peak hours and effectively manage load forecasting and the power grid.

Pre-paid (or pay-as-you-go) smart meters are spreading rapidly across developing countries. Evidence suggests that consumers switching from post-paid monthly bills to pre-paid meters reduced their electricity usage drastically. From the utility perspective, it allows an efficient bill recovery and controls theft. Thus, helping in meeting the financial obligations of the respective DISCO. Compared to a centralized conventional billing system, pre-paid metering linked to the DISCO level billing system enables the fair and transparent flow of information and revenue.

In Pakistan, illegal electricity connection or meter tampering, lack of management, corruption, poor infrastructure, poor monitoring system, and poor staff training are common. Pay-as-you-go smart meters can resolve these power sector challenges significantly.

⁴⁶ Especially for low-usage customers where meter reading and subsequent (post-paid) billing entail high expenditure, sometimes even more than the usage/billing at these sites).

Box 12.3. Challenges of Pre-paid Smart Metering System in Pakistan

- Resistance from DISCO employees due to the fear of downsizing non-technical personnel, i.e., meter readers, and the fear of losing a back door income.
- Lack of technical expertise at the DISCO level to implement and the lack of information at the government level to select the best suitable pre-paid metering type.
- On the consumer end, fear of an increase in tariff or subsidy elimination.
- The internet-based purchase of electricity requires specific technical expertise for designing, installing, and managing the backend operations of the pre-paid metering system, which is currently missing.

Under the power sector reforms agenda, several countries have introduced pre-paid metering and gained significantly in increasing electricity use efficiency and reducing commercial losses. Compared to a centralized conventional billing system, pre-paid metering linked to the DISCO level billing system enables the proper and transparent flow of information and revenue. Yet, migrating from the conventional standalone post-paid metering system to the new smart pre-paid metering system would require initial capital investments.

- The most critical challenge in implementing the pre-paid metering system in Pakistan is the availability of financial resources for developing an IT infrastructure at the DISCO level and a two-way communication system, importing, or manufacturing meters, vending points, etc.

The cost can be reduced/ managed through various options, as in Figure 2.4 in Chapter 2. Start implementing the pre-paid metering system from a few loss-making feeders in utilities like PESCO, SEPCO and HESCO, where GSM technology is also available. Later extend it to all consumers.

- A future with robust IT and Artificial Intelligence (AI) based content ensures apt supplies, usage in line with the contracts (between the utility and its consumer base), facility of Time of Difference (TOD) tariffs and allied use. It increases the ability to share Demand Side Management (DSM) gains between the utilities and its clientele, restricted or complete stoppage of supply due to non-payments.
- The AI component would further improve the service and assure predictability of supplies etc. The IT support systems have the potential to ensure consumer discipline, stop misuse of power supplies, safeguard equipment and lastly be able to inhibit illegal abstraction of energy.
- With technology, the current load suppression model of tariff formulation will also give way to a rational tariff

- The extensive use of IT / AI-based asset management tools will help convert the Pakistan power sector into a robust system. Consequently, assuring continuous, standard, and affordable power for the people⁴⁷.
- While upgrading the distribution system, moving distribution grid stations and NTDC sub-stations underground will help mitigate accidents and increase system resilience. The beginning work may also start from large urban centers_ clearing the city landscape.
- With the addition of UHV and DC transmission lines, the present loss level will reduce substantially. Providing converter stations at appropriate locations would ensure alternating current use for distribution.
- On the transmission side, upgraded design configurations for power transmission with high voltages can reduce system losses and stability.

12.7. INDIGENOUS ENERGY FOR FUTURE

There is a need to optimize the generation portfolio. There is a need to monitor, forecast, and manage a complex mix of small to large generation units. Due to the highly volatile global energy market, distributed generation using localized renewable energy sources is gaining traction worldwide.

The world is racing towards increasing energy productivity through efficient use, renewable energy sources, and related technology. Pakistan also needs to shift to enormous indigenous energy potential. It is vital to induct the system of advanced storage batteries – necessary to stabilize intermittency content in the system on account of high ARE content and to arrange balancing of the system to counter emergency shortages. If made, these additions would be revolutionary in shifting from the current reliance on imported fuels.

- Distributed generation (renewable energy sources) offers a solution to the retail competition. It is a better option compared to mega renewable energy projects.
- As net metering and solar power systems (up to the industrial scale) move ahead, irritants need to be cleared in this regard rather than adding more hurdles to it.

⁴⁷ Continued political interference in the sector has compromised the attainment of these goals.

- SBP may thus formulate a policy for commercial banks to encourage further and take the renewable energy projects as security/collateral for providing loans for ARE projects in the private sector. The current portfolio for such loans should also be enlarged to cater for the demand.

IGCEP (2021-30) set the target for variable renewable energy sources at 12 per cent by 2030. It is below the target of 30 per cent set in Pakistan's Renewable Energy Policy 2019. Wind and solar are quickly becoming the cheapest sources of generation technologies, and Pakistan has enormous potential for these.

- Generation of power needs a quick relegation of polluting thermal power while increasing wind, solar, hydro, and other alternative energy sources to more than 70% of the power generation facilities by 2030.

In the initial stages of renewable energy, these have little impact on grid stability as they could be either connected or disconnected because of their low penetration level. But with its increasing share, it creates grid stability and reliability issues.

- A grid that relies on distinct types of renewables, e.g., solar, wind, and hydro, can handle intermittency issues and experience less generation volatility. A unified control system across resources results in the utilization of generated power more effectively as the balance between the sources is achieved.

IGCEP (2021-30) has included hydro among renewable sources. It is planned to increase from 9873MW in 2021 to 23035MW in 2030. Hydro is the cheapest energy source in terms of levelized cost. It is encouraging to see several small hydro projects in the plan. However, in the committed hydropower projects, there are several big dam projects. Large hydro projects come with risks. That makes the implementation of the proposed plan uncertain. For example, the cost of the Diamer Bhasha Dam was US\$ 12.6 billion in 2008. It has now increased to US\$14 billion (a conservative figure). It is feared that a dam could require twice its initial financial estimates because of inflation, debt servicing, local currency depreciation, and environmental externalities costs.

In energy planning strategies, the focus on indigenous resources has always been at the forefront, but unfortunately, not timely implementation. The construction of the Diamer Bhasha dam has already been delayed due to a lack of finances and conflicts (cited from Malik and Ahmad, 2022). One can only hope that the committed hydro projects are complete in time, unlike Neelum Jhelum. Only timely completion of these hydropower projects can avoid cost escalation to some extent and enhance cheap electricity generation capacity⁴⁸.

Another issue worth considering is net hydel profits (NHP). The issue of NHP has plagued the relationship between the provincial governments, particularly Khyber Pakhtunkhwa and the federal government for over 40 years. There is a need to re-examine the issue based on changing power sector dynamics and constitutional legalities and solve the matter permanently.

Box 12.4. Net Hydel Profits (NHP) Controversy in Pakistan

NHP is the money paid by the federal government to provinces for the electricity produced from hydropower stations within their boundaries. The constitution of Pakistan guarantees the right of NHP for the federating units. Article 161 (2) says, “the net profit earned by the federal government, or any undertaking established or administered by the federal government from the bulk generation of power at a hydro-electric station shall be paid to the province in which the hydro-electric station is situated”. An explanatory clause is, “for the purpose of this clause, ‘net profit’ shall be computed by deducting from the revenues accruing from the bulk supply of power from the bus-bars of a hydro-electric station at a rate to be determined by the council of common interest, the operating expenses of the station, which shall include any sums payable as taxes, duties, interest or return on investment, and depreciations also elements of obsolescence, and over-heads, and provision for reserves”.

In 1986, the GOP constituted a committee under Mr. A G N Kazi (Deputy Chairman of Planning). It decided that the net profit would be computed based on what the consumers pay. The calculation would be worked out through backward computation by deducting the T & D cost. In January 1991, the CCI endorsed the recommendations. However, over the years, the issue of NHP continued to plague the smooth working of the constitutionally protected arrangement regarding the transfer of NHP to provinces. It is because of the weak balance sheet of WAPDA that it could not pay NHP fully and on time. It is pertinent to mention that WAPDA's balance sheet has suffered due to inefficient and high-cost thermal power plants inducted into the power system over the years.

Source: Government of Pakistan (2019)

⁴⁸ We started Neelum-Jhelum from Rs 18 billion and around Rs 500 billion. The escalated cost was paid by consumers in the form of ‘Neelum-Jhelum Surcharge’ in their electricity bills for more than a decade.

The world is moving from centralized energy management to decentralized management, storage technologies, and micro & smart grids. Tailor-made renewable energy solutions provide support and an alternative to centralized grids, while battery storage can enable a 24/7 power supply. Smart grid technologies can enable higher levels of renewables in electricity systems by making the system more flexible, responsive, and intelligent. Smart grid technologies provide the means to integrate these renewables cost-effectively.

- Move from centralized energy management to decentralized management; storage technologies; micro & smart grids. There is also a possibility of shutting down some grids and making way for renewables.

The localized energy grid solutions offer energy independence and efficiency. The government must support distributed energy projects.

Private investment, particularly FDI in renewable technology, is a growing phenomenon. Pakistan may also explore this option through. Public-private partnerships can also be explored and encouraged. A comprehensive energy development plan gives global investors an idea of how much the market for renewables will grow.

- Continuity and consistency of rules, processes and, above all, a consistent policy is necessary to attract not only foreign but local investors.
- Make a level playing field for renewable technologies.
- Prioritized and guaranteed access to the national grid.
- The process for approving power plants, from submitting the proposal to obtaining the approved power purchase agreement, is quite long. There is a need to minimize administrative and regulatory burdens.

Box 12.5. Micro & Smart Grid Vs National Grid

National Grid extracts electricity from power plants over long distances via T & D lines. Delivering electricity from distances is inefficient, with losses of around 8-15% in transmission. The introduction and widespread use of several sensitive electrical and electronic gadgets in economic activities have increased the importance of electricity quality and reliability issues.

A reliable power system requires an appropriate grid infrastructure to be renewed and maintained according to efficiency criteria. Implementing microgrid technologies will allow enhancements to the operations of the existing infrastructure, improving energy efficiency and supporting the development of new power market models based on distributed generation (DG). DG and integration of distributed energy resources in the form of microgrids can significantly improve power quality and reliability to suit the customers' needs.

In Pakistan, the main challenges with the national grid are:

- Optimization of grid infrastructure.
- Decades of under-investment_ T & D operators in Pakistan needs to update their grid infrastructure and upgrade their monitoring, controlling and operating technologies to meet new challenges and technologies.
- Effective demand management.
- Infrastructure availability to areas with no access to electricity.
- Integration of energy storage devices and manage volatile renewable generation to mitigate the risk of unplanned generation capacity losses.

With the CD of Rs 2.3 trillion, high system losses, huge capacity charges and dependence on imported fossil fuel, the energy cost is 30-40% higher than its regional counterparts. Inadequate T & D infrastructure are adding fuel to the fire. Over 40 million people in Pakistan are not connected to the national grid, while grid-connected consumers face power outages daily. A microgrid can be a viable option to support power companies to meet increasing challenges.

Yet, a microgrid is not without challenges for remote areas with no access to electricity because of:

- High installation costs
- Lack of technical knowhow in local communities
- Lack of communication and transmission infrastructure
- Infrastructure availability to areas with no access to electricity.

Management and operational issues

For such areas, the microgrid can be an arrangement provided the abovementioned challenges are handled through government support, public-private partnerships, or local initiatives. However, a microgrid can give support to the national grid. It can increase reliability and reduce power outages.

All new capacity additions must be below the average cost of current production. Let the market dictate the new capacity additions; they should not be prescribed. Let the market decide on energy sources for the future.

Given the current capacity (installed and in the pipeline), the level of coal-fired power would quadruple within the current decade; the present resolve to convert local coal to gas or diesel would come to naught as there is no champion to ensure so. Besides, providing clean technology for coal-fired generation would be acceptable to a limit.

- Nuclear energy⁴⁹ contributes and will do so in the future, along with heightened security standards. The only thing that needs to be ensured is the safe disposal of nuclear waste. Capacity through innovative techniques must be developed to dispose of nuclear waste.
- Likewise, generation plants using hydrogen fuel and some little nuclear fusion generating stations⁵⁰ are another potential to exploit its fuller capacity. All these transformations in the generation mix would significantly reduce the generation cost.

12.8. ENERGY CONSERVATION AND EFFICIENCY

Efficient energy use can ease production costs, raise factor productivity, and promote economic growth. Energy demand in Pakistan has grown by about 5% over the years. 25% of the population is still without access to electricity. With rising urbanization, a growing population, and a burgeoning middle class, energy demand is expected to increase even more.

⁴⁹ Pakistan Atomic Energy Commission (PAEC) has done a great job installing and managing 2612 MW of nuclear power. In the process, the commission has achieved very high plant factors besides providing predictable power. PAEC's power-generating plans – up to 2025 and beyond (on the drawing boards) will ensure that such generation capacity will double soon.

⁵⁰ In a fusion reaction, two light nuclei merge to form a heavier nucleus. The process releases energy because the total mass of the resulting single nucleus is less than the mass of the two original nuclei. The leftover mass becomes energy. This technology is ground-breaking and could mitigate the high cost of generation and fuel transportation issues and glitches..

In Pakistan, if we transform our energy system with increased use of renewable energy in combination with energy efficiency and conservation, it will reduce our net energy production costs. According to one estimate, we can reduce energy demand by 20% to 25% through its productive use in various sectors. The fourth industrial revolution has empowered us to consume energy more intelligently. 20% savings from efficiency and demand management in Pakistan corresponds to a more than 50% reduction in oil imports.

In Pakistan, environmental and energy legislations do exist that can force a shift to more resource-efficient and low-carbon economic activities. Implementation of existing laws has been hindered by weak coordination among the relevant institutions and ministries.

Energy conservation and improving efficiency in using energy resources via technological advancements and improvements in institutional quality are critical. Without a complete shift towards energy conservation and efficiency, all efforts will fail.

High-efficiency usage requires standard supply; otherwise, the mismatch would result in considerable damage. As electronics is bound to increase its share of the gadgetry, the concept of filters drawing firewalls between the utilities and the customers would be necessary, and so would be the upgraded control systems – for both the utilities and the customers.

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APPENDIX A. POWER SECTOR AND ESTABLISHMENT OF WAPDA

At the time of independence in 1947, Pakistan had only about 67 MW of power generation capacity, including three small hydel plants in northern areas. Power supplies in main towns were owned and operated by private companies in an isolated mode. Distribution networks had diverse voltages and frequencies. The provinces' respective electricity and irrigation departments were responsible for developing the needed schemes in the power and water sectors.

In 1958, WAPDA was formed to implement the Indus Basin Treaty and develop both the country's power and water projects. Under WAPDA, power generation capacity continued to grow steadily. Hydel and thermal plants were inducted. However, consistent power supply deficits, massive load shedding, and resource constraints remained the major bottleneck in the rapid growth of generation capacity, transmission lines and distribution network.

Box A1. WAPDA's Primary Responsibilities before Power Sector Restructuring

- To meet the electricity demand of the country (excluding Karachi) by installing new power generation plants, transmission lines and distribution systems
- To develop hydro storage projects (dams) to meet the irrigation demand of the country and install hydropower plants at dam locations

Pakistan Power Sector Generation History

Pakistan's Power Sector has transformed many a time since its independence in 1947. Pakistan inherited a generation capacity of only 69MW⁵¹, including KESC⁵², which could only reach 119MW by 1958.

WAPDA, a semi-autonomous organization, was established with duties to generate, transmit and distribute electricity, along with water resource management for irrigation, flood control etc. It became a utility through an amendment in the WAPDA Act in 1959. WAPDA became a premier organization through its professional approach and with the help of a dedicated team.

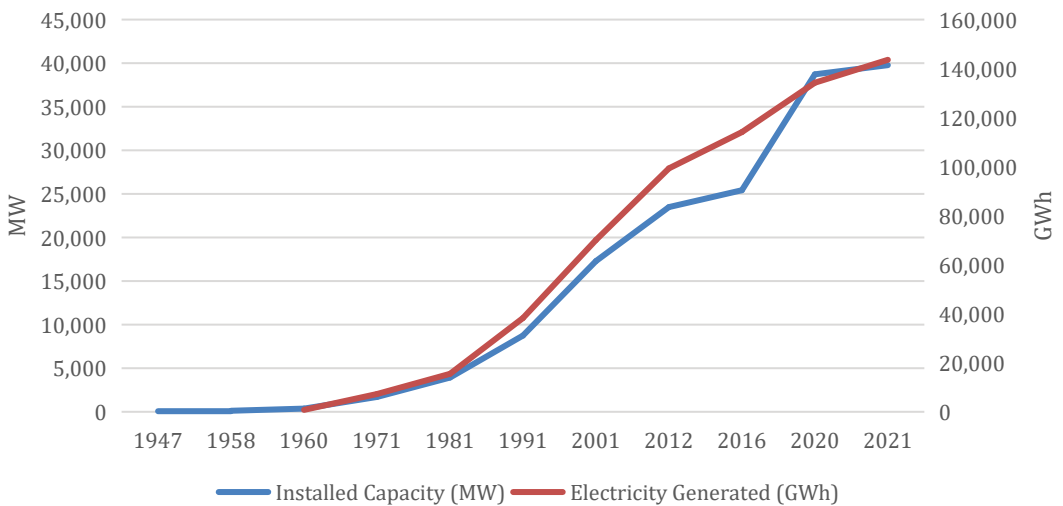
⁵¹ (WAPDA statistics, 1958).

⁵² KESC was incorporated in 1913 as a private corporation under the Indian Companies Act of 1882, as amended to date vide the Companies Ordinance 1984. The government of Pakistan took control of the company by acquiring a majority shareholding in 1952.

Through hydro and thermal projects, installed capacity reached 1,317MW in 1971. Power infrastructure development gained momentum in the 1970s and onwards. The installed capacity reached 7023 MW in 1990-91 with the construction of two large dams, Tarbela (3478MW) and Mangla⁵³(1,000MW) and some other thermal plants (NTDC, 2011; Malik, et al., 2009).

The performance of both vertically integrated utilities WAPDA and KESC remained satisfactory till the mid-1980s; after that, severe constraints in the availability of capital led to an inadequate generation capacity. Power supply lagged demand resulting in an excessive electricity shortage, especially for industrial and commercial consumers⁵⁴. Heavy financial losses due to undue political interference, poor law and order situation, and overall operational inefficiency in the sector created the need for restructuring.

Figure A1. Installed Capacity and Electricity Generated



Source: NTDC Electricity Marketing Data (2022) and NEPRA State of Industry Reports (Various Years)

⁵³ Construction work of Mangla Dam started in 1962 and was completed in 1967, with an installed capacity of 1000MW.

⁵⁴ Load shedding up to 30 % of peak demand (NEPRA Annual Report, 2000-01).

APPENDIX B: WHY THE REFORMS OF THE 1990S FAILED?

For more than two decades, the Pakistan Power Sector has been in the limelight for negative reasons. What was considered a reform for the good of the people in the mid-1990s is now a nightmare for the people. The service has deteriorated, management of the sector has gone awry with the left not knowing what the right is doing, and the consumer-end tariff is exorbitantly very high. The anecdotal evidence suggests that the power sector is worse off regarding service reliability, consumer-end tariffs, and overall management than in the 1990s. Decision-makers know nothing about how the problem would be resolved. The problem lies in the PD-MoE, owned and operated by non-professionals, who, unfortunately, don't know anything about the sector.

Why is it that the reforms of the 1990s failed, and that too on a gigantic scale? Looking back, we see that reforms took the AEBs out of WAPDA's Power Wing along with the generation assets, transmission, and grids, corporatized separately as public limited companies, only on paper. These companies were never allowed to grow independently.

These new companies lost the status of entities able to recover their unpaid monthly bills as government revenue or laying distribution and transmission lines under the Telegraph Act of 1885. It was wrongly thought that the power sector would be out of the governmental rules and the ensuing audits – and be able to become independent entities enjoying full autonomy.

Besides becoming a hybrid coming under the ambit of public and private sector laws, the corporatized entities (present-day DISCOS, GENCOs and NTDC) have become top-heavy setups. In other words, the reform process started by removing some crucial rights while highlighting various obligations on paper only.

PEPCO – a private limited company, was formed as a management company. It was envisaged to be a temporary entity (for three years) to smooth the privatization process of all state-owned companies (except NTDC), but it didn't happen.

After unbundling WAPDA as corporate entities, eight DISCOs (later ten), the NTDC, and the four GENCOs were to have their BODs, as per the Companies Ordinance of 1985 (later updated to the Companies Act, 2017). While the new companies were in the making, WAPDA was handed over to the Pakistan Army in 1997⁵⁵. PEPCO and all companies were

⁵⁵ During the period 2000 to 2004, the DISCOs were headed by Brigadiers.

were re-brought under the control of the chairman, WAPDA. To assure a semblance of corporate correctness, the chairman of WAPDA assumed the role of chairman PEPCO and handed over the position of MD, PEPCO, to the Member Power, WAPDA. The result was_ business as usual_ a push-pull started, which could not lead to any good.

In September 2007, at the insistence of the donor agencies, the GOP notified the separation of PEPCO and its management of DISCOs, GENCOs and NTDC from WAPDA by separately notifying PEPCO's Chairman and the MD. Slowly, PEPCO also took over the work of appointing BODs to these companies and then directly took-over operations of the DISCOs. Later, distinct BODs of all the state-owned companies were appointed, with members from the WAPDA cadre, the then Ministries of Water & Power and Finance, and wealthy businesspeople as public representatives.

This resulted in some independence from WAPDA and a greater leaning towards the BODs. But decision-making remained dominated by PD-MoE. The companies emphasized procurement in billions and much lessor to enhance efficiencies. The losses have ballooned since then while the revenue collector has plummeted. These remain hidden behind percentages (Figure 2.3 in Chapter 2).

To add another negative, the GOP set up the GHCL to look after the four GENCOs in the presence of PEPCO; the avowed policy to disinvest some parts of the government holding of the power sector. However, it did lead to the shutting up (not even mothballing) of all publicly owned generation assets (details in Chapter 6). Consequently, assets worth billions are dormant, no plan to utilize these sites and the allied facilities worth billions to the advantage of people. The trained human resources of the now shut plants is in the doldrums. Even the most critical, 1320 MW coal-fired power plant at Jamshoro, is planned to be scuttled. They forget that it costs only 60% of the CPEC-funded similar plants with second-class Chinese fittings, as against primarily GE equipment at Jamshoro. Overall, GHCL has been a disaster which only a generalist could conjure.

Considering NTDC, with money, PD-MoE nominated one of its Joint Secretaries with an additional charge of MD NTDC. It is one of the main reasons for the continued lackluster working of NTDC. The DISCOs are also headed by temporary, primarily chief engineers and sometimes GM-level engineers, who look after such work in addition to their substantive duties.

In summary, the BODs are not supporting the management of DISCOs, the NTDC and the GENCOs with their temporary CEOs and the direct control is by the PD. An arrangement where the PD calls all the shots; non-professionals are profusely making decisions. The PD has also set up an intelligence cell headed by a retired army officer to advise the Secretary, Joint Secretaries (looking after the NTDC, the DISCOs and the GENCOs) and placed on a few BODs for further steering the sectoral operations.

DISCOs are relying on revenue-based load shedding to improve their efficiency artificially. For instance, currently, HESCO, SEPCO, QESCO, PESCO, and the TESCO are resorting to rationing of electricity supplies in their challenging areas_ where recovery of revenue is difficult or where illegal abstraction of electricity is rampant. Consequently, lesser supply to these areas results in improved line losses and revenue collection on a percentage basis (details in Chapter 2).

As service diminishes, tariff increases, circular debt escalates, and the sector suffers for all intents and purposes, it can safely be concluded that Power Division's sectoral capture is the major challenge. No reform – with any nomenclature, can succeed with the generalists steering the same.

Now, PEPCO has been revitalized as PP&MC. It is in the process of being settled in Islamabad as an appendage to the PD. Soon we will have the member (energy), Planning Commission, the PP&MC, CPPA(G), NTDC and the donor agencies (WB, ADB, KFW, JICA and the USAID) once again planning for the power sector. A shift of PP&MC to Islamabad_ changing its role from a management company to an arm of the PD is not much of a solution.

In other words, the capture of the power sector continues. Additionally, under the present arrangements, the possible offering of DISCOs on short-term management contracts, the implementation of CTBCM and the establishment of the multi-buyer system (against the current single-buyer model) becomes impossible.

The power sector has been poorly managed since it was taken out of WAPDA. Now stands without sectoral expertise and knowledge, which WAPDA used to have.

APPENDIX C. SENIOR MANAGEMENT CHALLENGES

The Pakistan Power Sector is beset with many management issues. For instance,

- Chairman WAPDA, a non-professional or a generalist.
- Members of WAPDA authority, although those holding the position of Member (Power), Member (Water) and Member (Finance), are junior-level professionals, posted temporarily (with look after charge) in addition to their substantive positions. These postings ensured that the related officers remained subservient to the competent authorities.
- Non-professional board members of ex-WAPDA companies, against the criteria of the SECP.
- Arbitrary postings by the Power Division (PD) to fill management posts (CEO) of DISCOs, NTDC and the GENCOs (inclusive of the GHCL) on the retirement of the earlier stop-gap incumbents.

These have severe ramifications for the efficiency of WAPDA and ex-WAPDA companies. For instance, in ex-WAPDA entities, the incumbents to the position of CEOs or on the BODs immediately enter the hegemonistic mode to cover up for their non-professional or weak professional experience. These individuals often overturned tried/set procedures to prove that they knew the job; it damages the sector. After the expected setbacks, the hegemonistic mode gets converted into the amazement mode. They also started to understand that the entity, especially WAPDA and the Ex-WAPDA companies, have a long history of existence, management structures, accountability modules and specific identity.

For example, take the army's management of WAPDA between 1998 till 2004. In the first year, all set procedures were overlooked or overturned. In the next six months, the regime was intimidated by the established procedures in WAPDA. Then incumbents entered the learning mode and tried to learn what WAPDA professionals had learnt in their 20-30 years of service in six months or so. As a result, the management in the power sector got burdened with issues and resulted in many flawed decisions; the efficiency and efficacy of the sector got hit.

That was the most damaging period for the powers sector because the generalist / non-

professional had to show that he was better than the earlier ones. Via fudging of figures, comparisons were crafted. These all got debunked with the posting of professionals to these positions.

At present, again, the situation is critical as experienced professionals have been sidelined. Most positions have been handed over to the generalist or people with little experience in the power sector. Moreover, the government's thinking excludes sector professionals, while ex-pats with spurious experiences are given preference as a panacea. The same thought process is applied in selecting members of BODs of corporate government entities. The BODs have members with irrelevant experience, even people having severe conflicts of interest.

Political influence in all appointments is obvious; the minority selection based on merit has not been able to stay for extended periods. In some cases, subsequent soul-searching by the selectors highlighted the earlier wrongful selections. Yet, the replacements were even worse. In most instances, the governments resorted to just handing over the vacant slot as an additional charge to a generalist.

So much has been the misuse of this short-time solution that ministry officials had held necessary power sector charges for years_ detriment to the company. Those granted charges did not even accord it any importance and carried on while sitting mainly in Islamabad, even calling the BOD meetings in the capital. Besides resulting in mismanagement, it is the reason behind the creation of cliques in the PSCEs, influencing management.

All PSCEs are directly controlled and governed by the generalists of the PD and unprofessional boards. Thus, resulting in a stalled sector with a circular debt of more than Rs. 2.3 trillion, a default amount of more than Rs. 1.6 trillion (to be recovered from the defaulting power sector consumer base (governmental and private sectors), continued load shedding and poor service to the consumers.

Selecting Senior Management

With continuous mismanagement, permanent damage has been done to the fundamental structures relating to regulatory and corporate affairs, procurement modules⁵⁶, posting

⁵⁶ Procurement activity has been permanently damaged. The local engineering industry (set by great effort and support of WAPDA during 1975-1995) has nearly done. Unknown foreign companies are the leading suppliers of intricate equipment; MNCs have left without leaving behind any successors, e.g., Siemens. The sector relies on designs and non-specified equipment, illegal naming of assemblers as valid manufacturers, hijacking the AMI / RMS systems by hardware suppliers against the requisite IT integrators, etc.

and placement for various positions, succession procedures, HRM & HRD process, etc. In other words, the entities subject to such abuse have been relegated with time.

The power sector is highly technical. It is transforming quickly and needs engineering expertise with IT modules to counter various problems besetting current operations. The senior managers must have the ability to adjust and innovate.

A professional can quickly adapt to new realities and completely transform in the least possible times, which is impossible for the generalist. He has a deep insight into the dynamics of the core responsibilities and the ability to dip into current and future trends. He is equipped with knowledge of the weaknesses and strengths of the specific sub-sector and would be able to build upon the existing expertise. That is, to enable the organization to jump even higher by breaking earlier constrictions and barriers and change management in a structured manner. He can arrange conversion to the next generation of technologies.

For instance, the CEO of a public sector corporate entity is responsible for the overall management of company operations and for ensuring the achievement of the company's service and revenue targets. To meet higher operational performances, he will set targets and formulate plans with particular emphasis on load management, loss reduction, theft control and significant augmentation/improvement of the distribution network and services to customers in a new paradigm of customer-friendly culture. He will ensure adherence by the company to NEPRA performance standards and meet relevant regulatory and operational requirements.

The management needs to comprehend the mission statements and objectives; therefore, he must be creative and have the inbuilt capability to adapt or counter-force, assailing the primary core responsibilities of the state-owned company. Besides, he must understand national policies. Therefore,

- A pro-active, results-oriented professional with established credibility and performance record who could take the above challenging assignment is required.
- The candidates must have strong leadership, interpersonal and communications skills with a high drive for performance targets.

- Qualification and experience_ preferably to be a professional engineer registered with the Pakistan Engineering Council (PEC) or a senior power utility management expert. Additional engineering and management qualifications and experience in power utility operations are considered an added plus.
- A minimum of 20 years of experience, with at least five years in a senior management position, is essential.

The current practice allows for the senior slots to increase. The GOP, through its PD, starts the process by drafting advertisements and getting approved. There is no set format. A matrix of some of the advertisements is in the Table below. A review of this Table reveals a difference in the experience, educational and maximum age criteria. This aspect alone depicts the confusion in the sector.

The advertisements reveal that the BODs (including the PD) are oblivious to the sector's experience requirements and dynamics⁵⁷. At the same time, oblivious to the earlier failures, the advertisements ask for a minimum of 15 years of experience without being in the power sector. Strangely, the experience of the MD, PP&MC (Power Planning & Monitoring Company), initially 15 years, was quickly changed to only 12 years. For this post, the minimum experience must be at least 25 years and that too of the power sector itself, as fixed by the SECP in its fit and proper criteria for CEOs of SOEs.

⁵⁷ Between 1958-1981, under WAPDA, all employees were civil servants under essential services. It led to the promotion based on the principle of seniority cum fitness. It was fair in the Pakistani context to avoid political interference. As a downside, it led to the ouster of many stars_ as the seniority comes late in service and soon the senior is up for retirement. The professionals of the ex-WAPDA corporate entities are experienced and in their late-50s. The rule for the top slot, i.e., CEOs, cannot be capped at less than 60 years; otherwise, the sector will lose access to the most experienced.

Table A1. Matrix of Job Advertisements

Date of Publication	Position	Company	Minimum			Minimum years (Sr. Mangt Level)	Maximum age of Applicant
			Required experience				
			(Break-up)				
			Years	Specifically Engineering - Power Utility	General Or Non - Specific		
08/11/2021 Last date	Managing Director	PP&MC	15	15 Years		5 Years	No upper age fixed
21/11/2021	Managing Director	PP&MC	12		12 Years	5 Years	No upper age fixed
08/11/2021 Last date	Director General	PP&MC	15	15 Years			No upper age fixed
20/12/2021 Last date	CEO	MEPCO	20	10 Years	10 Years	3 Years	No upper age fixed
24/01/2021	CEO	LESCO	20	10 Years	10 Years	3 Years	No upper age fixed
Within 15 days of publication	CEO	FESCO	20	10 Years	10 Years	3 Years	No upper age fixed
17/01/2021	CEO	GEPCO	20	10 Years	10 Years	3 Years	No upper age fixed
21/01/2021 Last date	CEO	MEPCO	20	10 Years	10 Years	3 Years	No upper age fixed
19/01/2021	CEO	SEPCO	20	10 Years	10 Years	3 Years	No upper age fixed
17/01/2021	CEO	IESCO	20	10 Years	10 Years	3 Years	No upper age fixed
23/01/2022	CEO	FESCO	20	10 Years	10 Years	3 Years	60 years
13/01/2022	DMD	NTDC	15	15 Years	-	-	58 years
04/03/2022	CEO	Public Sector	20	20 Years	20 Years	5 Years	62 Years
03/02/2022	CEO	GHCL	20	-	20 Years	7 Years	62 Years
13/02/2022	RECTOR	PIEAS	20	20 Years	-	5 Years	60 years
13/02/2022	CEO	GEPCO	20	10 Years	10 Years	5 Years	60 years
13/02/2022	CEO	PIAC	20	20 Years	-	10 Years	62 Years

Then comes the selection process itself. Who would shortlist and then interview the applicants? The best would be for the existing BODs of the PSCEs to task their HR Committees to shortlist the applications based on a set format. Once the shortlisting is complete, just like FPSC, the BODs would have to invite sectoral experts or subject specialists to be part of the selection interviews⁵⁸.

In short, selecting the right person(s) for the sector is beset with problems: below-par understanding of the sector, its obligations, the dynamics, and the underlying currents. No one has ever undertaken the required SWOT analysis. Once the prerequisites/ requirements are laid-out and accepted, another issue to contend with in the present pre-conceived notion is that the in-house resources cannot deliver. There is a need to understand that the best candidate would be from within the Pakistani power sector instead of the private sector or amongst the so-called ex-pats.

Corrections from top to bottom is required. The present lot, including the BODs, the CEOs, and the rest of the senior management, must be replaced soon.

⁵⁸ In the selection process of the MD, PP&MC, the selection board comprised of the Secretary (PD), Additional Secretary (PD) (with a look-after charge of PP&MC), NESPAK employee, earlier Joint Secretary (PD), and a private sector personality with experience of being on the BOD of MEPCO. None of these persons qualifies to be in the selection process.

APPENDIX D. POWER COMMISSION

The unbundled power sector companies (especially NTDC) are now without legal support. Earlier, it was available through the Revenue Acts and the Telegraph Act of 1885 – enacted solely to support laying lines for the public good, etc. The situation can be improved through the support of power utility practitioners, the Power Commission, comprised of hardcore eminent sectoral practitioners.

Commission’s Terms of reference (TORs)

- To monitor the implementation of re-structuring of the Power Sector.
- Prepare the initial sectoral diagnostics report with broad outlines for the best possible operations.
- Structure a revival roadmap with set milestones and a timeline.
- Suggest ways to stop the illegal reaping of the political economy of the sector and the threats posed by the present level of customer indiscipline.
- Review the existing policies.
- Prepare long-term strategy and policy documents.
- To provide solutions to the financial viability and economics of ending the revenue-based load shedding.

The commission would be answerable to the Prime Minister⁵⁹. Its members must be hard core power sector practitioners who have headed sectoral entities_ preferably those considered leaders in the sector. The commission, comprised of six to eight professionals, would place the power sector operations under their magnifying glass, monitor, and then advise appropriate quarters to correct wrongful processes. The commission would also offer advice in the implementation process. Stakeholders would be obliged to accept the advice; otherwise, the PM’s secretariat would take the delinquents to the task.

Power Commission may be mandated for one year after its efficacy can be gauged.

⁵⁹ The Cabinet Committee on Energy (CCOE) formed earlier cannot be the panacea for sector ills. It is a coordinating body and does the preliminary work for the Cabinet. In many cases, CCOE placed its TORs on the back burner by trying to run the sector.

APPENDIX E. POWER SECTOR REVENUE RECOVERY PLAN

Preamble

The Pakistan power sector has been facing a crisis since 2006 with no reduction in the offing. Poor financials of the power sector exacerbated the power shortages of 2006-07. Even after the significant addition of MWs from 2015 to 2017, the sector is held hostage by the more aggravated financials (high technical and administrative losses coupled with low bill recoveries).

Apart from being unable to effect full targeted recovery of the current bills, the earlier build-up is added to each month. The policy to pass on most inefficiencies to the compliant power consumers did not help much but disincentivized efficiencies. A little insight into current DISCO affairs reveals that recovery activity is never comprehensively taken. The emphasis remains on preventing the build-up of the default figure alone, which is also not achieved; a negligible amount gets recovered from the earlier defaulters.

The whole chain of officers responsible for recovery is mired in billing issues⁶⁰, leading to a slight improvement in only the current billing recovery. Yet, there is no effort/ activity towards improving the recovery from earlier defaulters.

The government must first tackle the ever-deteriorating financial situation of the sector before any restructuring. A plan to recover Rs. 300-500 billion in the next six months must be prepared and implemented. After that, a similar plan for the remaining amount in the next 12 months. Later, the DISCOs should be made to fend for themselves. The government must set targets before the plan is implemented. All necessary changes required in the existing legislation to strengthen the recovery process must be made before executing the recovery plan.

Power Sector Revenue Recovery Plan (PSRRP)

The Power Commission may be tasked to execute this plan, where the Commission chair would act as the coordinator. Senior power sector professionals would be hired for six to

⁶⁰ The chain starts from the CSD at the DISCO HQ, the Director Commercial at the HQ, the Director Commercial at the circle level, the Revenue Officer at the (Executive Engineer Office (XEN)'s level and lastly, the meter reading supervisor at the sub-divisional level.

twelve months, with an extension on a need basis⁶¹. Their job would be to implement and monitor the recovery roadmap.

The coordinator would be responsible for giving targets to these experts (maximum of two) for each DISCO, based on the quantum of receivables from these distribution companies_ details of which are available in published statistics. To set the targets, the coordinator would prepare lists of all big defaulters (probably 20% of all defaulters), including Federal and Provincial government entities. All this information, in detail, is available with the DISCOs and the Power Information Technology Company (PITC). The coordinator, via these experts, would require the DISCOs to immediately prepare individual account sheet(s) of all defaulters; currently, individual account sheets are not available to the sub-divisional staff, primarily responsible for the recovery. This record would assist in actual recoveries as the default amount would be listed herein (and could be provided to the defaulter if they demand). The coordinator will fix the targets based on 30-day rosters.

The plan would target the low-hanging fruit in the first stage, i.e., the running defaulters (those in default but still receiving power supply). Under the plan, the DISCO will disconnect all running defaulters within ten days after the Revenue Recovery Plan's commencement. The DISCO will only restore the connection once the default amount is fully paid; only those premises will be exempted from the action where court injunctions are in force. Similarly, the DISCO will not disconnect the defaulters where the department / competent authority has set aside the default amount.

The DISCOs, through their Superintendent Engineers (SE) (business units), would be obligated to immediately take up the vacation of stays etc., from the courts (higher courts), if needed and then assure recovery of the default amounts. The services of the Company Legal Officers (CLOs) must be made available to the SEs as per the erstwhile performance contracts signed earlier between the then Ministry of W&P and DISCOs. That would also make the CLOs responsible for recovery along with the SEs/Executive Engineers (XENs)/Sub-divisional Officers (SDOs).

⁶¹ It is crucial as local officers and functionaries of DISCOs face difficulties in recovery, especially from influential people. They do the job only when they can easily qualify responsibility on HQ officers or Ministry.

The current legislation is deficient in relating to the recovery process after the corporatization of WAPDA. Thus, Power Commission must be tasked to draft a summary to recommend changes in the Electricity Act of 1910⁶², enabling the DISCOs to recover legitimate revenue on the fast track and without protracted legal processes.

In case of a setting-aside administrative order being in force, the office issuing the order in the first place would be obligated to give a show-cause to the customer in default, receive the reply to the same and then issue a speaking order deciding about the fate of the default. It all must be done in 10 days. If the DISCO fault is evident, e.g., wrong billing, it will remove the default amount immediately and starts an inquiry against the negligent DISCO officer. On the other hand, if the bill is correct, the DISCO would disconnect the defaulter's premises at once. The DISCO would reconnect the premises only after the full payment of the outstanding invoice.

The governmental default would be tackled by first approaching the Deputy District Officer (DDO) concerned at each station/city in a particular DISCO, giving notices of disconnection via the next higher offices, wherever located. Then, taking up actual disconnections of non-essential premises first and then others too.

There is a requirement to clearly distinguish between the recovery of current billing each month and earlier default amounts. Once this distinction is made, then the actual efficiency of any entity / DISCO would be seen, and the Power Commission would be able to monitor and report the recovery campaign.

The DISCOs (over the years) have overlooked the specific duties of field staff_ opting for a mix and match of tasks from maintenance, new connections, disconnections, reconnections and even meter readings to the same supervisors. This division of duties keeps them happy, allowing them to evade accountability and concentrate on jobs getting illegal gains, e.g., bribes.

The experts would visit the DISCOs HQs (designated for recovery) _ meet the Customer Service Director (CSDs) and other relevant staff, check the recovery process, visit the problematic circle's offices to understand their process and upgrade the same where required, and then oversee the recovery process. As all the experts would have held senior

⁶² To be made available through an Act ratified by the Parliament.

positions in the past in the sector, they would face no problem from the circle offices in implementing the plan.

Federal & Provincial support to DISCOs is of the most importance – especially when the DISCOs are service providers alone.

Box A2. Revenue Generation Task Force (RGTF) Report

An RGTF was set up in 2010. It came up with a comprehensive report, followed as a manual till 2011 when it was relegated to a significant loss for the Power Sector. This manual was programmed to be updated by 2014. However, on being relegated, updating of the same was ignored. The experts, in addition to streamlining and fast-tracking the recovery activity in the DISCOs would also update the above document in three months for use in the fields (DISCOs). The release of the updated version of the RGTF Report would help the DISCOs to generate more revenue, which can result in possibly lowering the consumer-end tariff

APPENDIX F(a). REGULATORY FRAMEWORK: NEPRA

NEPRA Rules

- Licensing Distribution Rules, 1999
- Tariff Standards & Procedure Rules, 1998
- Fees Rules, 2002
- Fines Rules, 2002
- Licensing (Generation) Rules, 2000
- Performance Standards (Transmission) Rules, 2005
- Performance Standards (Distribution) Rules, 2005
- Performance Standards (Generation) Rules, 2009
- Uniform System of Accounts Rules, 2009
- Complaint Handling and Dispute Resolution (procedure) Rules, 2015
- Market Operator Registration Standards and Procedure Rules, 2015

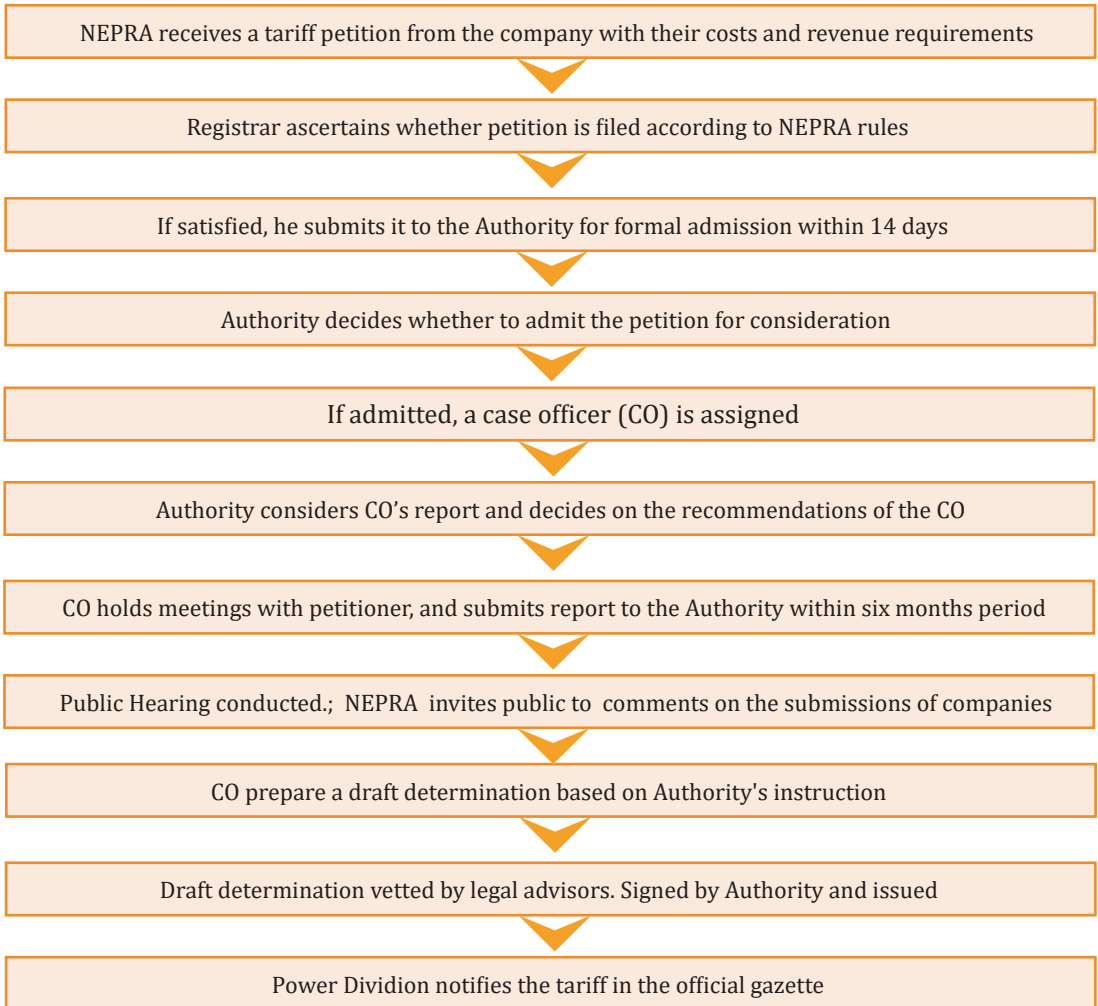
NEPRA Regulations

- Competitive Bidding Tariff (Approval Procedure) Regulations, 2017
- Import of Electric Power Regulations, 2017
- Wheeling of Electric Power Regulations, 2016
- Distributed Generation and Net Metering Regulations, 2015
- Interconnection for Renewable Generation Facilities Regulations, 2015
- Supply of Electric Power Regulations, 2015
- Upfront Tariff (Approval & Procedure) Regulations, 2011
- Review Procedure Regulations, 2009
- Interim Power Procurement (Procedure & Standards) Regulations, 2005
- Resolution of Disputes between Independent Power Producers and other Licensees Regulations, 2003
- Fees Pertaining to Tariff Standards & Procedure Regulations, 2002
- Licensing Application & Modification procedure regulations, 1999

Guidelines/ Codes

- Guidelines to Lay Down the Methodology & Process for Determination of Revenue Requirement and UOSC for Transmission Licensee
- Selection of Engineering, Procurement and Construction Contractor by Independent Power Producers) Guidelines, 2017
- Sale of Electric Power by Renewable Energy Companies, Guidelines, 2015
- SOPs for Examination & Provision of Copies of Documents, 2015
- Guidelines for Determination of Consumer End Tariff Methodology and Process, 2015
- Commercial Code 2015 of CPPA-G
- Consumer Service Manual, 2010
- Grid Code, 2005
- Distribution Code, 2005
- Eligibility Criteria for consumers of distribution companies, 2003

APPENDIX F(b). TARIFF DETERMINATION PROCEDURE



APPENDIX F(c). ELECTRICITY TARIFF IN PAKISTAN: HISTORICAL PERSPECTIVE

Consumer-end Tariff Methodology

From 1960 to 1973: DBT, i.e., high rates for initial units and lower on succeeding units. In the 1960s, 60 % of the electricity was produced from hydro sources; therefore, initial units were expensive to cover the capacity price.

The trend reversed in 1973 to IBT, i.e., initial units became cheaper. Shortage of energy capacity led to this change

Electricity tariffs for WAPDA have remained above the cost of production, that is, above MC until 1996

Tariff for Distribution Companies

During the transition phase towards the complete corporatisation of the former WAPDA companies, the bulk tariffs charged for the electricity purchased by the distribution companies have been determined at the discretion of NTDC.

Until 2000, a uniform bulk tariff was charged to all distribution companies to purchase electricity

In 2001, a new pricing methodology was established, allowing each distribution company to retain a margin that reflects its cash expenses, debt services, and line losses (but not capital expenditures or non-cash expenses).

Source: Malik (2022) & Suhail (2014)

PIDE POWER COMMISSION

Objective:

A financially viable power sector with supply reliability, competitive & affordable tariffs, relying on indigenous and green energy resources, with access to electricity for all.

Commission Members

- Tahir Basharat Cheema (Former MD, PEPCO) – Team Lead
- Salis Usman (General Manager, Power Planning, NTDC)
- Mujahid Islam Bilal (Ex. CEO, FESCO)
- Basharat Ali (CFO, PEPCO)
- Sajad Haider Syed (Deputy Manager, NTDC)
- Masood Akhtar (Former GM, NPCC)
- Azhar Iqbal (Director Finance, PEPCO)
- Adnan Riaz Mir (General Manager, Monitoring, PP&MC)
- Abdul Qadeer Khan (Ex General Manager, NPCC)

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