

REGIONAL EXPERIENCE IN THE ENERGY SECTOR RESTRUCTURING AND REFORMS

SAARC ENERGY CENTRE

PAKISTAN PERSPECTIVE

HUSSNAIN ZAIGHAM ALVI 15 September 2025

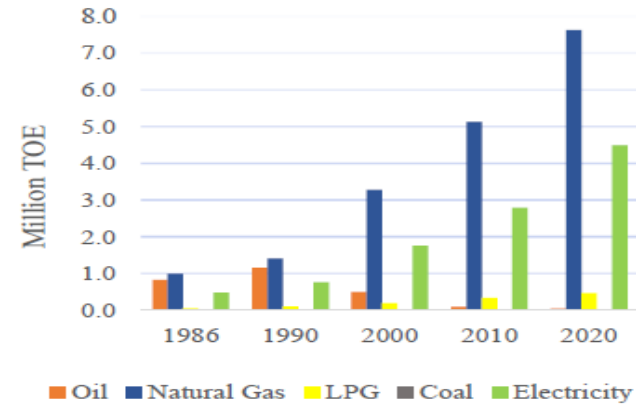
- Planning Commission of Pakistan carries out Integrated Energy Planning (IEP) for Pakistan.
- Develops Energy forecasts using Regression based Models
- Sector - wise forecast shows that historical consumption patterns are followed for Oil, Natural Gas, Liquefied Petroleum Gas (LPG) and Electricity in Domestic, Commercial, Industrial and Transport Sectors. Increased Demand for Electricity in Agriculture and Transport sectors is observed -- Subsequent slides
- Oil and Gas Sector is regulated through Oil and Gas Regulatory Authority (OGRA) established in 2002 ---- Licenses, Gas Price, Petroleum Prices
- Power sector is regulated by National Electric Power Regulatory Authority (NEPRA) established in 1997. Details subsequent Slides
- Circular debt in Energy Sector stands at Rupees 4.7 Trillion

PAKISTAN ENERGY OUTLOOK

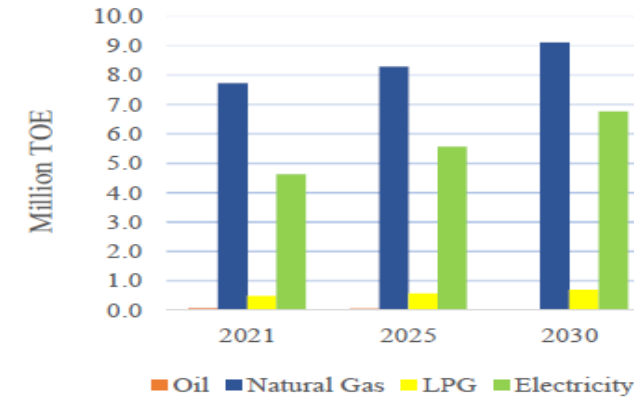
Overview of Results

Domestic Sector

Historical Consumption (1986-2020)

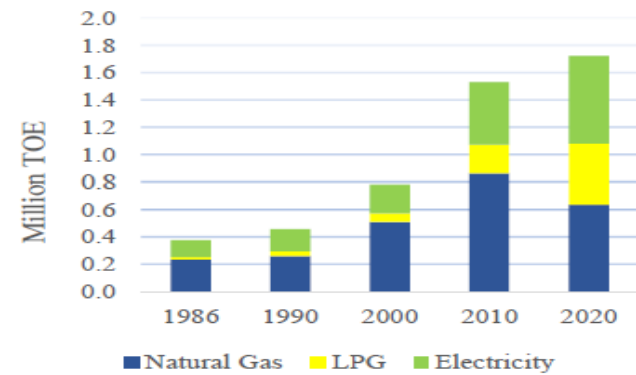


Energy Forecast (2021-30)

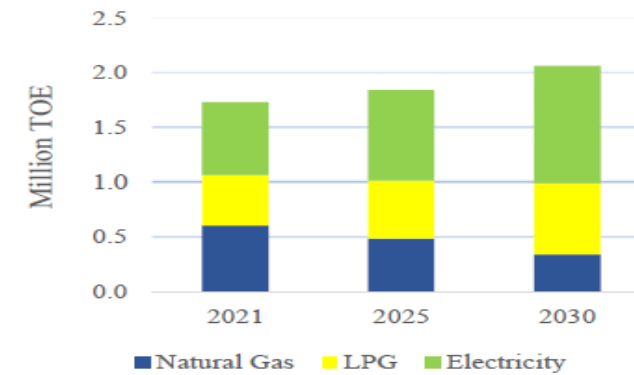


Commercial Sector

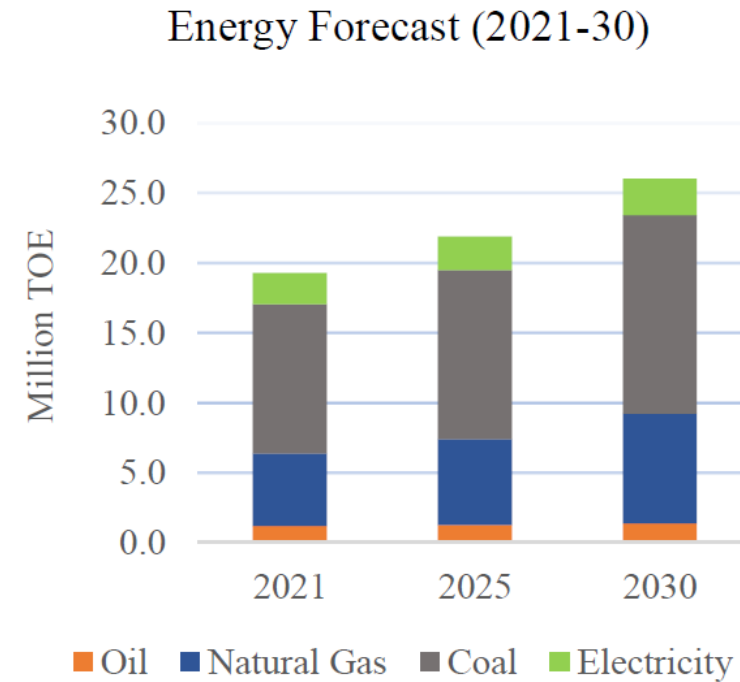
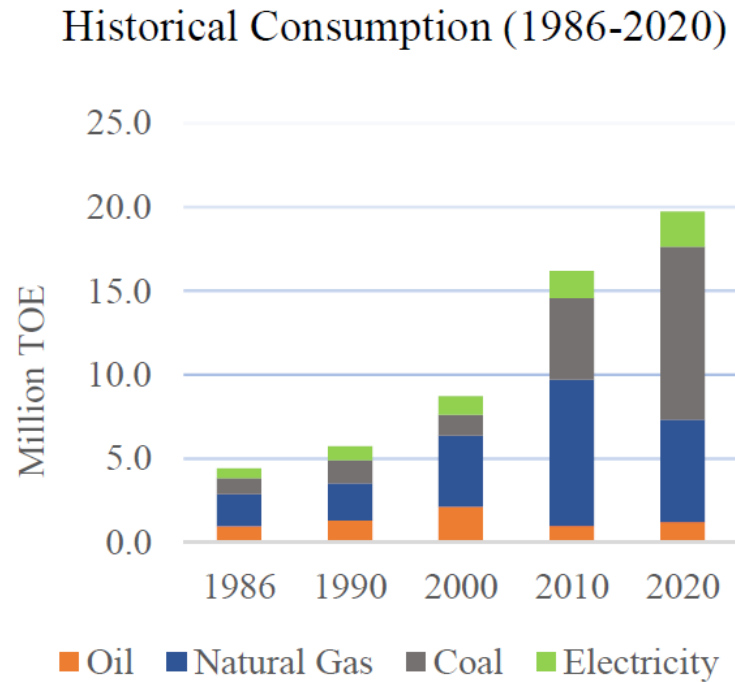
Historical Consumption (1986-2020)



Energy Forecast (2021-30)

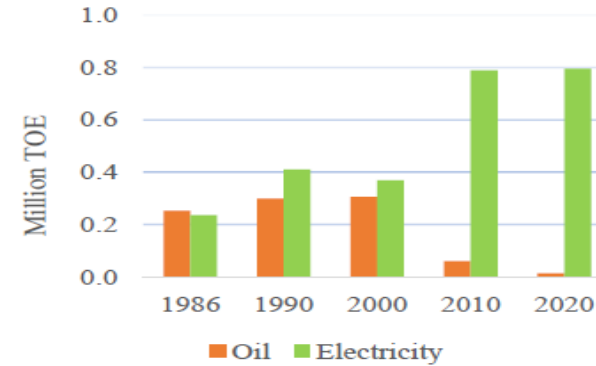


Industrial Sector

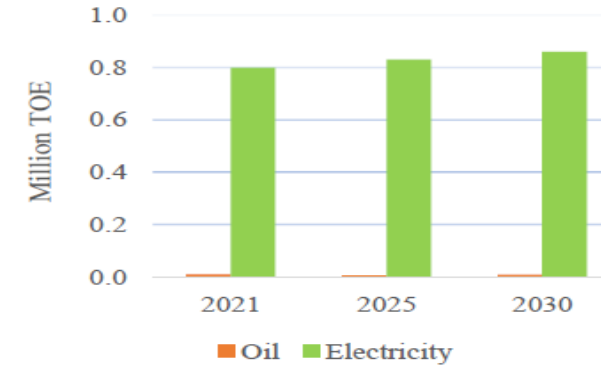


Agriculture Sector

Historical Consumption (1986-2020)

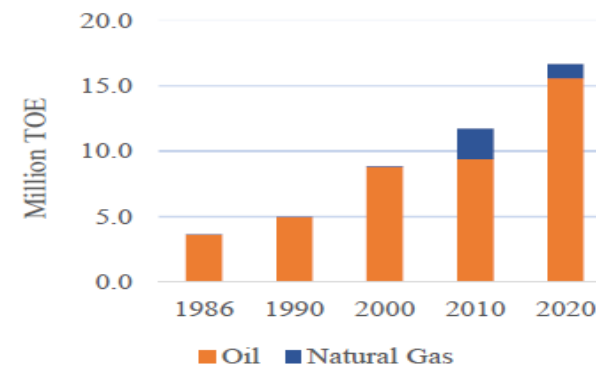


Energy Forecast (2021-30)

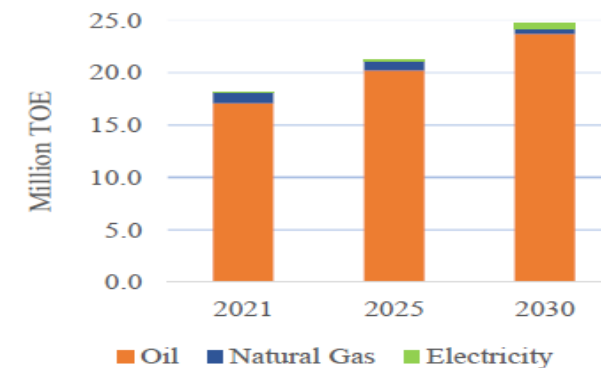


Transportation Sector

Historical Consumption (1986-2020)

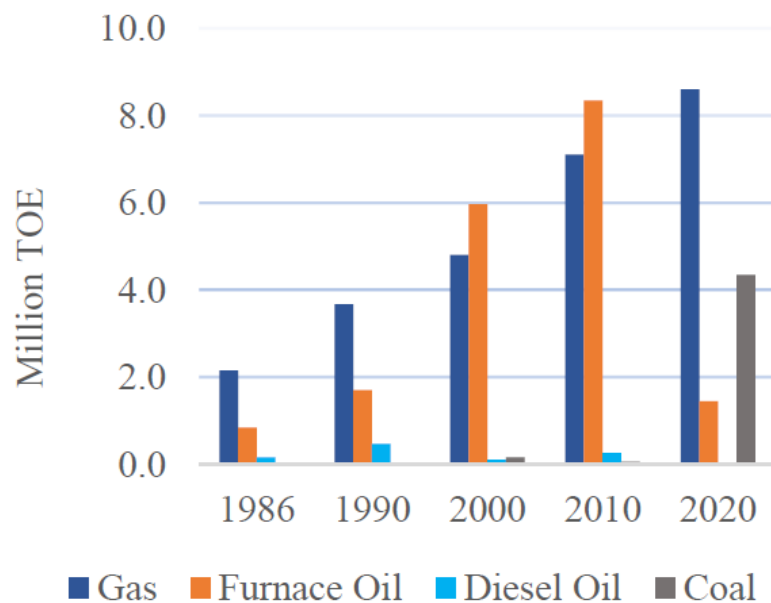


Energy Forecast (2021-30)

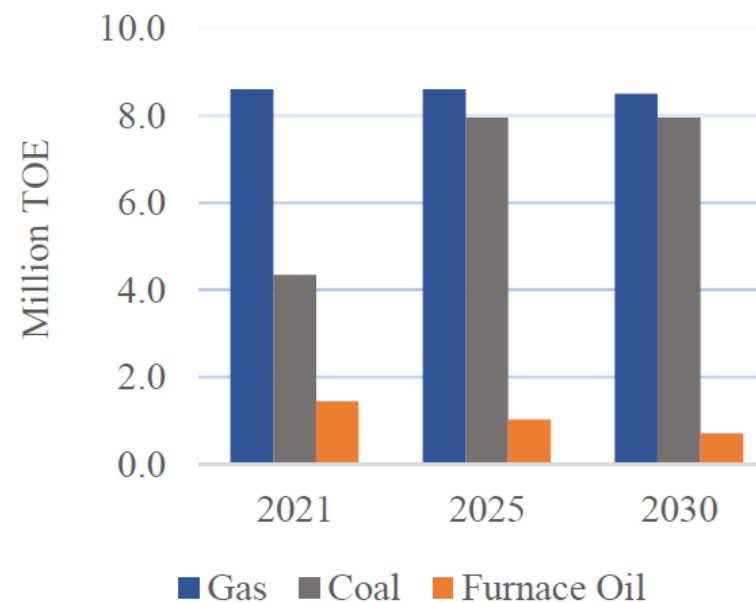


Fossil Fuel Requirements for Thermal Power Generation (2021–2030)

Historical Consumption (1986-2020)



Fuel Requirement (2021-30)



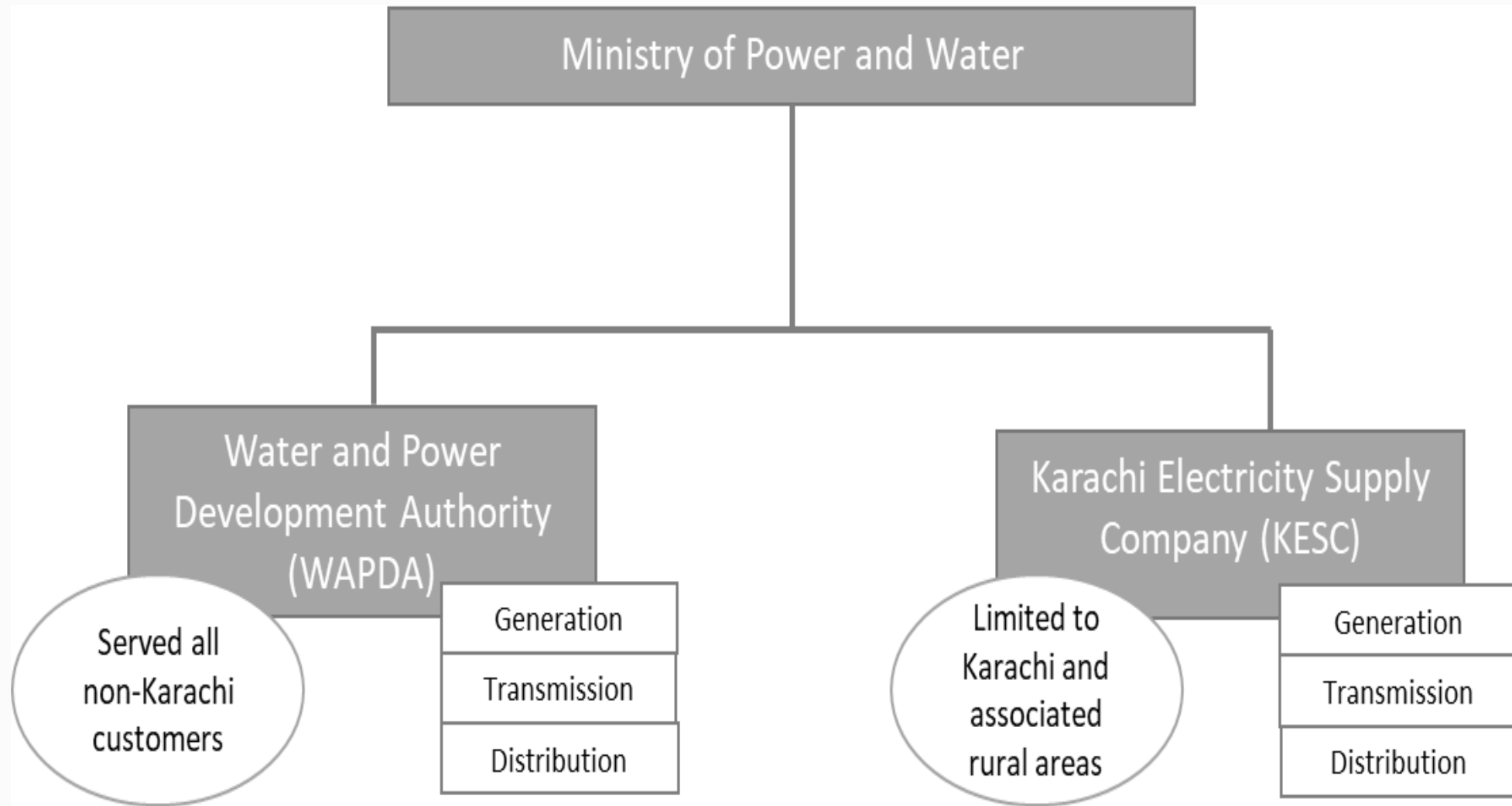
PAKISTAN POWER SECTOR -- Reform and Restructuring

Sector before 1990

- Installed Capacity at the time of Independence – 60 MW
- Power sector consisted of one hydropower station and a few integrated transmission lines connected to a few load centers, and Karachi Electric Power Company
- Formal Planning Process Started with First Five Year Plan (1955-1960) and Integrated Water and Power Development Authority under the control of Federal Government was established in 1958.
- World Bank involvement --Tarbela and Mangla Dams of 2500 MW capacity were added in 1977.
- Fourth Five-Year-Plan (1970 -1975) pointed to inability of WAPDA to shoulder the responsibility of retail distribution of power and construction of irrigation and power generation facilities.
- Mid eighties witnessed severe breakdowns, outages and power shortages
- IMF assistance was used in 1986 to deal with chronic fiscal and external account deficits as a result of subsidized tariffs to the consumers

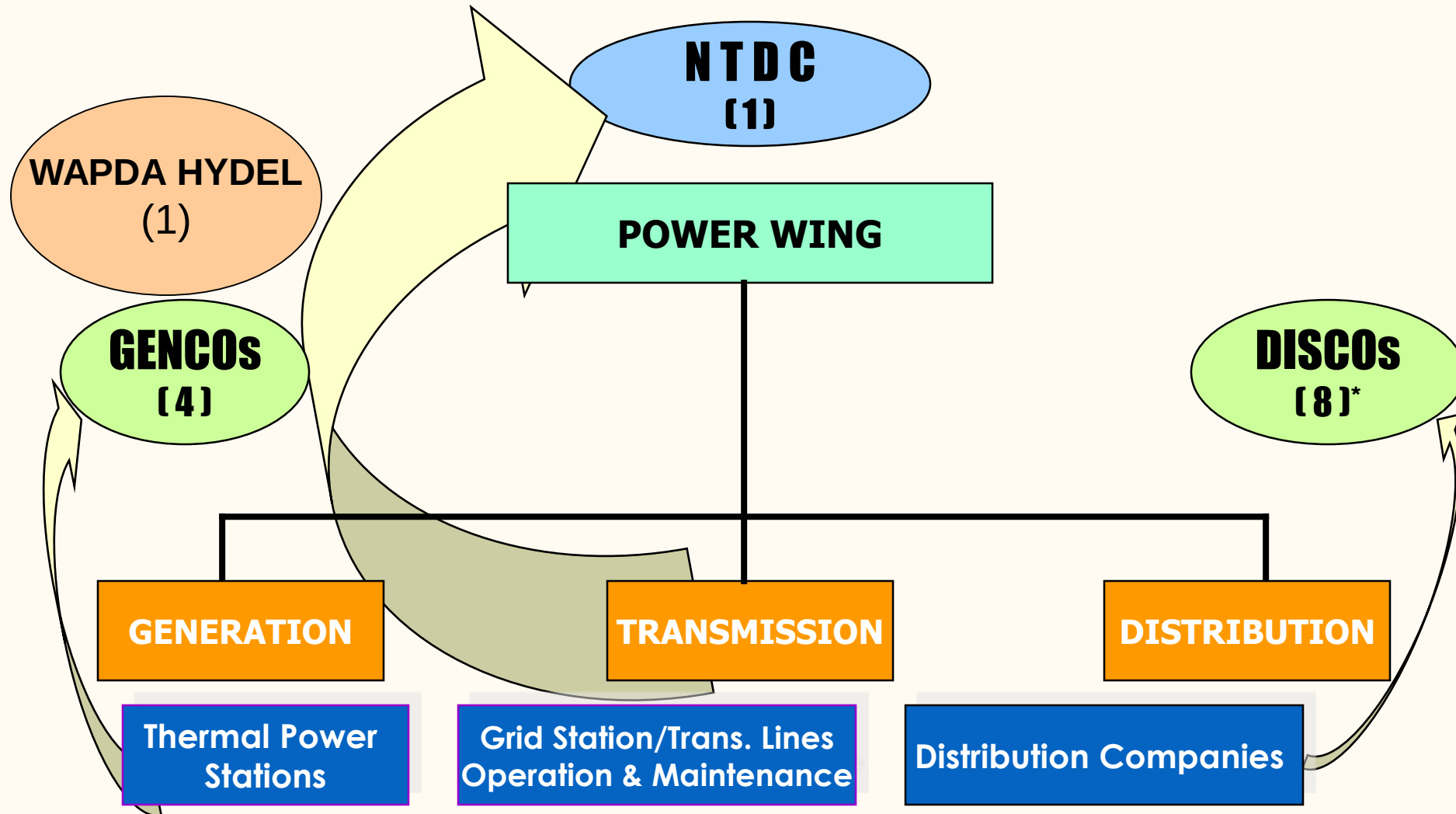
PAKISTAN POWER SECTOR -- Reform and Restructuring

Power Sector Organization 1991



PAKISTAN POWER SECTOR – Reform and Restructuring

WAPDA's RESTRUCTURING



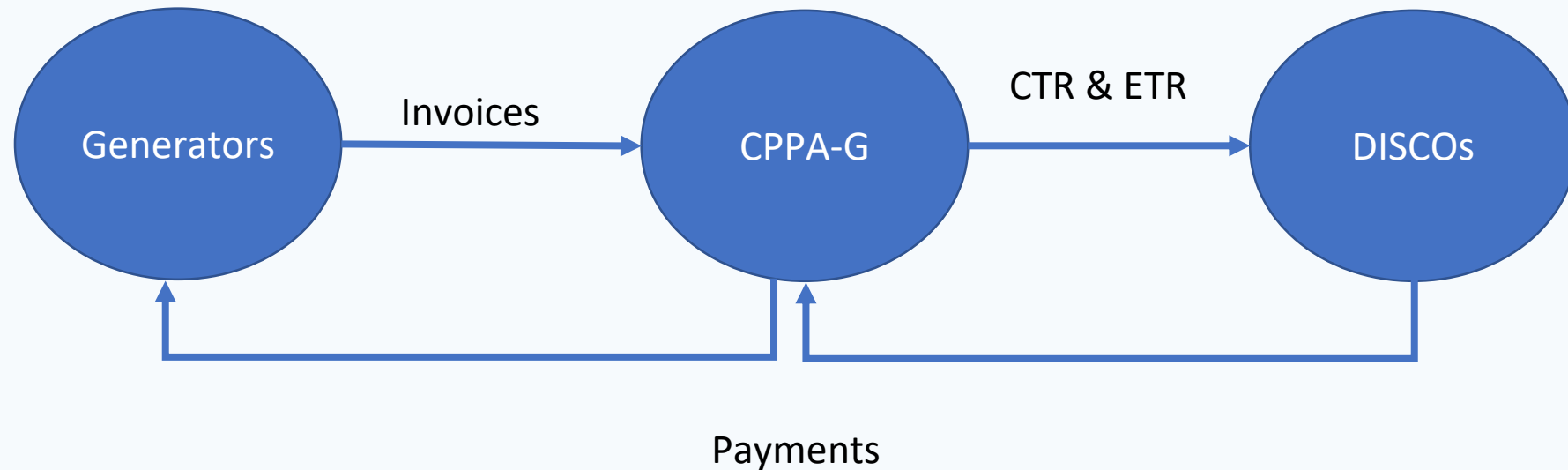
NEPRA ACT 1997

- The Regulator (Neptra) was established in 1997, through an Act of Parliament
- License mandated for every entity involved in generation, transmission and distribution sectors. Separate license for public sector entities
- Bulk Power Consumers (BPC) defined. Sale to BPC allowed
- Special Purpose Transmission Licensee
- Regulated Tariff for generation, transmission and distribution businesses based on cost of service
- Rules and regulations, Codes and Performance Standards developed
- Multi year tariff announced for KESC
- Rules and regulations, Codes and Performance Standards developed
- Multi year tariff announced for KESC
- Upfront tariff announced for different technologies including for Renewable Energy

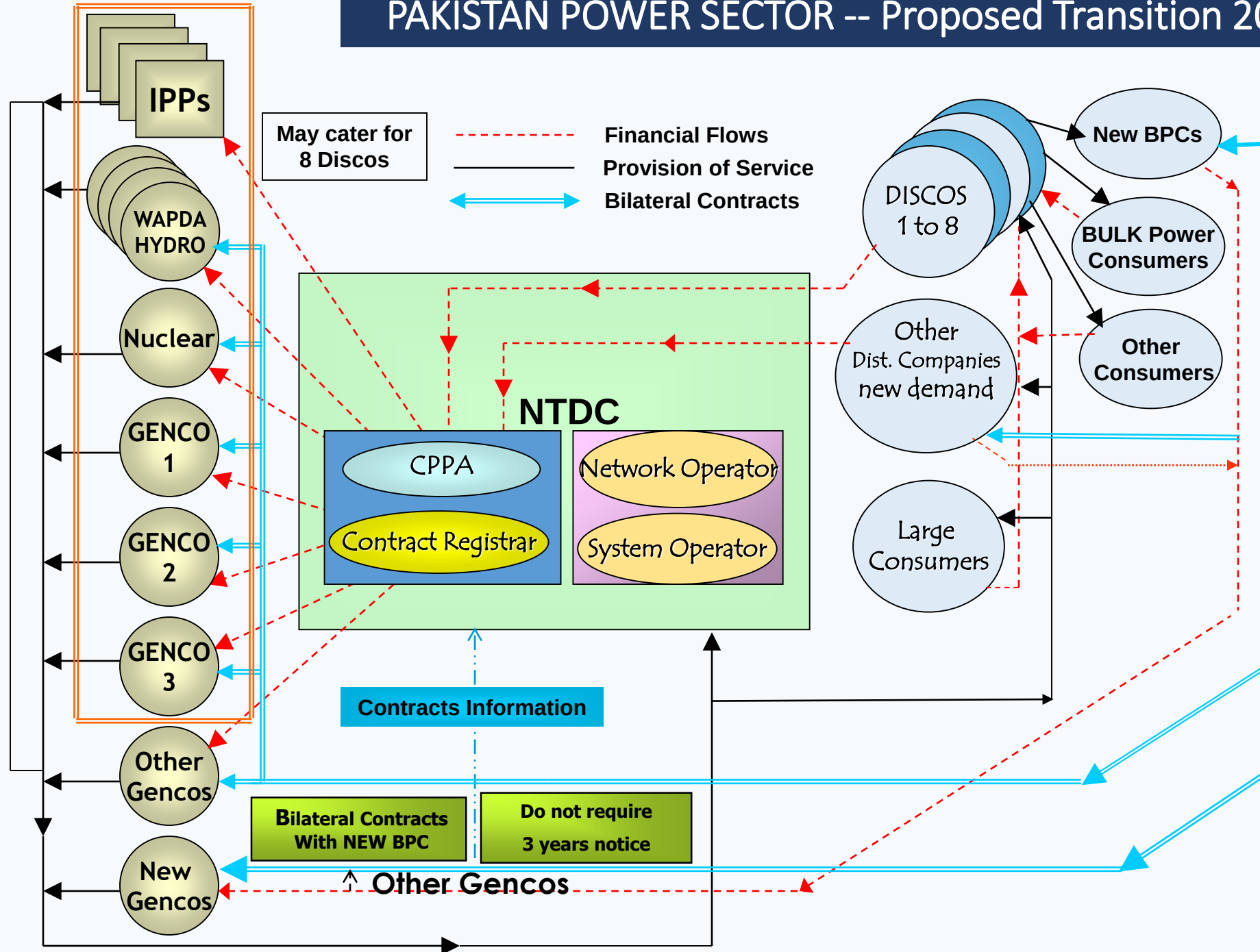
Single Buyer Market Structure

Single Buyer: Means only one Buyer can purchase power

Buyer: Central Power Purchasing Agency Guarantee (CPPA-G) Ltd as an agent on Behalf of DISCOs

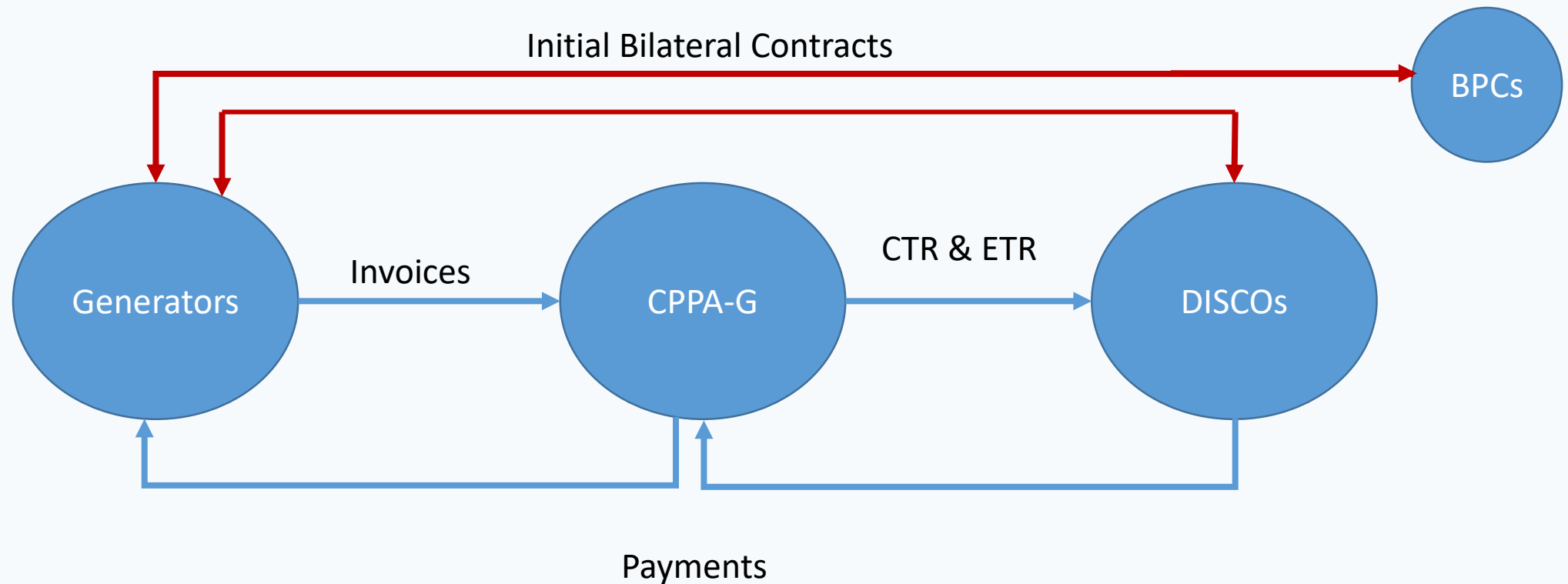


PAKISTAN POWER SECTOR -- Proposed Transition 2001

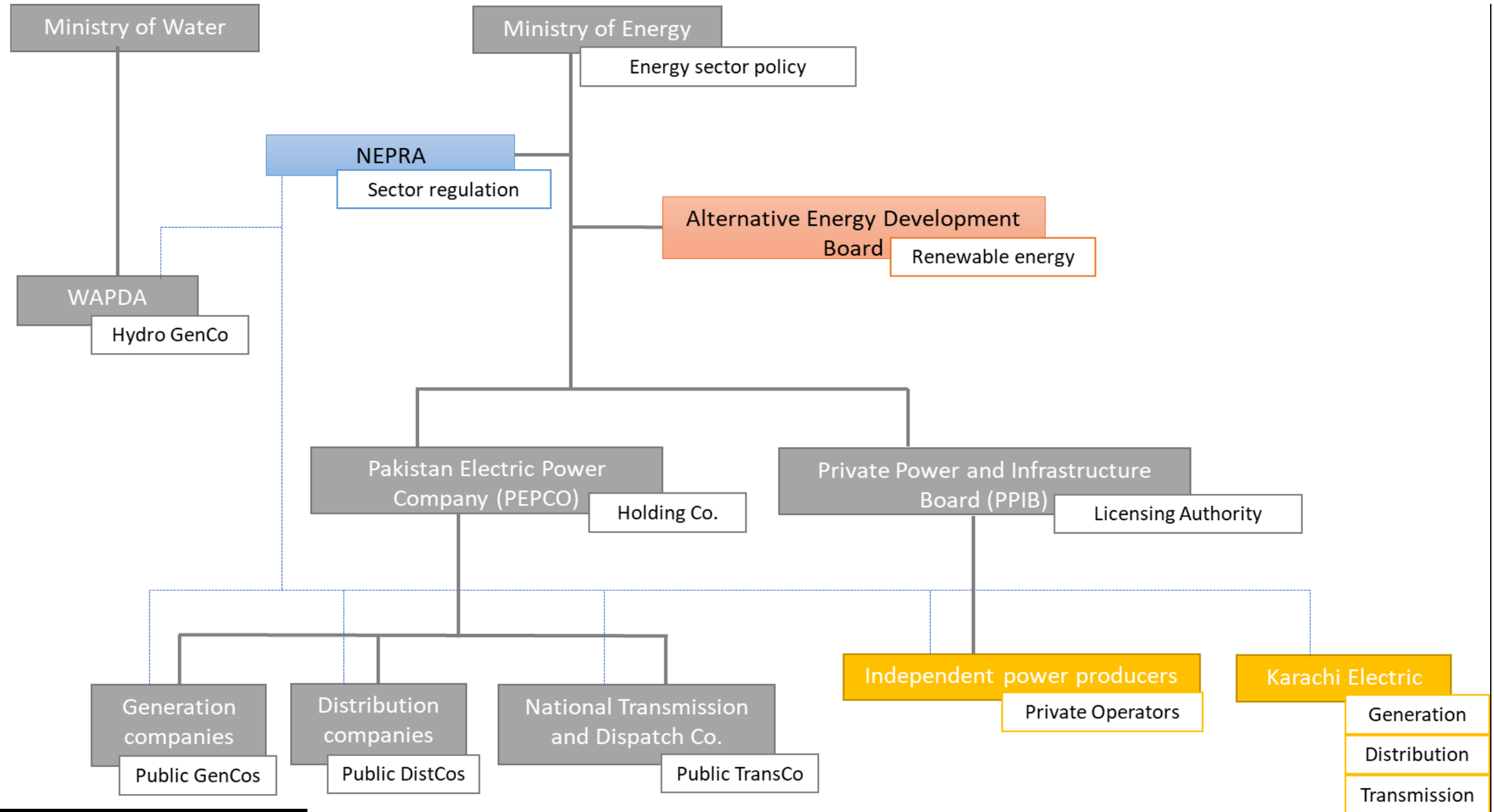


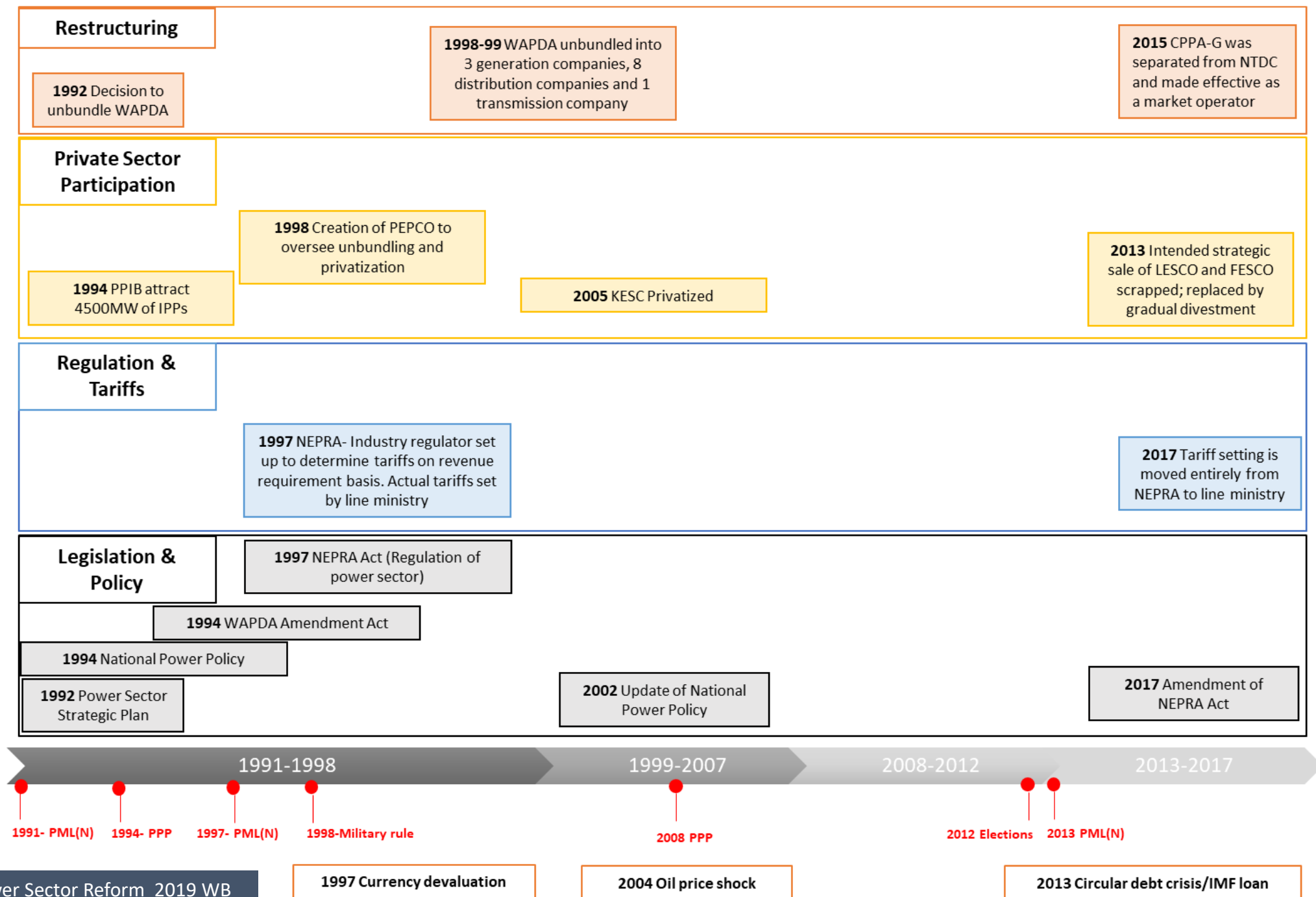
Structure prior to CTBCM Concept : Single Buyer Plus Market

Single Buyer Plus: Means where BPCs can purchase directly from Generators as well as DISCOs are also allowed to purchase bilaterally from generators apart from single buyer

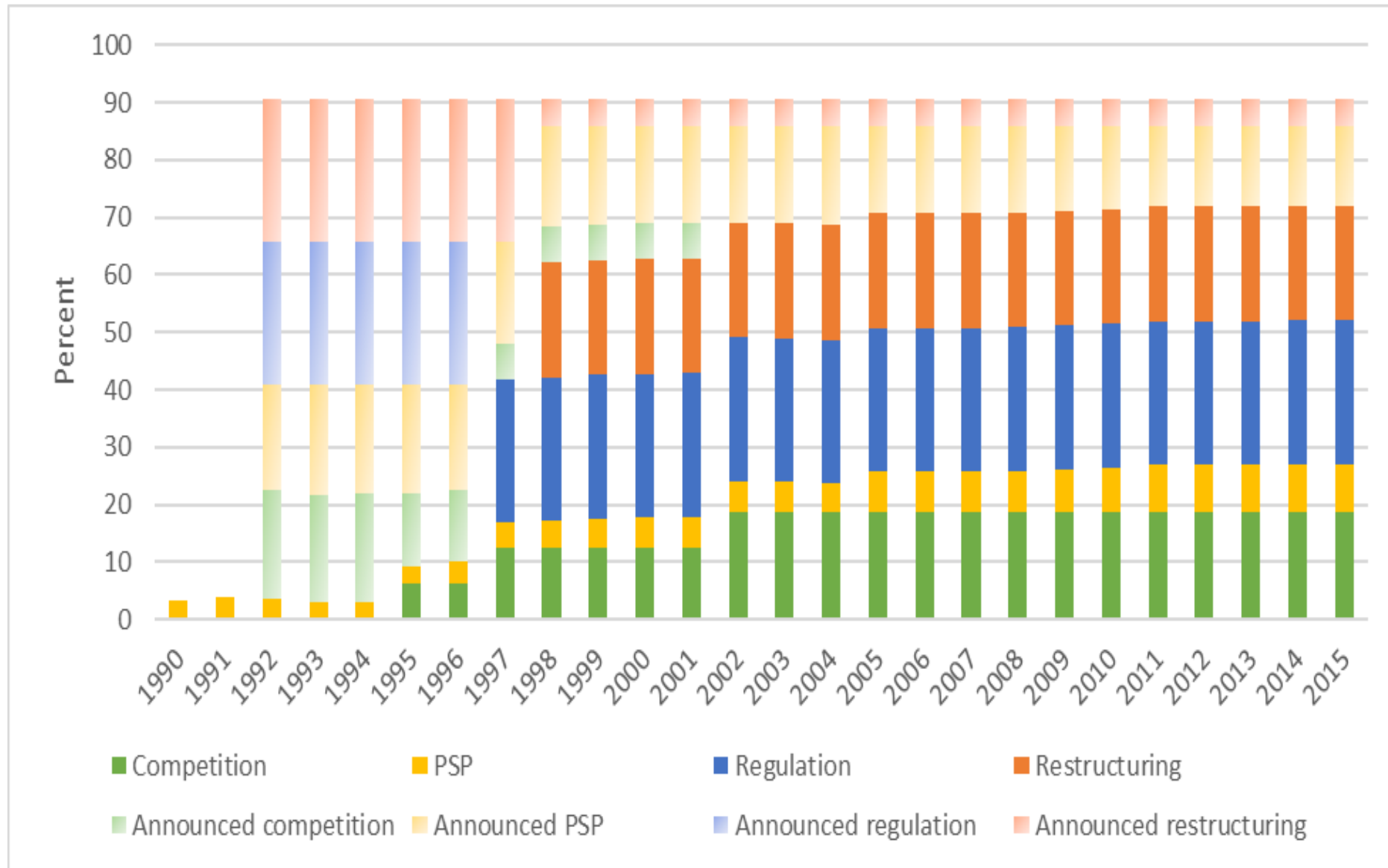


PAKISTAN POWER SECTOR -- Organization 2017





PAKISTAN POWER SECTOR -- Reform -- Restructuring -- Competition



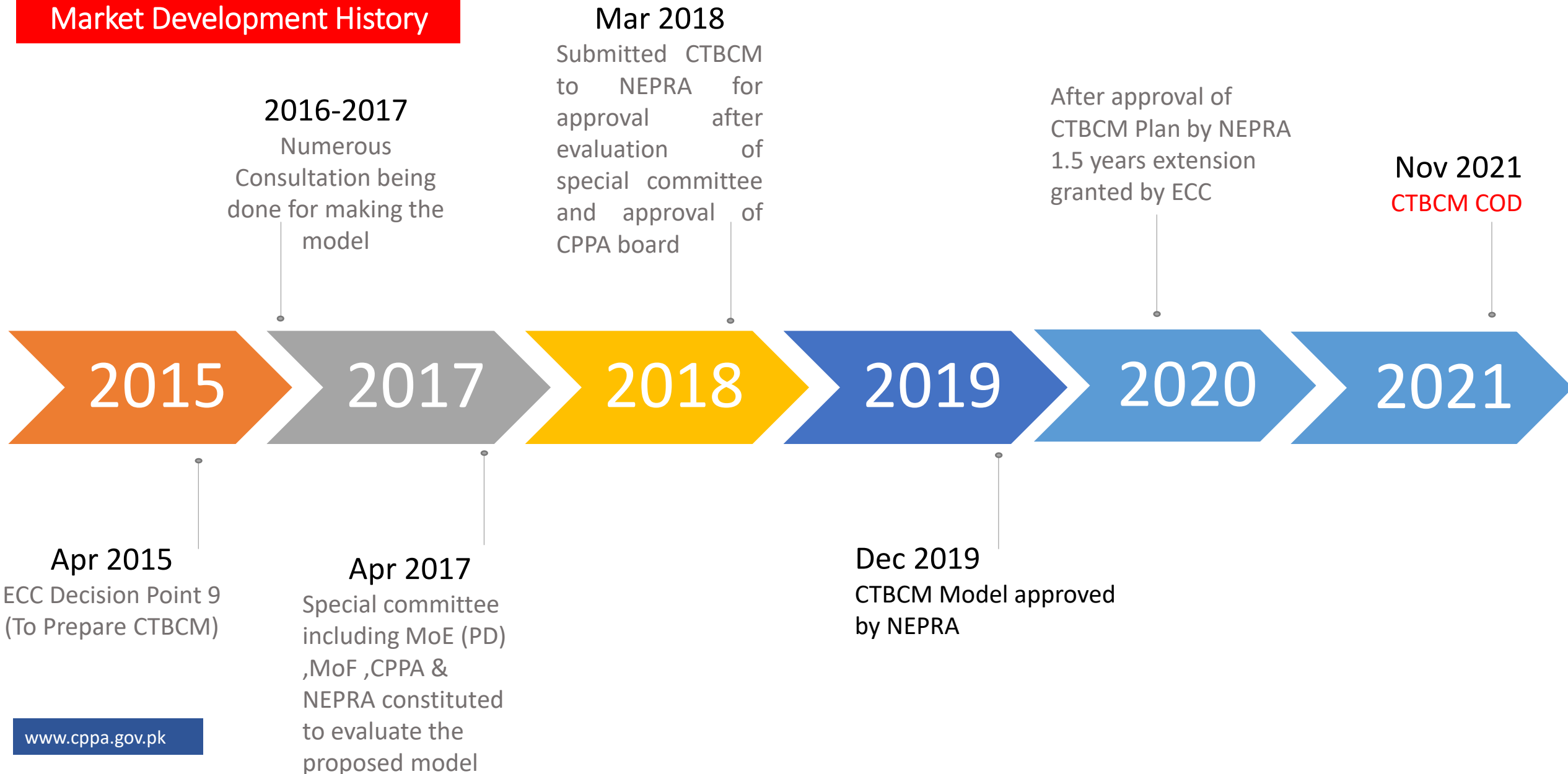
NEPRA AMENDMENT ACT 2018

(more powers for federal government)

- Federal Government to develop National Electricity Policy and Plan for Nepra to follow
- Gradual Cessation for license in Generation
- Distribution business divided into supply and network businesses
- Distribution network, Market Operator, Trader, Supplier, System Operator licensees introduced
- Provincial Grid Companies Allowed
- Rules to be prescribed by the Federal government, Nepra role limited to notifying Regulations
- Uniform Tariff for end consumers
- Appellate Tribunal Established

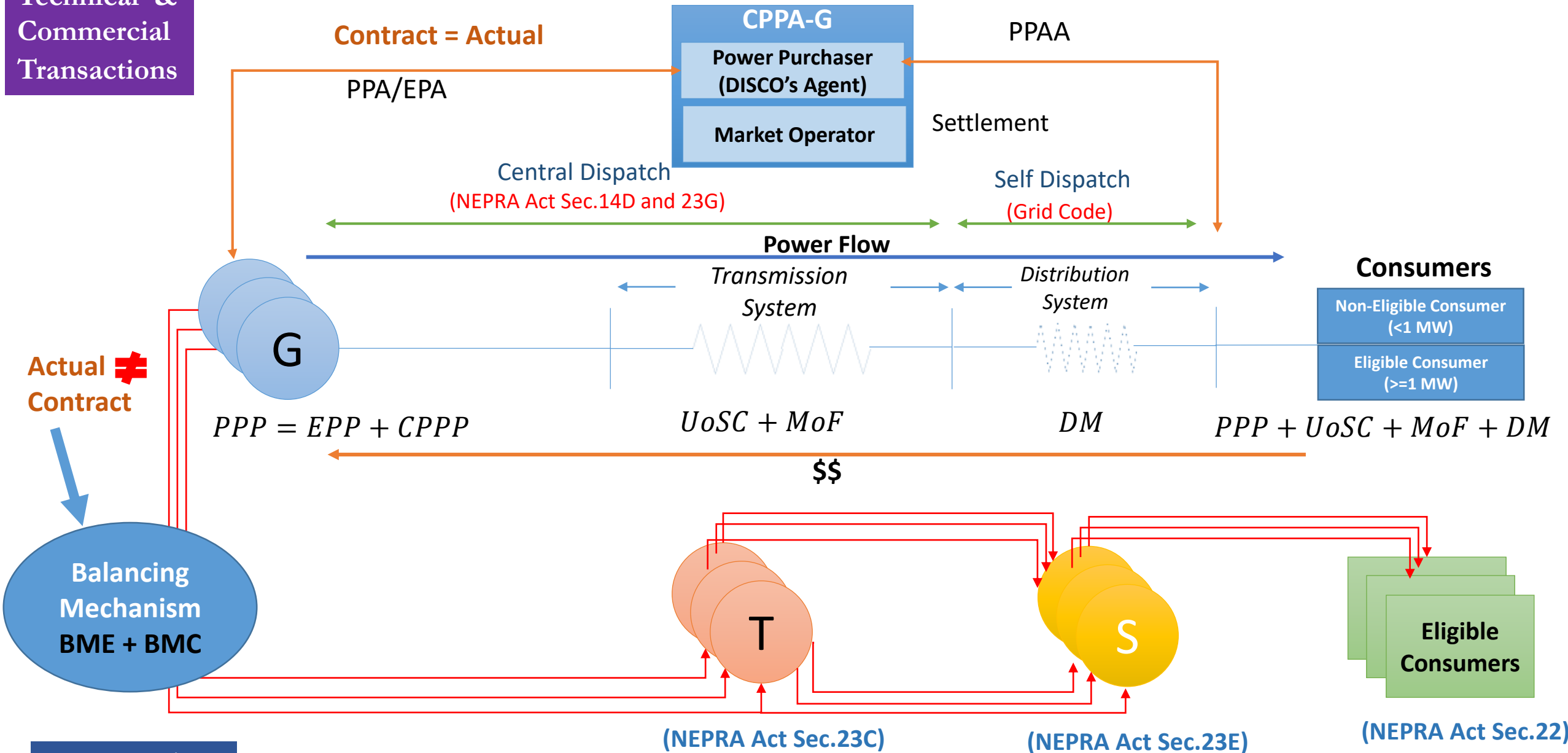
PAKISTAN POWER SECTOR -- Reform – Restructuring -- Competition

Market Development History



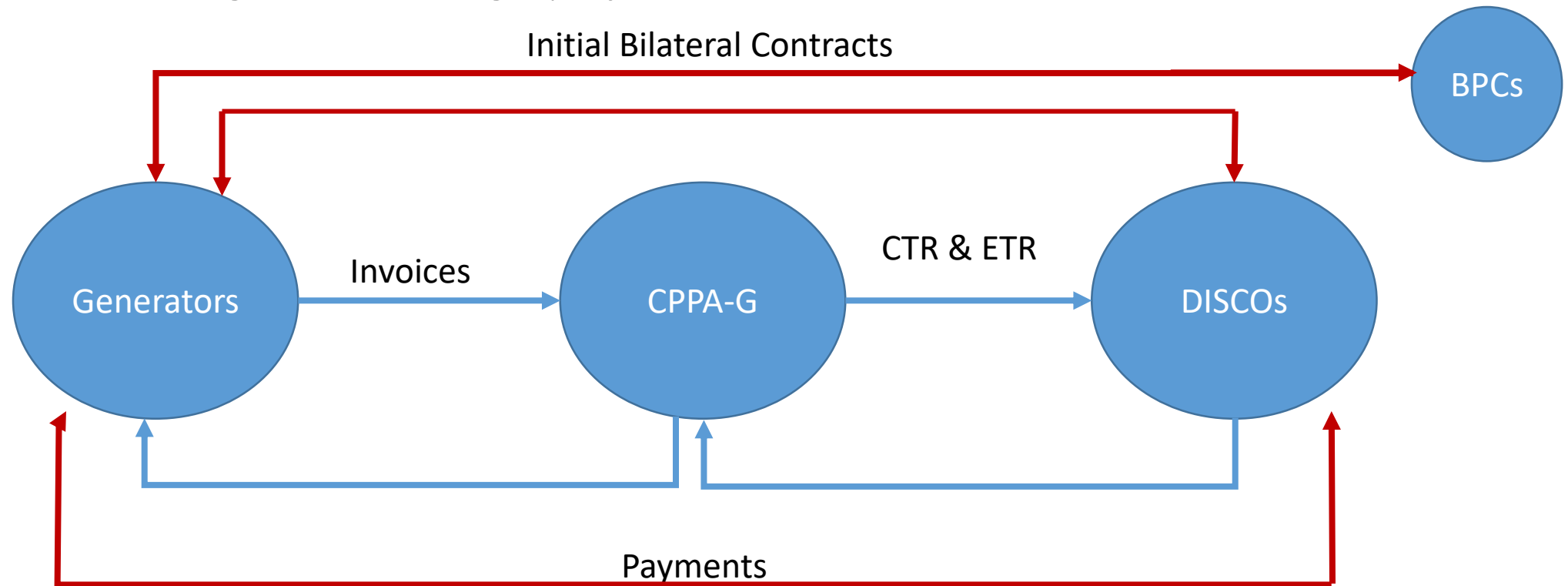
PAKISTAN POWER SECTOR -- Competitive Trading and Bilateral Contract Market (CTBCM)

Technical & Commercial Transactions



Competitive Trade Bilateral Contract Market (CTBCM)

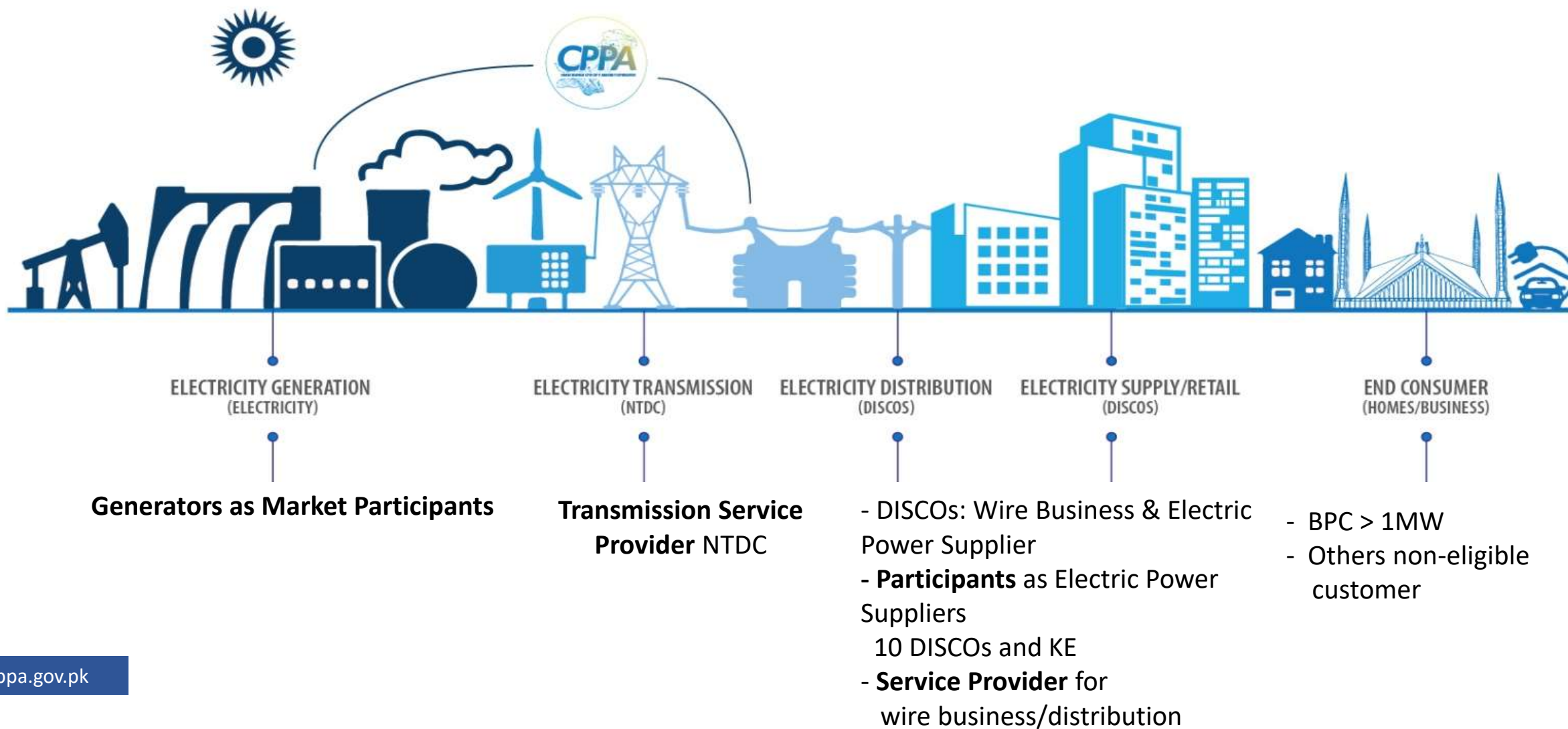
CTBCM: Means where BPCs and DISCOs can only purchase directly from Generators and are allowed to purchase from single buyer only to the extent of large-scale strategic projects.



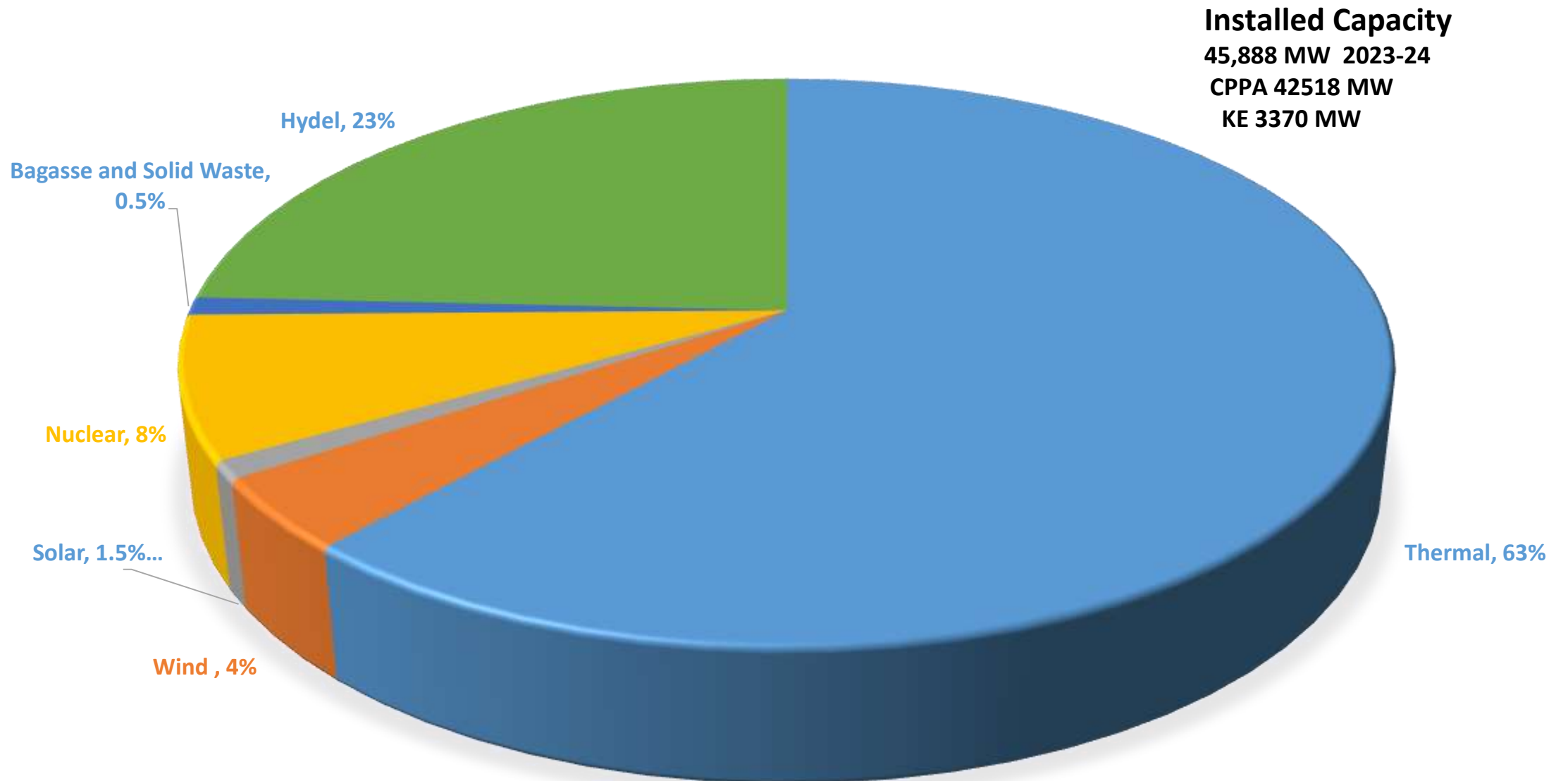


Electricity Market: Service Providers and Participants

Wholesale Electricity Market Operator



PAKISTAN POWER SECTOR -- Current Power Mix



PAKISTAN POWER SECTOR -- Transmission and Distribution

TRANSMISSION

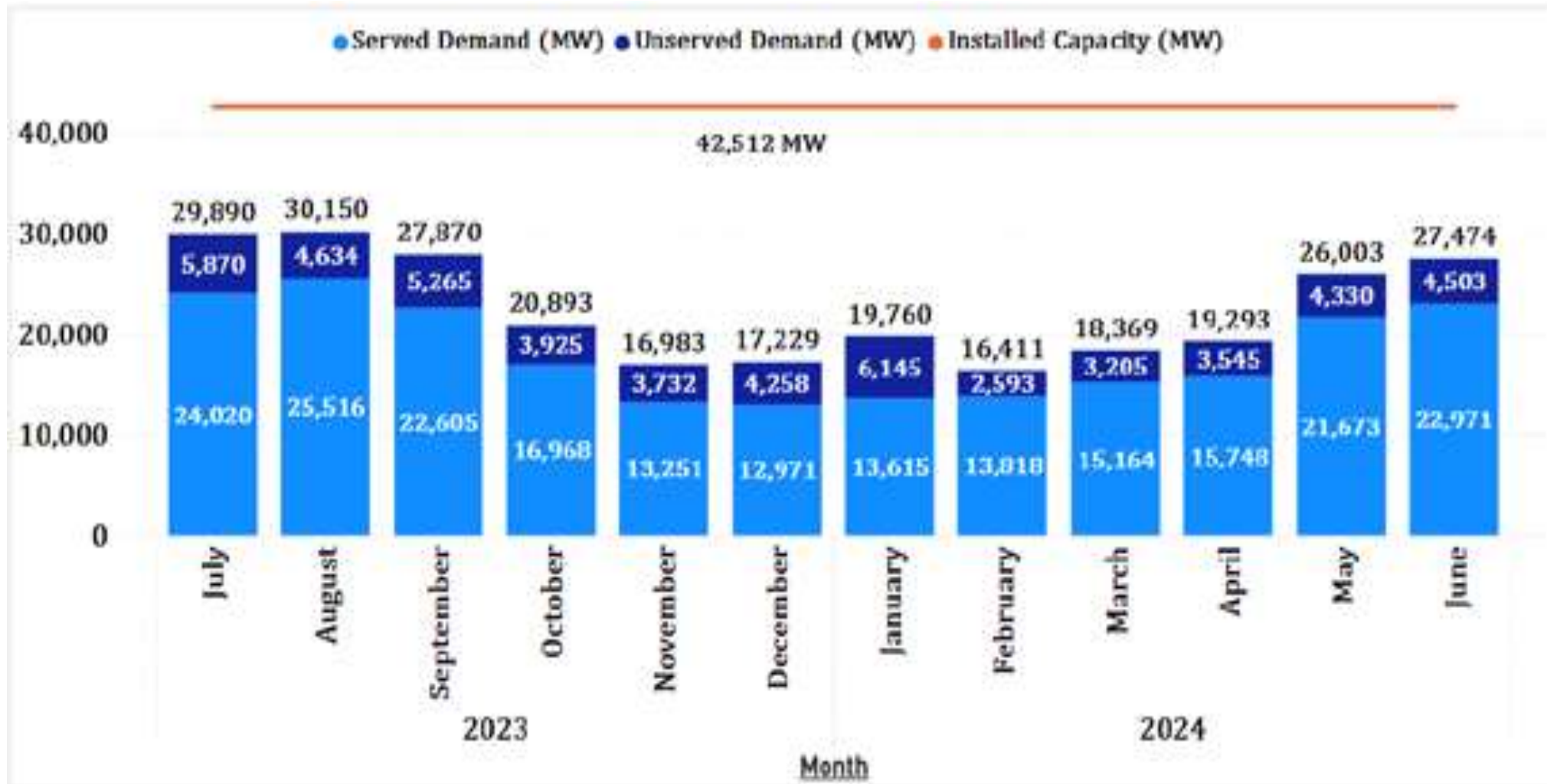
<u>660 kV HVDC</u>	<u>878 km</u>	
<u>500 kV HVAC</u>		
• Grid Stations	20	No.
• Capacity	26700	MVA
• Transmission Lines	9100	km
<u>220 kV HVAC</u>	<u>NTDC</u>	<u>KE</u>
• Grid Stations No.	49	11
• Capacity MVA	39930	550
• Transmission Lines (km)	11852	436

DISTRIBUTION AND SUPPLY

	National Grid	KE
Large Companies	10	1
Consumers (Million)	36.4	3.7
T&D Losses (%)	18.32	15.27
Recovery ratios (%)	92.44	91.54
Net- Metering Consumers	141,054	15,318

PAKISTAN POWER SECTOR -- CPPA SYSTEM

Installed Capacity, Demand and Unserved Load



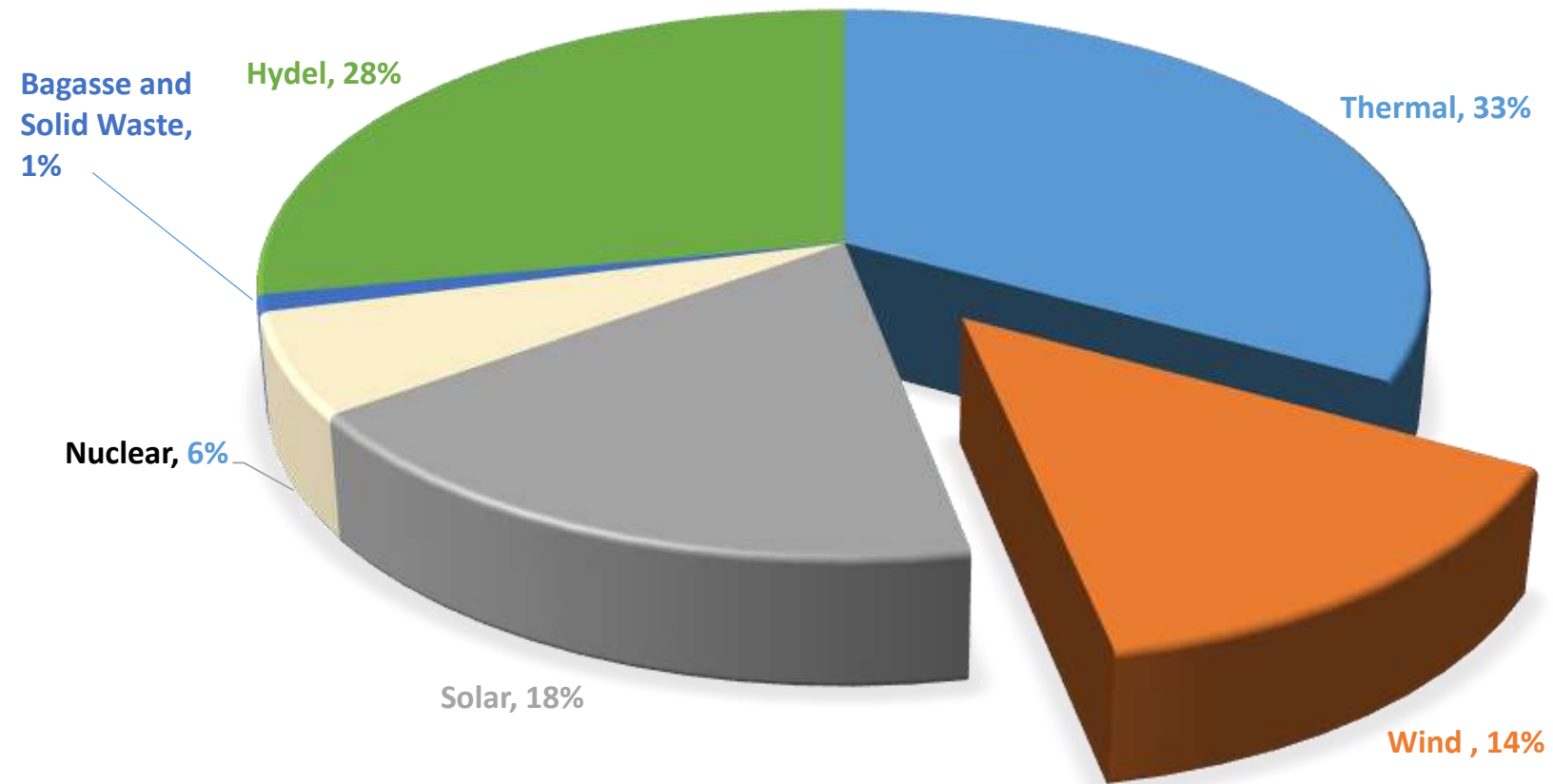
NATIONAL ELECTRICITY POLICY 2021

- Gradually reduce reliance on imported fuels, Sustainable renewable energy market to be developed. IGCEP and TSEP to be developed
- For liquidity of the market, Regulator to review losses and recovery of discos
- Electric Power Supplier to perform as per approved market design by Regulator
- Distribution Companies to make investment through Public-Private Partnership (PPP)
- System Operations to be restructured or reformed to meet objectives of Policy. SCADA to integrate higher share of Renewable Energy to be upgraded
- Regulator to timely approve wholesale market design. Market Operator to develop and implement Regulator Approved design
- Regulator to align Generation end Tariff with consumer end Tariff. Uniform tariff to be maintained through direct subsidies by the government.

NATIONAL ELECTRICITY PLAN September 2023

- Definition of RE revised to include hydel generation. RE targets set 40% of total generation capacity by 2025 and 60% by 2030.
- Distributed Energy Resources (DER) to be promoted against utility-scale procurement.
- Amended Grid Code Approved by the Regulator
- Discos to be Supplier of Last Resort (SOLR). Not allowed to have Competitive Supplier License
- Increased Role of System Operator
- Universal National Electrification (UNE) program to have 100% electrification by 2030. Regulator to be upgrade micro grid regulations.
- Fixed charges to be gradually incorporated in Tariff
- 65% of generation through Clean Energy by 2030. Assessment of GHG Emissions of Power sector

PAKISTAN POWER SECTOR -- Projected Power Mix --2030



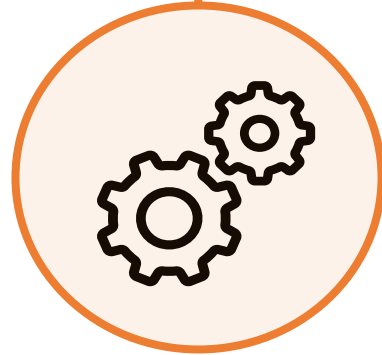
PAKISTAN POWER SECTOR -- INFOGRAPHICS FOR RE DEVELOPMENT

2004



- ✓ AEDB established, pilot RE projects.
- ✓ RE awareness campaigns launched.
- ✓ Wind risk concept evolved

2006-08



- ✓ RE Policy 2006.
- ✓ Sindh Leased Land for Wind.
- ✓ Wind feasibility studies approved.
- ✓ First Wind IPP Tariff by NEPRA.

2013-17



Wind – 788 MW
Solar – 430 MW
Bagasse – 201 MW

2018-20



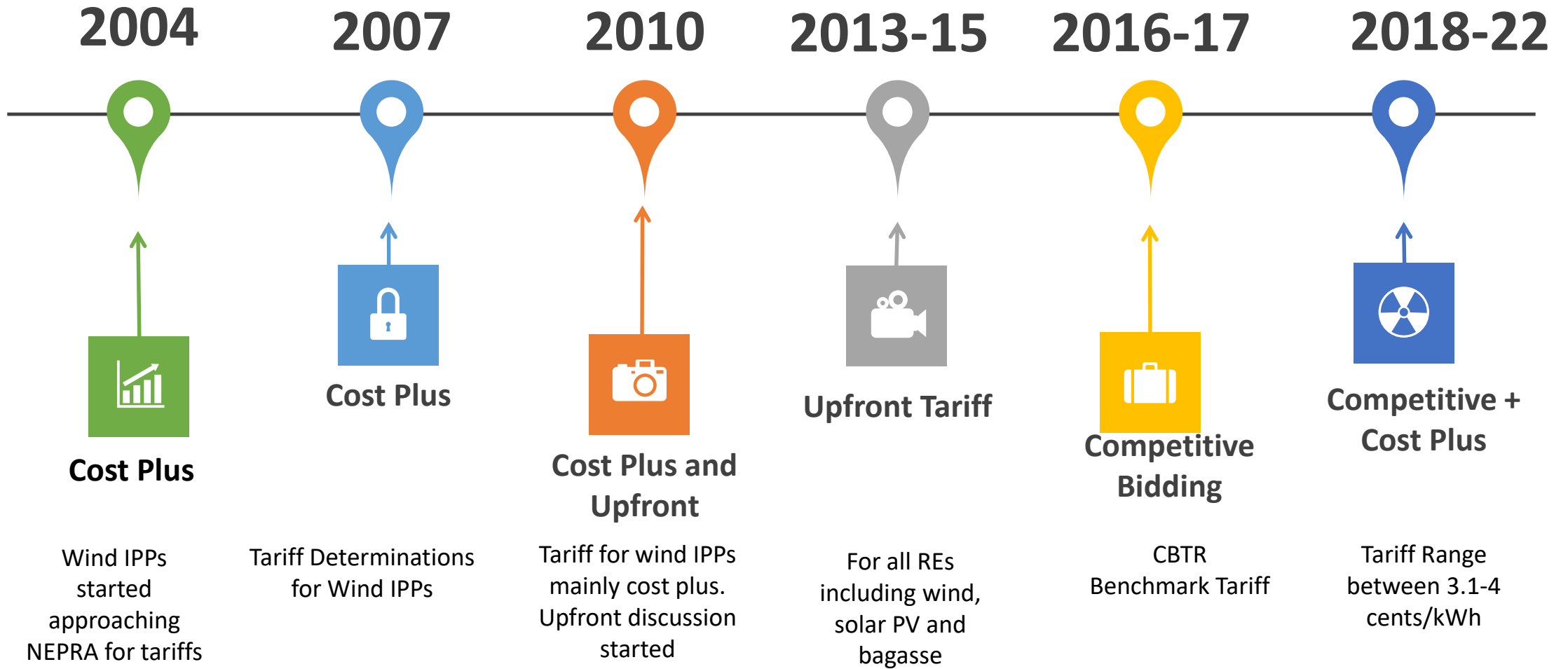
- ✓ Wind 1236 MW
- ✓ Solar 530 MW
- ✓ Bagasse 259 MW
- ✓ ARE Policy 2019

2022

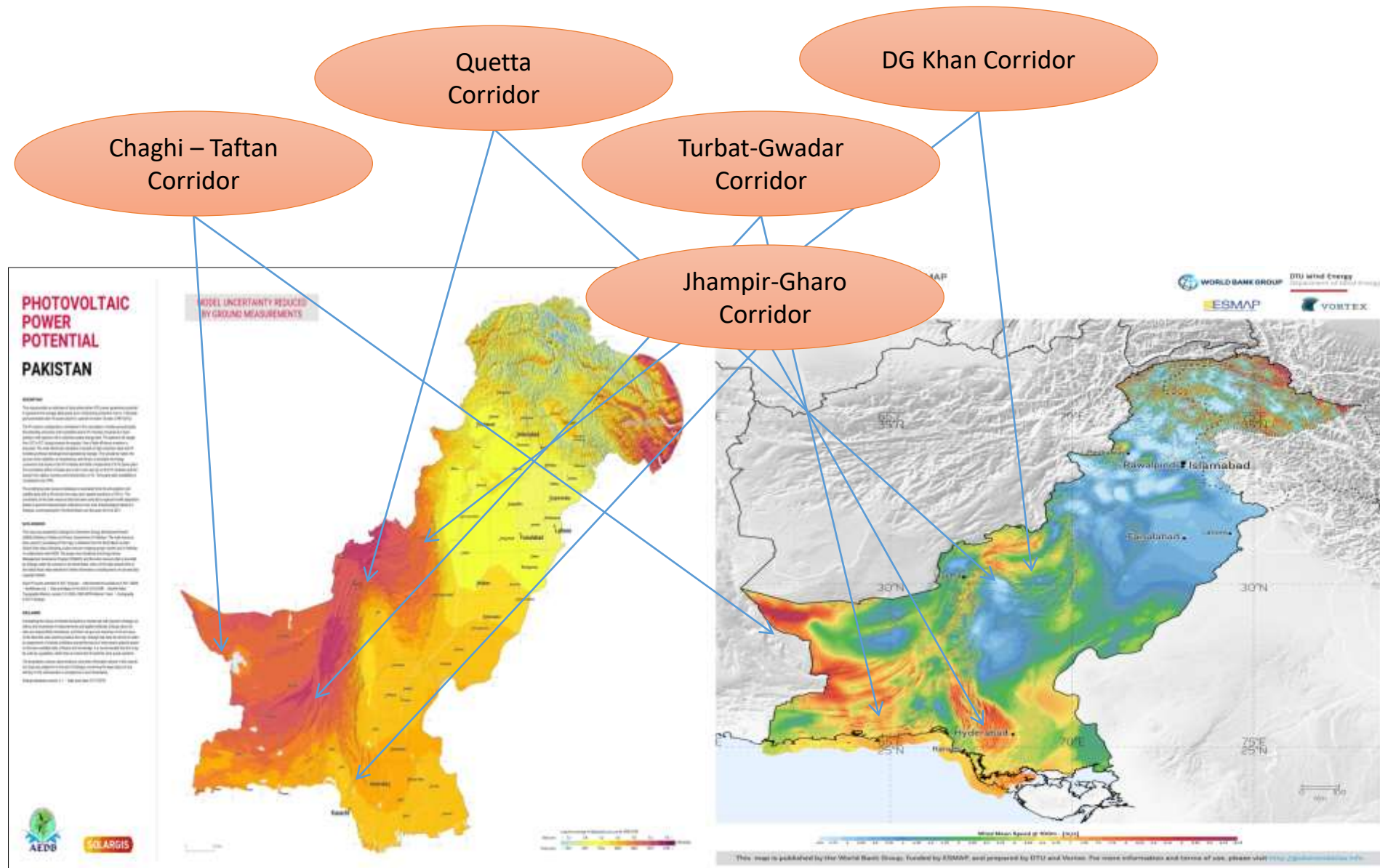


- ✓ Wind 1846 MW
- ✓ Solar 630 MW
- ✓ Bagasse 259 MW

TARIFF REGIME TIMELINE FOR RE



NEW WIND-SOLAR HYBRID PROJECTS PROSPECTS IN PAKISTAN



Transmission Sector --- Major ISSUES

Overloaded 500 kV transmission lines led to power evacuation challenges from south to north.

2 Power Evacuation Problems in North and MID Center (Overloaded 500 kV Transmission Lines)

500 kV Nokhar – Karot – Neelum Jhelum
Unable to despatch Karot & Neelum Jhelum on Full Load in this Loop during outage of any circuit connected with Nokhar

500 kV Sheikh Muhammadi – Tarbela Circuit

Sheikh Muhammadi 500 KV

Tarbela

Karot Hydro

Neelum Jhelum

Nokhar 500 KV

Yousfwala 500KV

Sahiwal Coal

500 kV Yousafwala – Sahiwal Coal CFPP
Unable to despatch Sahiwal Coal on Full Load

500 kV Shikarpur - Guddu 1&2 500 kV Moro – RYK
Unable to dispatch existing power plants in south on full load

Shikarpur

Guddu

Moro

Rahim Yar Khan

HUBCO

China hub

Dadu

K2/K3

Jamshoro 500 KV

Hala Road Circuit 1 & 2

Matiari Circuit 1 & 2

1 Power Evacuation Problems from South to North (Overloaded 500 kV Transmission Lines)

500 kV Jamshoro – Dadu & 500 kV Jamshoro – Matiari Circuit

Unable to dispatch existing power plants in south on full load

K2/K3, China Hub, HUBCO
Unable to dispatch power plants on full load or outage of either 500 kV China Hub – Jamshoro or 500 kV HUBCO – K2/K3

Data Source: NEPRA State of Industry Report, RF Calculations

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Transmission Sector --- Major ISSUES

System constraints forced the system operator to cut economic base load use, relying on costlier RFO/RLNG plants.

01 Transformation Congestion

500 kV

Gatti Grid Station

Muzaffargarh and New Multan Grid Stations

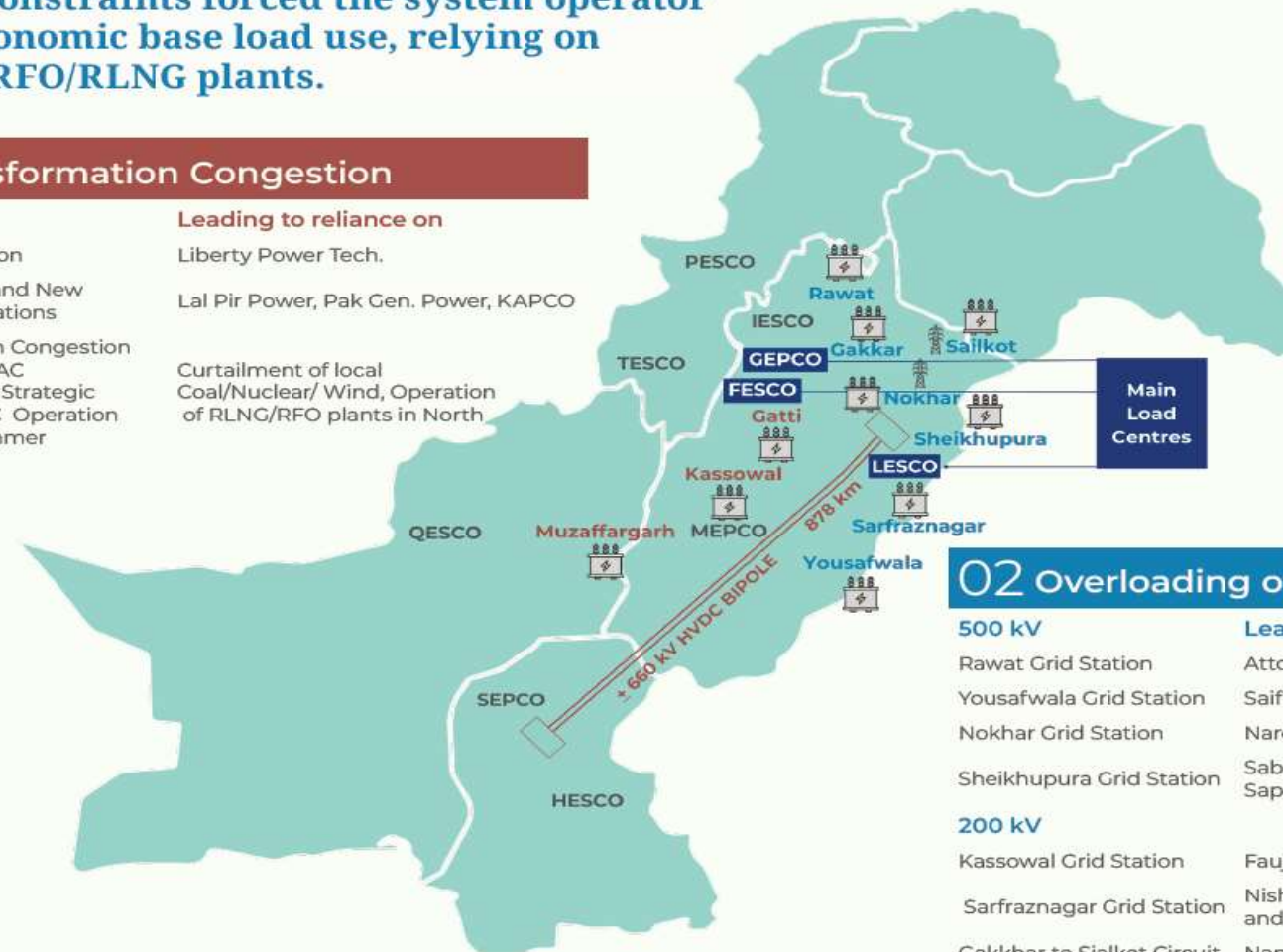
South to North Congestion HVDC and HVAC Limitation and Strategic Table for HVDC Operation for Winter/Summer

Leading to reliance on

Liberty Power Tech.

Lal Pir Power, Pak Gen. Power, KAPCO

Curtailment of local Coal/Nuclear/ Wind, Operation of RLNG/RFO plants in North



Data Source: NEPRA State of Industry Report, RF Calculations

02 Overloading of Transformers

500 kV

Rawat Grid Station

Yousafwala Grid Station

Nokhar Grid Station

Sheikhupura Grid Station

Leading to reliance on

Attock Gen.

Saif Power

Narowal Energy and Nandipur

Saba Power, Halmore Power, Sapphire Electric Power

200 kV

Kassowal Grid Station

Sarfraznagar Grid Station

Gakkhar to Sialkot Circuit

Fauji Kabirwala Power

Nishat Power, Nishat Chunian and Kohinoor Energy

Nandipur and Narowal Energy

RESTRUCTURING/UNBUNDLING

- Reasonable Progress

Whether Restructuring provides solutions to sector Issues?

Needs Commitment by the Federal Government

COMPETITION

- Negligible Progress

CTBCM success hinges on key decisions by the Regulator and the Federal Government

REGULATORY FRAMEWORK

- Reasonable Progress

Government Commitment needed

PRIVATE SECTOR PARTICIPATION

- Reasonable in Generation Sector, To some extent in Transmission Sector

A number of Policies Announced, Up Front Tariffs RE, RLNG and Coal Added (THAR COAL DEVELOPMENT)

HVDC Transmission Line also built through a Power Policy, Special Purpose Transmission License allowed under Nepra Act

Distribution ??? No Progress in Public Sector. Except KE ----- Bureaucratic Inertia

GRID MODERNIZATION

- Expansion in Conventional. No investment for Distributed Energy Resources (DER)
- Need for Smart Grid and Smart Metering System at Disco level. (IEEE 1547)