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# POWER

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## Research Team

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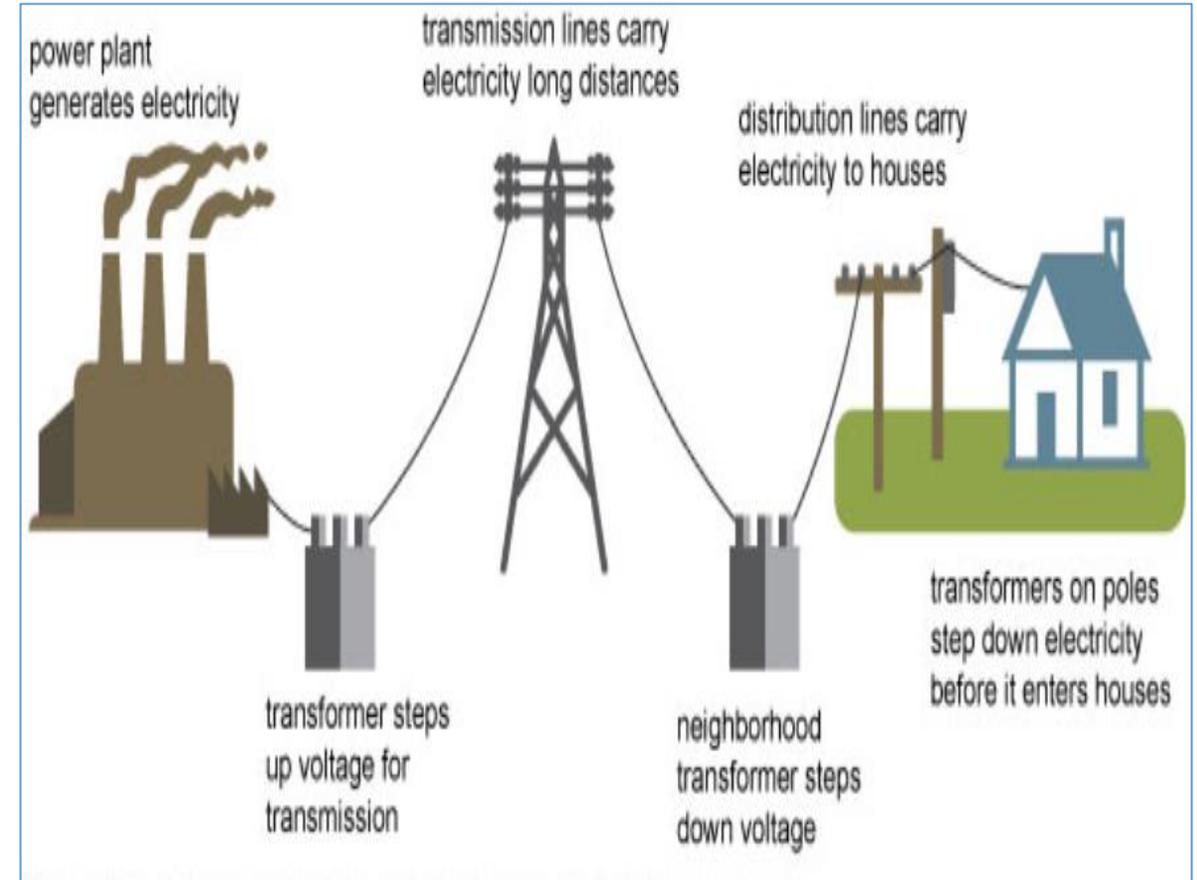


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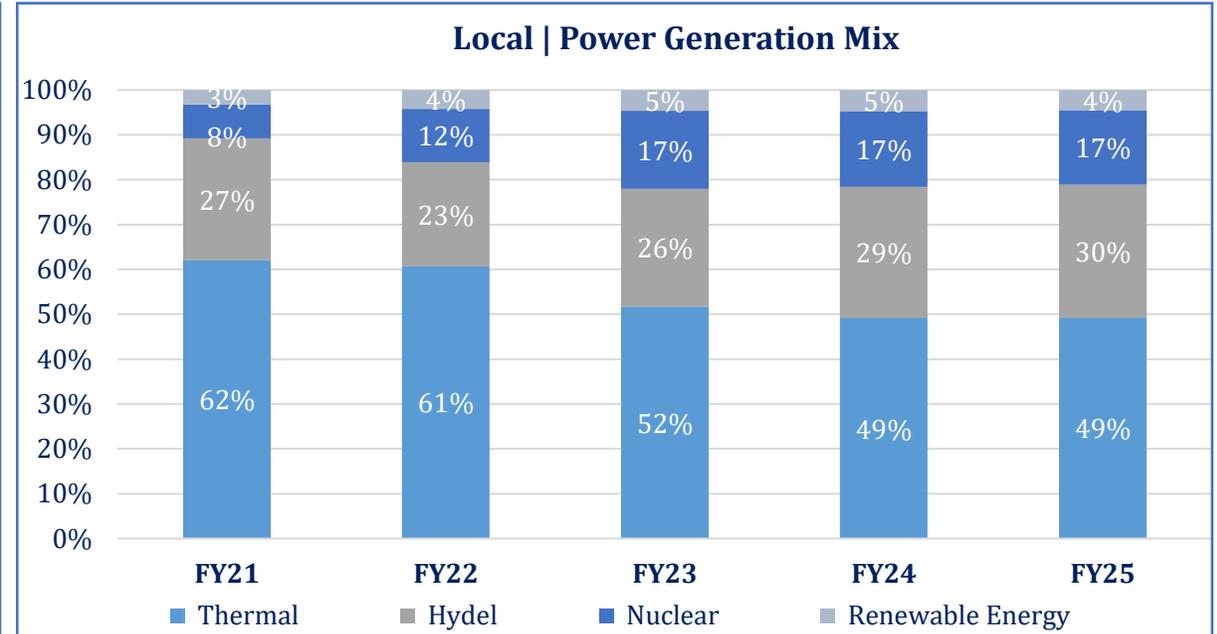
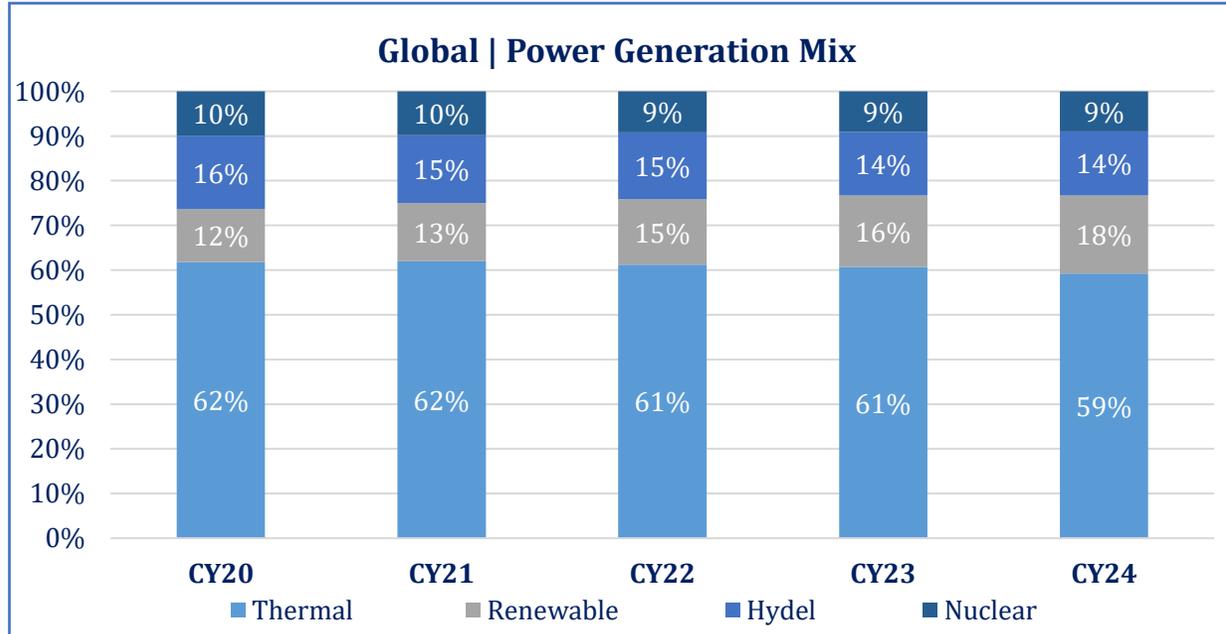
## Introduction

- Based on derivation, energy sources can be bifurcated into Primary and Secondary sources. Electricity, a subset of Power, is a secondary energy source. It is produced through the conversion of other energy sources such as Coal, Natural Gas, Oil, and Nuclear power, among others. These are known as primary energy sources. Primary energy sources can be renewable or non-renewable.
- Since the 1660s, scientists and inventors, including the likes of Benjamin Franklin, Thomas Edison and Nikola Tesla, have contributed significantly to shaping our understanding and use of electricity.
- In the late 1800s, Nikola Tesla pioneered the generation, transmission, and use of alternating current (AC) electricity, which reduced the cost of transmitting electricity over long distances.
- Electricity is generated at power plants and moves through a complex system, generally referred to as the grid, of electricity substations, transformers, and power lines that connect electricity producers and consumers. This study shall focus on the **power generation system**.



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## Power Generation Mix | Global vs. Local

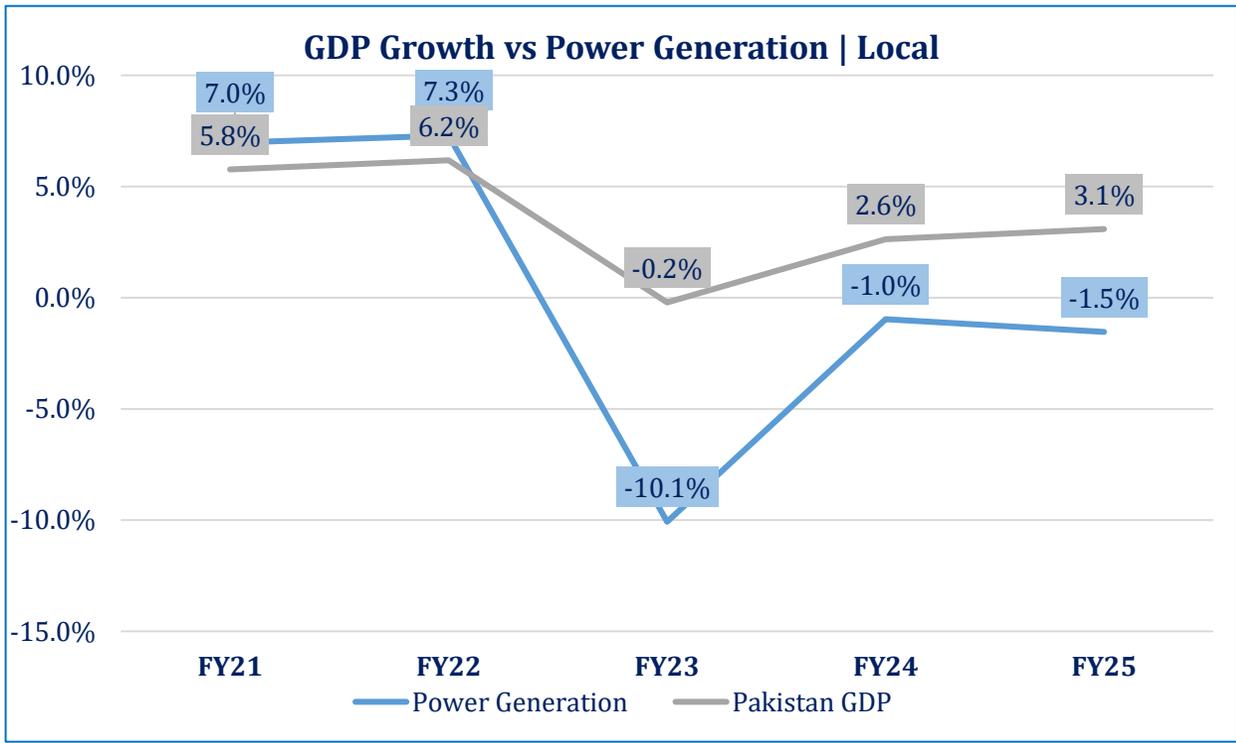
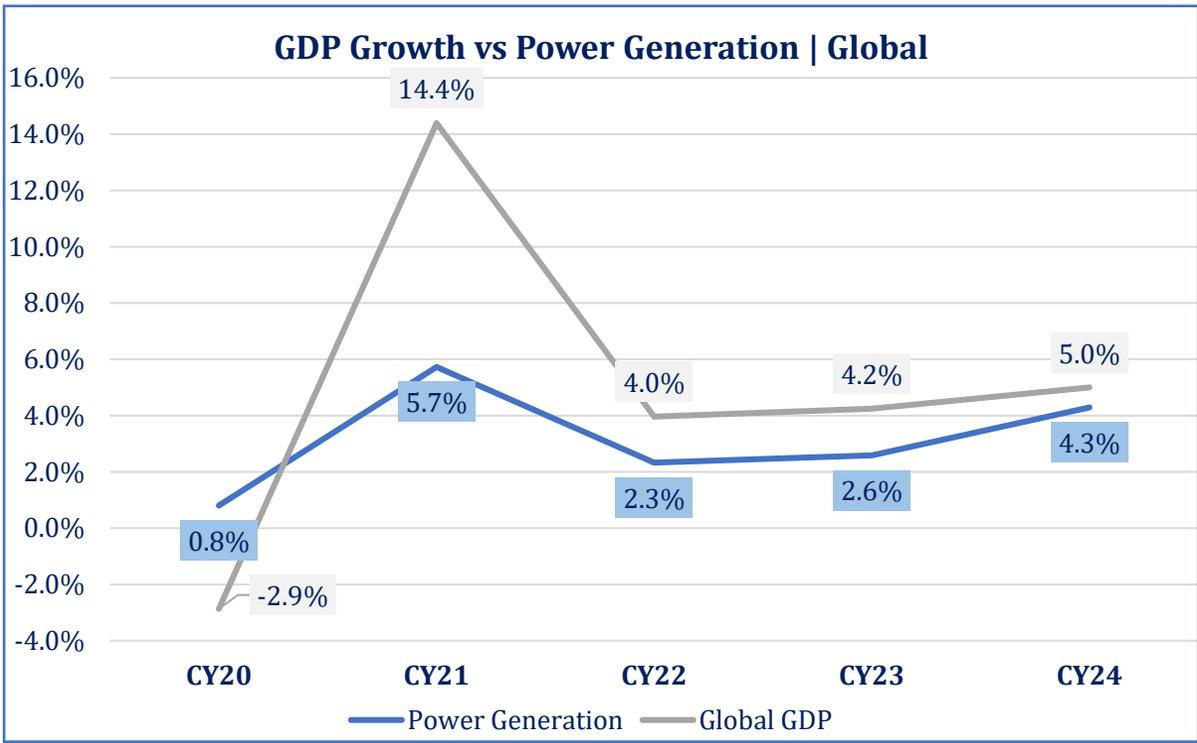


- The global power generation mix in CY24 remained predominantly reliant on thermal energy sources (Coal, Oil, and Gas), which collectively accounted for ~59.0% of total electricity generation. Renewable energy sources, such as solar and wind, represented a combined share of ~18.0% during the year. Among clean energy sources, hydel maintained the largest contribution at ~14.0%, while nuclear energy ranked second with ~9.0% share in CY24.
- In Pakistan, the energy mix has gradually shifted away from thermal generation. The share of thermal declined from ~62.0% in FY21 to ~49.0% in FY25, reflecting a structural transition towards relatively cleaner sources. Hydel's contribution increased from ~27.0% to ~30.0% during this span, while nuclear energy expanded significantly from ~8.0% to ~17.0% over the same period. Against total power generation of ~135,079 GWh in FY25, the combined share of hydel and renewables stood at ~34.0% in FY25, remaining broadly unchanged compared to the same period last year, indicating stability in the non-thermal contribution to the overall generation mix.

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## GDP and Power Generation | Global vs. Local

- Global electricity generation reached ~30,937 TWh in CY24, up ~5.0% YoY (SPLY: ~29,665 TWh). Meanwhile, the global GDP grew by ~4.3% YoY during the same period, recording at USD~110.98trn.
- Pakistan's power generation stood at ~135,079 GWh in FY25, marking a decline of ~1.5% YoY, while on the other hand, GDP grew, in real terms, by ~3.1% YoY from a growth of ~2.6% YoY in FY24.

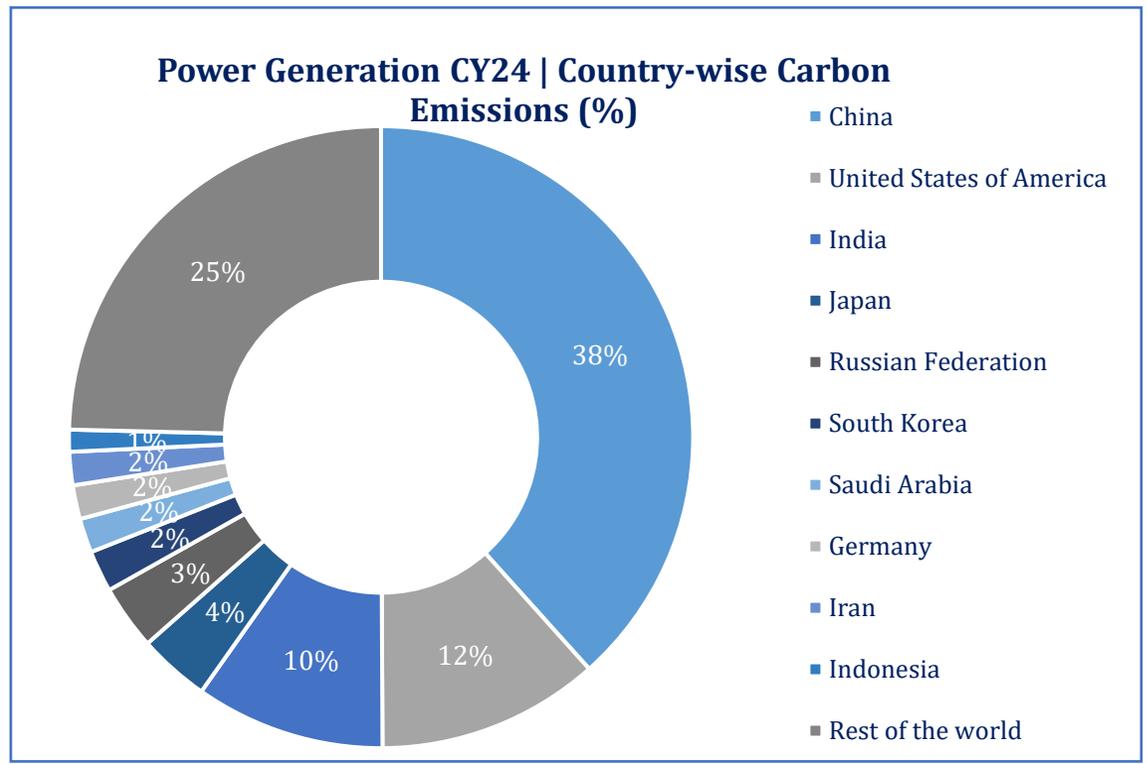
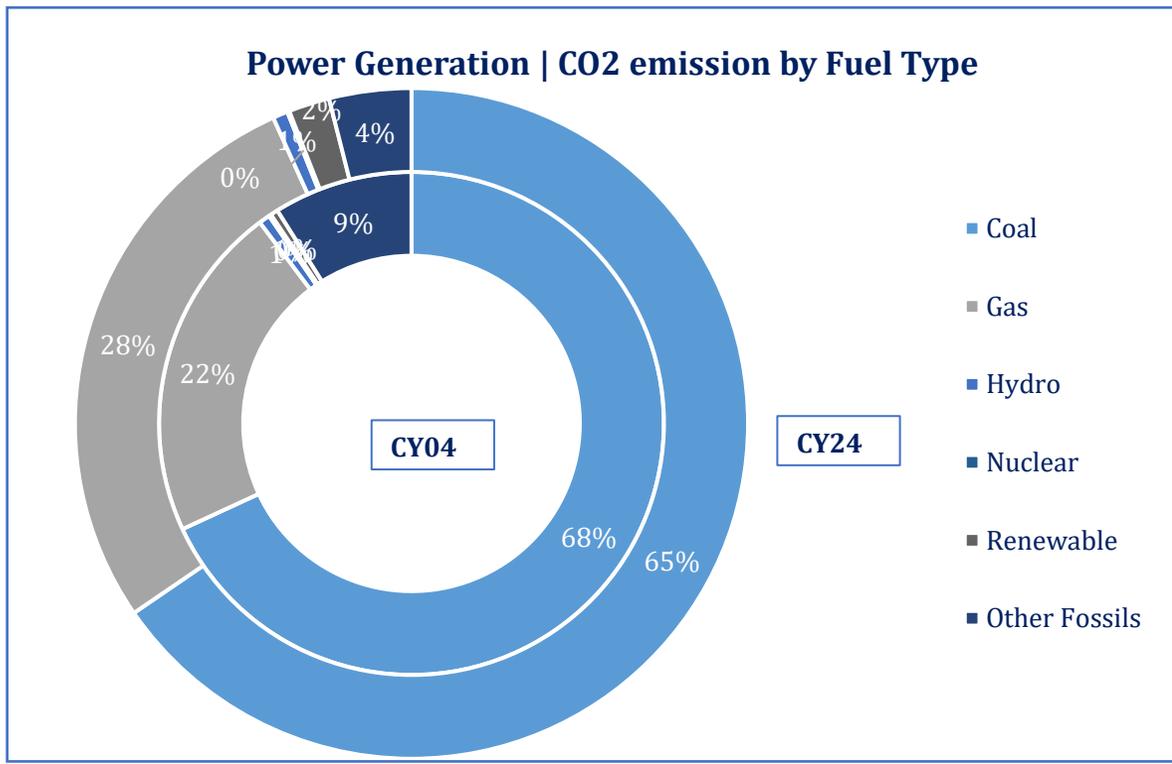


**Note:** Local power generation data reflects the CPPA-G and KE systems. MW is converted into GWh

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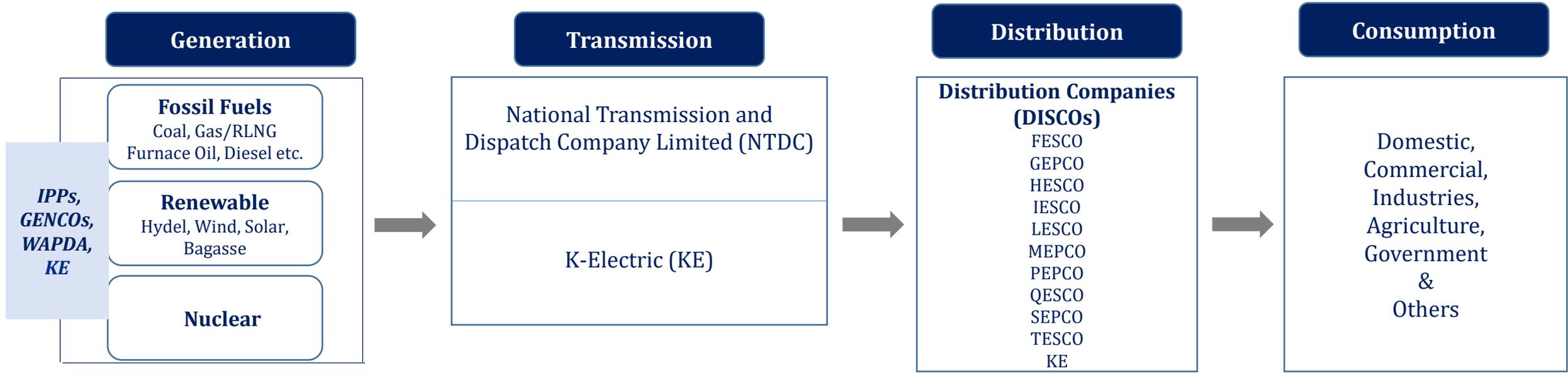
## Global | Carbon Emissions | Power Generation

- In CY24, the global carbon emissions from power generation rose to ~14,552mln MT, growing at a CAGR of ~2.2% since CY04. Country-wise, the USA and China alone contributed ~50.0% of the global carbon emissions emanating from power generation during the same period.
- Pakistan contributed just ~0.5% of global carbon emissions from power generation during CY24 (CY23: ~0.5%). However, it is one of the most vulnerable country at risk from climate change during the same period.



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## Local | Industry Structure

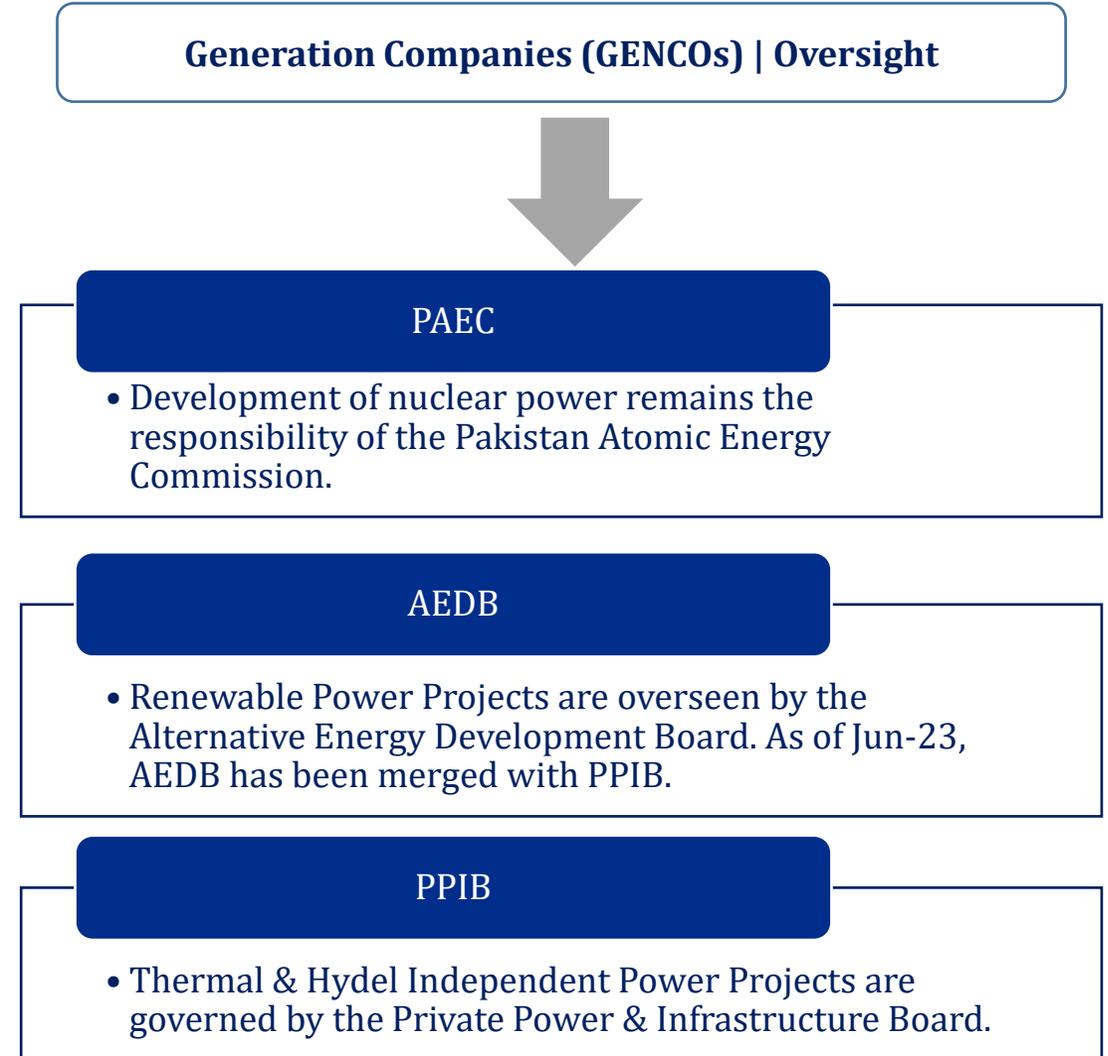


*Note: KE operates in all three segments of the Power Sector*

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## Local | Regulatory Structure

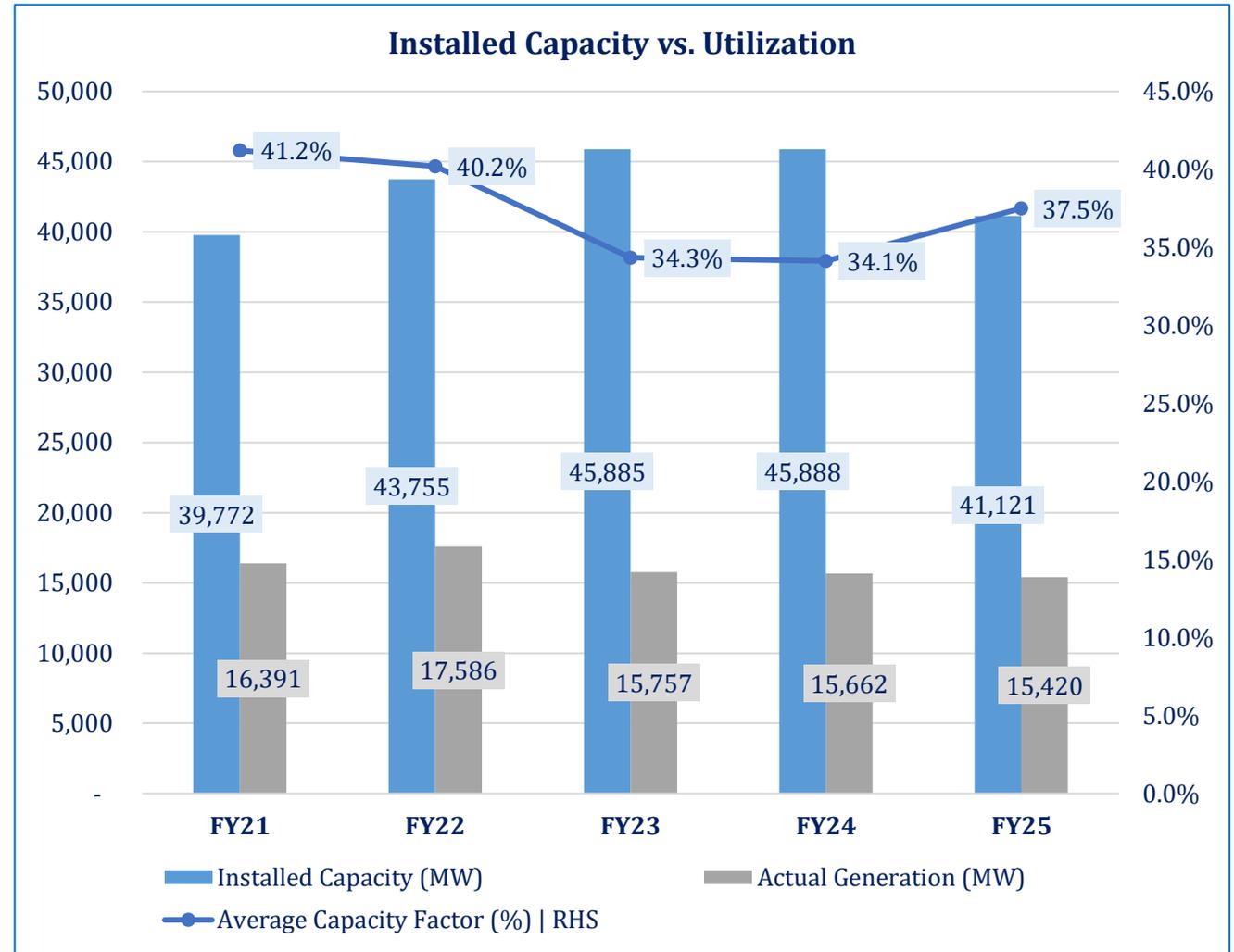
<b>Governance</b> Ministry of Energy	<b>Regulator</b> NEPRA	<b>Market Operator</b> CPPA-G
“Power Division” in the Ministry of Energy oversees the entire Power Sector of Pakistan.	NEPRA is an autonomous body mandated by the law to regulate the Power Sector to ensure that the interests of investor and customer are protected and the sector moves towards a competitive environment. The authority is also responsible for tariff determination.	Power market is operated by Central Power Purchasing Agency (CPPA-G). It procures power on behalf of DISCOs and settles the balances among all the market players. Its objective is to facilitate the power market transition from current single buyer model to competitive market.



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## Local | Installed Capacity vs. Utilization

- Pakistan’s total installed power generation capacity was recorded at ~41,121 MW in FY25, declining by ~10.4% YoY (FY24: ~45,888 MW), while the actual power generation was recorded at ~15,420 MW, down ~1.5% YoY.
- Meanwhile, average capacity factor was recorded at ~37.5% in FY25 (FY24: ~34.1%). The capacity factor measures the percentage of a power plant’s installed capacity that is utilized. A low-capacity factor indicates inefficiency in system usage. Despite lower, installed capacity, power generation didn’t suffer much due to higher capacity factor as inefficient plants are phased out.
- Generation from the public power plants in FY25 comprised ~59.7% of the total generation, whereas private sector plants contributed ~40.3% (SPLY: ~61.4% and ~38.6%, respectively).
- The CPPA-G contributed ~93.4% to the overall power generated in FY25, while KE comprised the remaining ~6.6%. In addition, Pakistan also imports some power from Iran.



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## Local | Power Plants

Generation Type	Nature of Entities (Public/Private)	No. of Power Plants	% Share in Country's Installed Capacity (FY25)	Description
<b>Thermal</b>				
IPPs	Private	42	41.0%	Major IPPs include KAPCO, Hub Power, Huaneng Shandong Ruyi, NPPMCL, Port Qasim Electric and China Power Hub.
GENCOs	Public	09	8.7%	Major GENCOs include TPS Muzaffargarh and Jamshoro.
KE – Own	Public	10	6.3%	Major plant includes Bin Qasim TPS-I.
<b>Total</b>		<b>61</b>	<b>56.0%</b>	
<b>Hydel</b>				
WAPDA	Public	22	23.0%	Major Hydropower units include Tarbela, Tarbela 4 <sup>th</sup> extension, Ghazi Barotha and Mangla
IPPs	Public/ Private	11	5.1%	Warsak units. Among the IPPs, Karot Hydropower has the largest installed capacity.
<b>Total</b>		<b>33</b>	<b>28.1%</b>	
<b>Nuclear</b>				
CHASHNUPP & KANUPP	Public	07	8.8%	CHASHNUPP (I, II, III, IV) with installed capacities of ~1,330 MW and KANUPP (I, II & III) with installed capacities of ~2,290 MW.
<b>Total</b>		<b>07</b>	<b>8.8%</b>	
<b>Renewables</b>				
Wind IPPs	Public/Private	36	4.5%	All projects have individual installed capacities of less than ~100 MW.
Solar IPPs	Public/Private	07	2.0%	All projects have individual installed capacities of ~100 MW or less.
Bagasse/ Biomass	Public/Private	09	0.6%	All projects have individual installed capacities of ~100 MW or less except Fatima Energy (installed capacity of ~120 MW).
<b>Total</b>		<b>52</b>	<b>7.1%</b>	
<b>Total Installed Power Plants</b>		<b>153</b>	<b>100%</b>	

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## Local | Plant-wise Installed Capacities

The CPPA-G basket includes all Power Generation Plants of the country except those falling in the K-Electric (KE) ambit. KE is responsible for generating, transmitting, and distributing electricity to all the residential, commercial, industrial, and agricultural areas of Karachi and its outskirts.

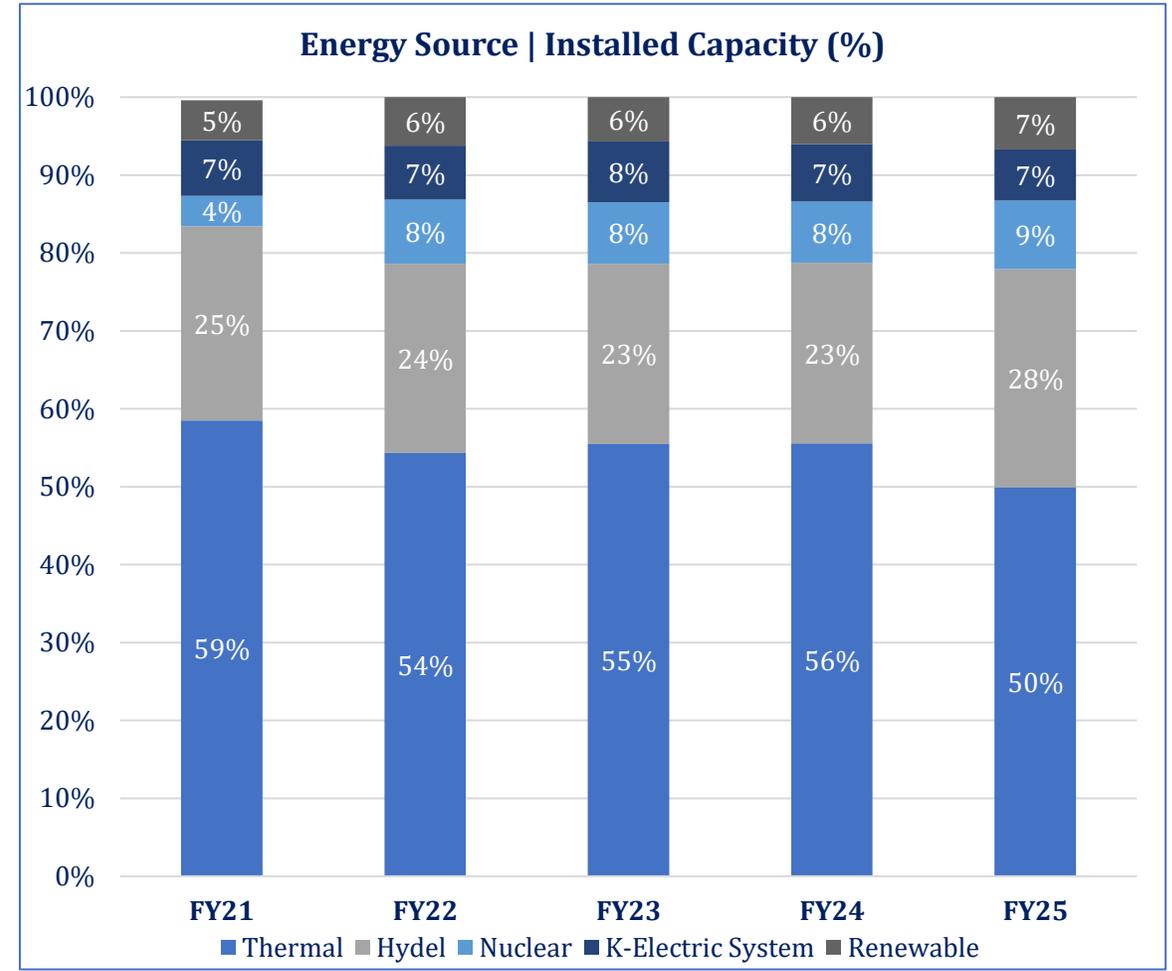
% Share in Installed Capacity	FY21	% Share	FY22	% Share	FY23	%Share	FY24	% Share	FY25	%Share
<b>CPPA-G System</b>	<b>36,930</b>	<b>93.0%</b>	<b>40,813</b>	<b>93.0%</b>	<b>42,362</b>	<b>92.0%</b>	<b>42,512</b>	<b>93.0%</b>	<b>38,431</b>	<b>93.0%</b>
<i>Hydel</i>	<b>9,915</b>	<b>25.0%</b>	<b>10,635</b>	<b>24.0%</b>	<b>10,635</b>	<b>23.0%</b>	<b>10,635</b>	<b>23.0%</b>	<b>11,500</b>	<b>28.0%</b>
- WAPDA	9,443	24.0%	9,389	22.0%	9,389	20.0%	9,389	20.0%	9,389	23.0%
- IPPs	472	1.0%	1,246	3.0%	1,246	3.0%	1,246	3.0%	2,111	5.0%
<i>Thermal</i>	<b>24,972</b>	<b>59.0%</b>	<b>23,821</b>	<b>54.0%</b>	<b>25,490</b>	<b>55.0%</b>	<b>25,490</b>	<b>56.0%</b>	<b>20,544</b>	<b>50.0%</b>
- GENCOs	4,881	12.0%	4,731	11.0%	4,587	10.0%	4,587	10.0%	3,572	9.0%
- IPPs	17,276	43.0%	18,750	43.0%	20,563	45.0%	20,563	45.0%	16,632	40.0%
- SPPS/CPPs	340	1.0%	340	1.0%	340	1.0%	340	1.0%	340	1.0%
<i>Nuclear</i>	<b>2,475</b>	<b>4.0%</b>	<b>3,620</b>	<b>8.0%</b>	<b>3,620</b>	<b>8.0%</b>	<b>3,620</b>	<b>8.0%</b>	<b>3,620</b>	<b>9.0%</b>
<i>Renewable</i>	<b>2,043</b>	<b>5.0%</b>	<b>2,737</b>	<b>6.0%</b>	<b>2,617</b>	<b>6.0%</b>	<b>2,767</b>	<b>6.0%</b>	<b>2,767</b>	<b>7.0%</b>
<b>K-Electric System</b>	<b>2,842</b>	<b>7.0%</b>	<b>3,022</b>	<b>7.0%</b>	<b>3,578</b>	<b>8.0%</b>	<b>3,376</b>	<b>7.0%</b>	<b>2,690</b>	<b>7.0%</b>
KE - Own	2,084	5.0%	2,345	5.0%	2,816	6.0%	2,816	6.0%	2,396	6.0%
IPPs	366	1.0%	366	1.0%	366	1.0%	366	1.0%	104	0.0%
SPPs/CPPs	155	0.0%	151	0.0%	94	0.0%	94	0.0%	90	0.0%
KANUPP	137	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%
Solar	100	0.0%	100	0.0%	302	0.0%	100	0.0%	100	0.0%
<b>Total (CPPA-G + KE)</b>	<b>39,772</b>	<b>100%</b>	<b>43,835</b>	<b>100%</b>	<b>45,940</b>	<b>100%</b>	<b>45,888</b>	<b>100.0%</b>	<b>41,121</b>	<b>100%</b>

*Note: The breakdown reflects installed and not dependable capacities.*

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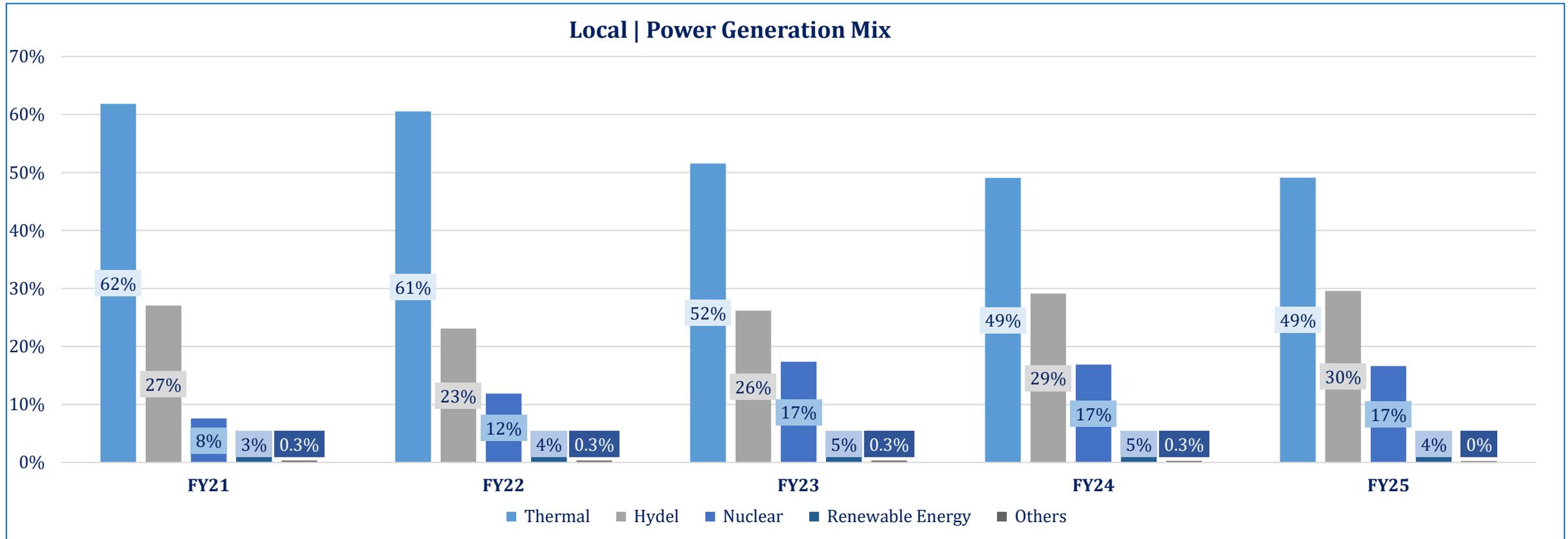
## Energy Source | Installed Capacity

- The total installed capacity of the country as of FY25 stood at ~41,121MW, decreased by ~10.4% from FY24 (~45,888 MW), and comprised the following:
  - Thermal (~20,544 MW), decreased from FY24 (~25,490 MW);
  - Hydel (~11,500 MW), increased from FY24 (~10,635 MW);
  - Nuclear (~3,620 MW), remained the same as in FY24;
  - Renewables (~2,767 MW) remained the same as in FY24.
  
- Total dependable capacity was recorded at ~38,474 MW in FY25 (FY24: ~41,041 MW), down ~6.3% YoY. With respect to the CPPA-G system, dependable capacities for Hydel, Thermal, Nuclear, and Renewables stood at ~11,448 MW (up ~7.3% YoY), ~18,479 MW (down ~12.3% YoY), ~3,266 MW (down ~1.8% YoY), and ~2,758 MW (up ~0.04% YoY), respectively.
  
- Meanwhile, KE system recorded ~2,523 MW in FY25, decreased by ~21.6% from FY24 (~3,217MW) in its overall dependable capacity.



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## Local | Power Generation Mix

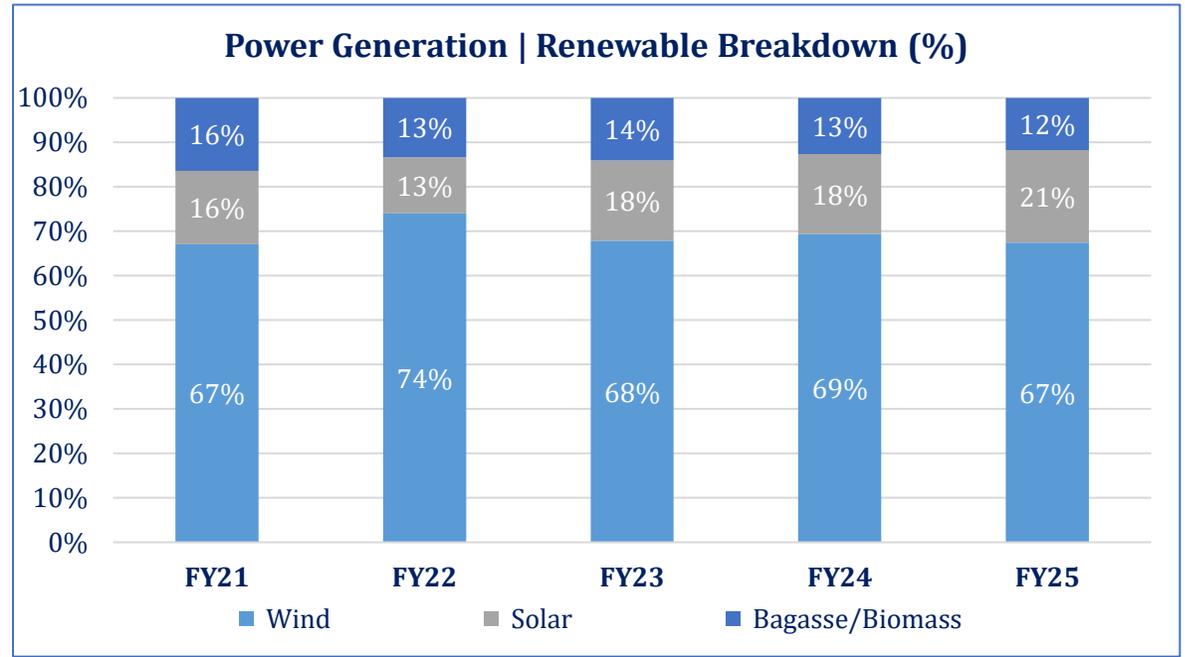
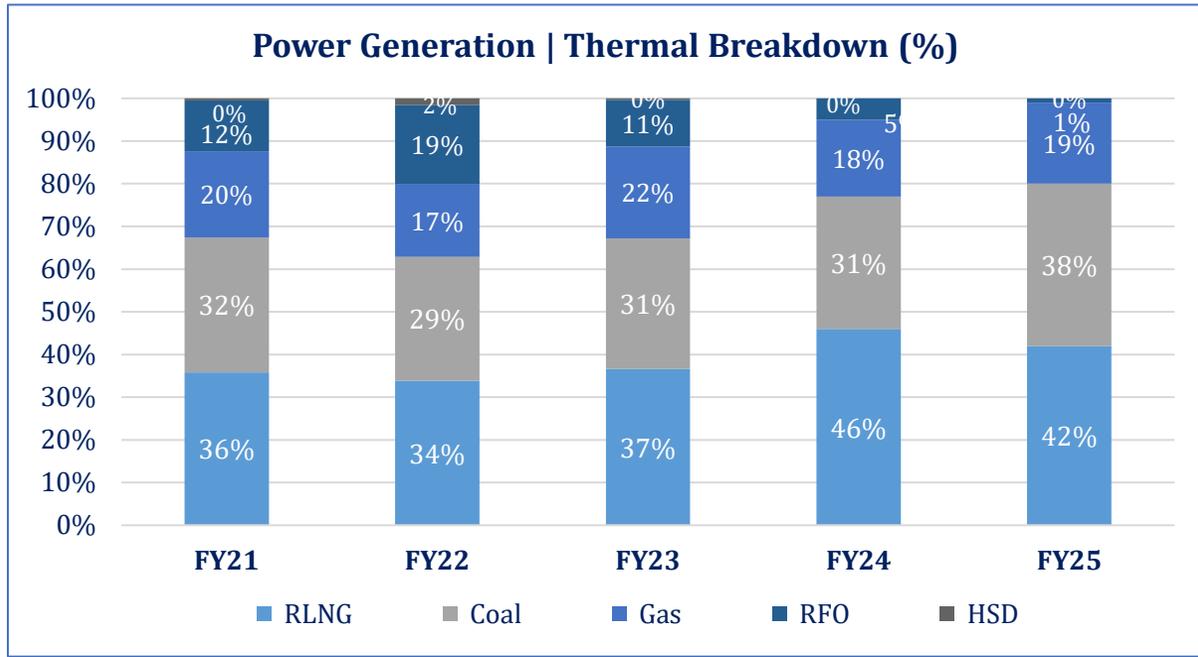


- Similar to the installed capacity pattern, thermal fuels continue to dominate the country’s power generation mix. However, amid rising fuel charges and the depletion of local natural gas reserves, the GoP is gradually steering the energy mix toward hydel and other renewable sources in place of thermal-based generation. During FY25, power generation from renewables did not witness any significant change and remained broadly in line with FY24 levels.

*Note: Others include electricity imported from Iran.*

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## Fuel-wise Generation Mix | Thermal & Renewable Breakdown



- Within the thermal generation segment, the fuel mix has undergone a notable shift over the past few years. Reliance has moved away from Natural Gas (FY21: ~20.0%) and RFO (FY21: ~12.0%) towards RLNG (FY25: ~42.0%) and Coal (FY25: ~38.0%). This transition has been primarily driven by the depletion of local natural gas reserves and the relatively higher generation costs associated with RFO-based power plants.
- Renewable energy continues to remain the cheapest source of power generation. Despite its cost advantage, the renewable segment's (excluding hydel) potential remained underutilized in FY25. Hydel accounted for ~30.0% of total Power generation, reflecting an increase of ~1.0% YoY. Meanwhile, solar, wind, and bagasse collectively contributed ~3.0% to the overall Power mix of the country.

## Power Generation Companies | IPPs

### Brief History

- Until the 1980s, Pakistan was continually facing the chronic issue of power shortage due to the rapidly increasing power demand (~7%-8% YoY) and lower supply. The disruption in power supply was impeding the country's industrial progress. This situation called for an immediate intervention by the GoP.
- Because developing power generation capacity is capital-intensive and could absorb a high portion of the allocated federal budget, the GoP made a principled decision to seek private sector investment in power generation. For this purpose, a dedicated organization, PPIB, was created as a one-window facilitator for attracting private investment in the power sector.
- HUBCO was the first private power generation project in Pakistan, founded in 1994. As of End-October'25, the Power Sector comprises GENCOs, WAPDA, and IPPs, with a total of 90 IPPs distributed under Renewable (55 IPPs), Thermal (30 IPPs), and hydel (5 IPPs) mix.
- Private Power Projects include Foreign-Local partnerships, including groups like Nishat, Sapphire, Attock, Engro and Fauji group.

### Key Features

- IPPs are governed under Implementation Agreements (IAs), Power Purchase Agreements (PPAs) and fuel/gas supply agreements.
- The long-term nature of the PPAs (spanning 25-30 years) shields them from adverse macroeconomic changes. Moreover, the underlying take-or-pay mechanism, established under the PPAs, insulates them from risk arising due to variations in the quantity of power purchased from them (through capacity charges).
- IPPs operate in a single buyer market – the CPPA-G (and KE in its respective geography). Under the IA between the GoP and the IPPs, a Guarantee is provided by the GoP of the payment obligations of the Power Purchaser. Any failure of the Power Purchaser to fulfil its payment obligations towards the IPPs is secured by the Government Guarantee.
- Minimum Equity Requirement for the IPPs is set at ~20% of the total project cost. Tariffs for the IPPs are determined by NEPRA and can be determined via (i) Upfront Tariff, (ii) Cost-Plus Tariff and (iii) Competitive Bidding.

## Power Generation Companies | WAPDA

- Pakistan Water & Power Development Authority (WAPDA), established through an Act of Parliament in 1958, is an autonomous and statutory body under the Federal Government's control. It operates with four verticals, namely, (i) Power Wing (ii) Water Wing (iii) Finance Wing, and (iv) Administration Wing.
- The Power Wing is responsible for the operation and maintenance of the Hydel Power Stations, electricity produced from which is delivered to the NTDC grid system, and invoices raised to CPPA-G according to the tariff approved by NEPRA. Presently, WAPDA is operating ~22 Hydel Power Plants with an installed capacity of ~8,420MW (~23% of the total system capacity).
- Hydel generation is the cheapest electricity source in the country, therefore, plays a pivotal role in the development of the economic and social sectors by stabilizing the overall power tariff for the consumers.
- During CY25, WAPDA's hydel stations generated 33.12Bn units of electricity that amounted for ~23% of the total national generation at an average tariff of PKR ~3.83/kWh, that is lower than the generation from other sources.



## Upcoming Hydel Projects | WAPDA

### Projects Under Construction

Sr.	Project Name	Generation Capacity (MW)	Annual Energy (GWh)	Location	Expected Completion Date
1.	Mohmand Dam	800	2,862	Swat River, KP	Dec'27
2.	Diamer Basha Dam	4,500	18,097	Indus River, Near Chilas	Oct'30
3.	Dasu Hydropower Project	4,320 (Stage-I: 2,160)	21,485	Indus River, ~74Km downstream of Diamer Basha	Dec'27
4.	Tarbela 5 <sup>th</sup> Extension	1,530 (3 units, 510 each)	1,347	Indus River, KP	May'26
<b>Total</b>		<b>11,150</b>	<b>43,791</b>		



*Mohmand Dam*



*Diamer Basha Dam*



*Dasu Hydropower Project*



*Tarbela 5<sup>th</sup> Extension*

- Of the ~11 hydel projects under construction, the table above depicts four, with the potential of providing ~43,791GWh. The others include the Kachhi Canal, Nai Gaj Dam, Kurram Tangi Dam, and Keyal Khwar Hydropower. Some of these projects are facing delays due to various issues like security, financing, complex design etc.
- Moreover, ~5 projects are ready for construction, namely, Naulong Dam, Bunji, Lower Spat Gah, Lower Palas Valley Hydropower and Chashma Right Bank Canal Project.

## Upcoming Hydel Projects | IPPs

Sr.	Projects	Expected Capacity (MW)	Location	Expected Completion Date	Status
1	Raili-II Hydropower**	7.1	Ghori Wala Nullah, Muzafarrabad AJK	Dec'26	TLOS issued. Under Construction.
2	Turtonas- Uzghor Hydropower Project	82.3	Golen Gol River, Chitral, KP	Dec'29	LOI Issued. FS completed and approved by POE.
3	Azad Pattan Hydropower*	700.7	Jhelum River, Sudhnoti, AJK	Sep'33	LOS issued.
4	Kohala Hydropower*	1,124.0	Jhelum River, Barsala, AJK	Mar'34	LOS issued.
5	Mahl Hydropower	640	Jhelum River, AJK/PUNJAB	Dec'33	LOI Issued. FS completed and approved by POE. Tariff determined by NEPRA.
6	Ashkot Hydropower	300	Neelum River, AJK		Project has been transferred by GoAJK to PPIB for further processing as per IGCEP.
7	Athmuqam Hydropower	450	Neelum River, AJK		LOI Issued. FS completed and approved by POE.
8	Rajdhani Hydropower Project	132	Pooch River, AJ&K		To be processed as per the requirements of new capacity in the IGCEP.
9	Kaigah Hydropower Project	548	Kaigah, Indus River, KP		
10	Chakothei-Hattian Hydropower Project	500	Muzaffarabad, AJ&K		
11	Neckeherdim-Paur Hydropower Project	80	Yarkun River, Chitral Valley KP		
<b>Total</b>		<b>4,564.10</b>			

## Upcoming Solar Projects | IPPs

- During FY25, ~10 solar projects were successfully integrated into the national grid, bringing the total installed solar capacity to ~680 MW. Other solar projects currently in progress are outlined below.

Sr.	Upcoming Projects	Expected Capacity (MW)	Location	Expected Completion Date	Status
1.	Zorlu Solar Pakistan Ltd.	100.0	Bahawalpur, Punjab	Dec'26	TLOS issued. Decision on Tariff Petition is awaited from NEPRA.
2.	Siachen Energy Ltd.	100.0	District Thatta, Sindh	Jun'28	Tariff determination is awaited from NEPRA.
<b>Total</b>		<b>381.8</b>			

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## Upcoming Projects | Wind | IPPs

- As of FY25, thirty-six (~36) wind power projects of ~1,845MW cumulative capacity have achieved Commercial Operation and are supplying electricity to the National Grid.
- Of these, ~5 (located in Thatta) fall under the ambit of CPEC with a cumulative capacity amounting to ~297 MW.

Wind Power Plants   Under Construction				
Project Name	Expected Capacity (MW)	Expected Commissioning Year	Location	Status
Western Energy Pvt. Ltd.	50	Jun'28	Jhampir District, Thatta	Tariff determination is awaited from NEPRA.
Transatlantic Energy Pvt. Ltd	50	Jun'28	Jhampir District, Thatta	Tariff determination is awaited from NEPRA
<b>Total</b>	<b>100</b>			

## Local | Generation License & CODs

During FY25, 3 licenses were issued with a cumulative capacity of ~810.9 MW. Following is the list:

### 1. Furnace Oil

1. Nestle Pakistan Limited (~12.5 MW)
2. Nestle Pakistan Limited (~21.7 MW)

### 2. Natural Gas

1. Central Power Generation Company Limited (~776.7 MW)

Capacity and Generation Licenses   Overview										
Type	FY21		FY22		FY23		FY24		FY25	
	No. of Licenses	Capacity (MW)								
Hydel	1	55	0	0	1	565.65	0	0	0	0
Solar	4	294.1	1	152.12	4	655.7	2	245	0	0
Thermal	-	-	0	0	0	0	0	-	3	810.9
Wind	18	49.7	9	34.74	5	7.62	6	10.6	0	0
Nuclear	1	1,145	0	0	0	0	0	-	0	0
Bagasse	3	47.6	0	0	0	0	0	-	0	0
Coal	-	-	1	10	0	0	0	-	0	0
Solid waste	-	-	0	0	0	0	0	-	0	0
RLNG	-	-	1	4.56	0	0	0	-	0	0
<b>Total</b>	<b>27</b>	<b>1,591</b>	<b>12</b>	<b>201</b>	<b>10</b>	<b>1229</b>	<b>8</b>	<b>256</b>	<b>3</b>	<b>810.9</b>

## Local | Tariff Determination

- Determined by NEPRA, tariffs are structured to recover costs charged by GENCOs, energy charges, and DISCOs margin to cover operation and maintenance (O&M) and administrative costs, depreciation, and rate of return.
- The GoP rates are notified with delays and also deviate from the recommended rates, thereby creating cash shortages for the DISCOs.

### Generation

- Tariff is determined based on the power purchase agreements (PPAs) between power producers (IPPs and GENCOs) and a single buyer – Central Power Purchasing Agency (CPPA-G).
- This tariff has three components: (1) Capacity Charge (CC) – majorly including construction and design costs of power units, debt financing charges, and ROE (2) Energy Charge (EC) – majorly including the price of fuel and (3) Variable Operations & Maintenance Costs (O&M).
- In Pakistan’s IPP framework, Capacity Charges are indexed to exchange rates and interest rates and are paid on a “take-or-pay” basis, meaning producers receive payment as long as the plant is available, regardless of dispatch. In contrast, variable charges depend on actual generation and fuel prices. The GoP is renegotiating IPP agreements to move toward a more dispatch-linked “take-and-pay” model, especially for new or revised contracts.

### Transmission

- Tariff includes the ‘Use of System Charge (UoSC) payable to NTDC.
- This amount is calculated using NTDC’s required revenue (after incorporating certain permissible expenses) divided by the sum of the maximum demand index of all DISCOs and bulk power consumers connected to the NTDC transmission network.

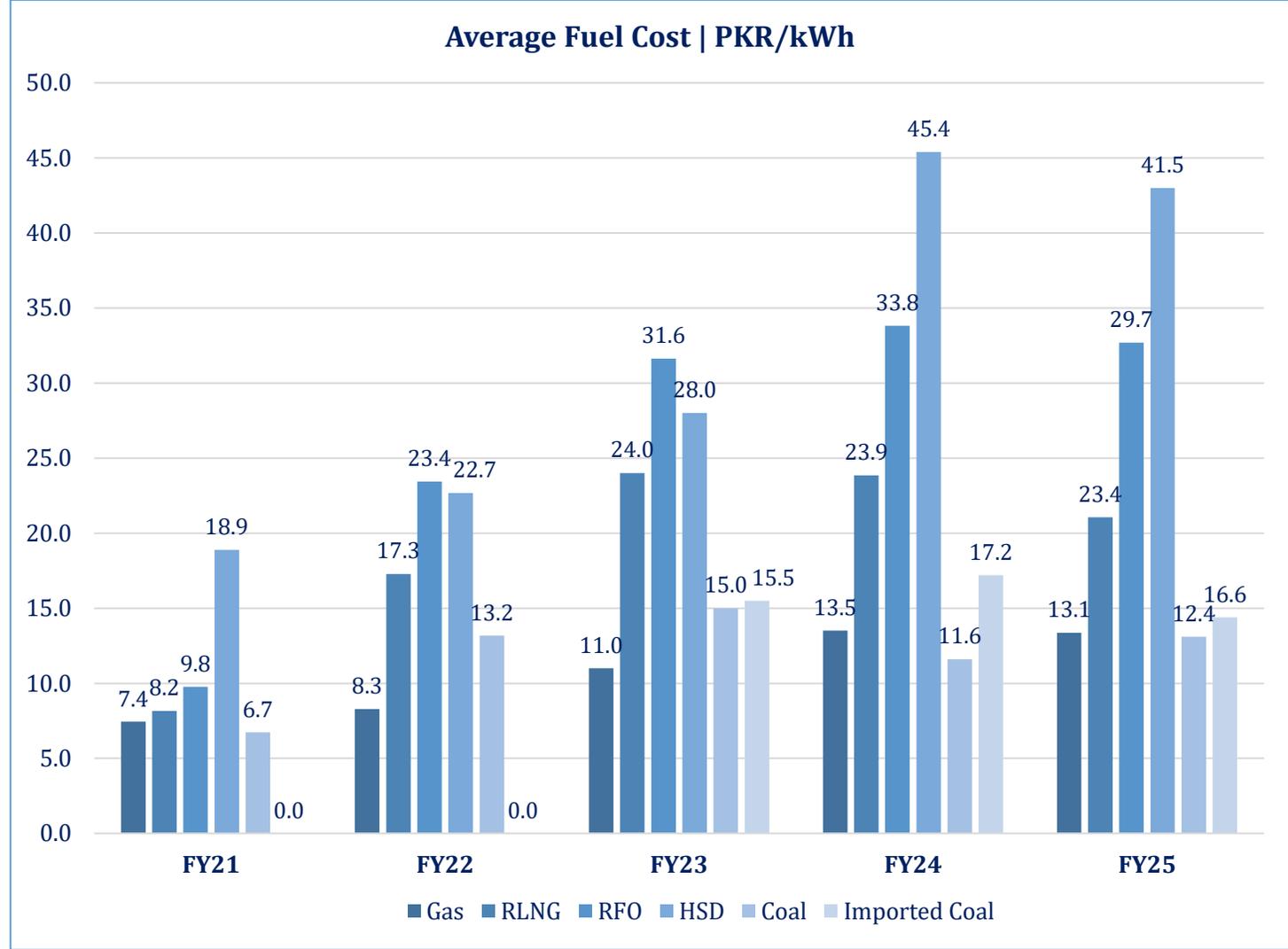
### Distribution

- This includes tariffs determined at the generation and transmission levels (CC + EC + O&M + UoSC) as well as fixed distribution margins of the DISCOs. Additionally, this tariff also includes allowed transmission and distribution losses.
- While the end-user tariff is determined by NEPRA, the actual tariff is notified by the GoP to unify tariff across all DISCOs.

# POWER

## Local | Average Fuel Cost

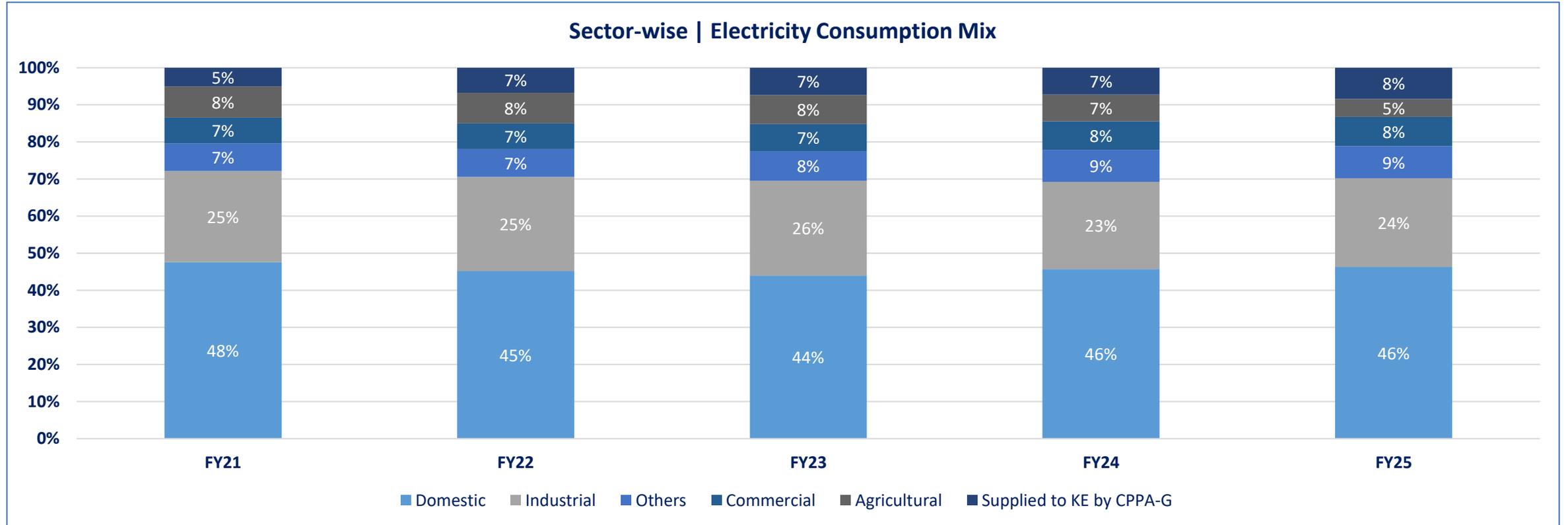
- During FY25, the generation cost of power (using thermal sources) comprised ~82% of the consumer-end tariff, net of taxes. The cheapest sources of fuel are renewable energy sources.
- In FY25, WAPDA’s average hydel electricity cost remained PKR~3.8/kWh, unchanged from FY24, while thermal generation averaged PKR~19.8/kWh (FY24: PKR~21.0/kWh).
- During FY25, HSD and RFO continued to be the most expensive fuel sources. However, their combined share in the country’s generation mix was reduced to only ~0.41% of the total generation mix of the country.
- Conversely, local coal was the cheapest fossil fuel in FY25, averaging PKR~12.4/kWh (FY24: PKR~11.6/kWh), while imported coal stood at PKR~16.6/kWh (FY24: PKR~17.2/kWh).
- In FY25 RLNG fuel cost reduced to PKR ~23.4/kWh (FY24: PKR ~23.9/kWh), while fuel cost by natural gas decreased to PKR ~13.1/kWh (FY24: PKR ~13.5/kWh).



*Note: Prior to FY23, average fuel cost for Coal had included both the local and imported components, whereas for FY24, these have been reported separately.*

## Local | Sectoral Power Consumption

Totals stated in GWh



- Pakistan’s overall power consumption increased by ~3.02% YoY in FY25 (FY24: ~-3.06%), equivalent to ~90.0% of the total power generated during the year. Domestic consumers remain the largest consumption segment followed by industrial consumers. The average power consumption per capita was recorded at ~748.11 kWh in FY25 (SPLY: ~737.0 kWh).
- In FY25, transmission losses in the CPPA-G system stood at ~2.57% (SPLY: ~2.52%), while distribution losses declined to ~17.6% (FY24: ~18.3%).

*Note: “Others” refers to ‘public lighting, bulk supply and Others’, as per NEPRA’s disclosure. The data includes both systems i.e., CPPA-G and KE.*

# POWER

## Local | Sectoral Tariffs

- Residential and commercial consumers are charged the highest average tariffs among the peer groups. In contrast, industrial and agriculture sectors are charged the lowest, due to different subsidies provided for the end-consumers as well as the low base effect of hydel fuel charges.
- For FY25, average tariffs for residential, commercial, industries, and agriculture segments were revised to PKR~41.30/kWh, PKR~39.92/kWh, PKR~30.68/kWh, and PKR~36.85/kWh, respectively.

Sector	FY22	FY23*	FY24	FY25
	Uniform Determined Tariff – Variable Charges (PKR/kWh)			
<b>Residential</b>	26.64	20.73	32.25	38.15
<b>Commercial</b>	26.58	29.55	34.25	34.52
<b>Industrial</b>	24.8-27.8	25.42	30.2-34.4	26.06-28.64
<b>Agricultural</b>	25.11	16.6-29.85	24.5-38.5	29.63-35.84

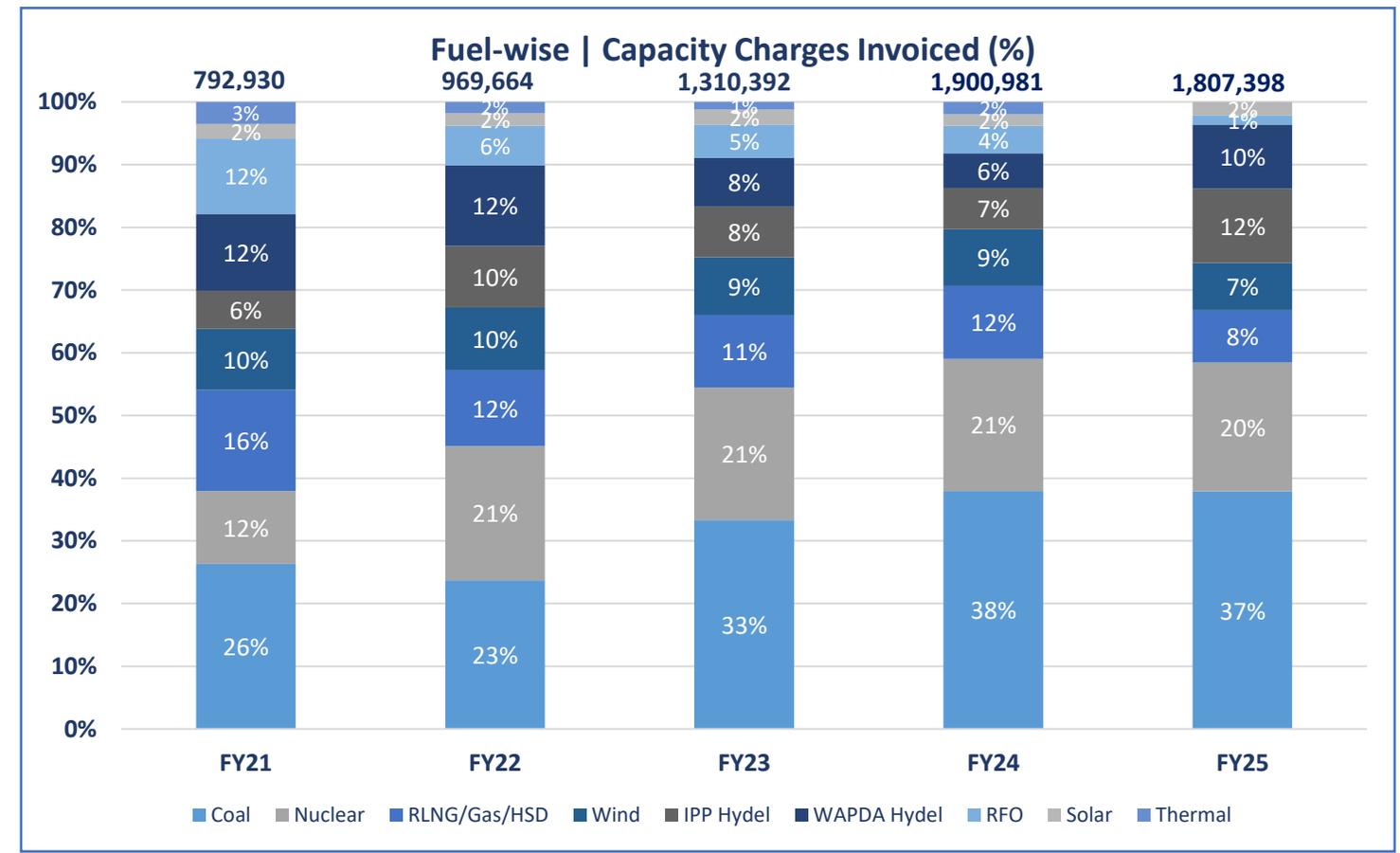
*Note: The ranges reflect Time of Use. Data is for Off-peak hours. \*Oct'22 onwards*

# POWER

## Local | Fuel-wise Capacity Charges

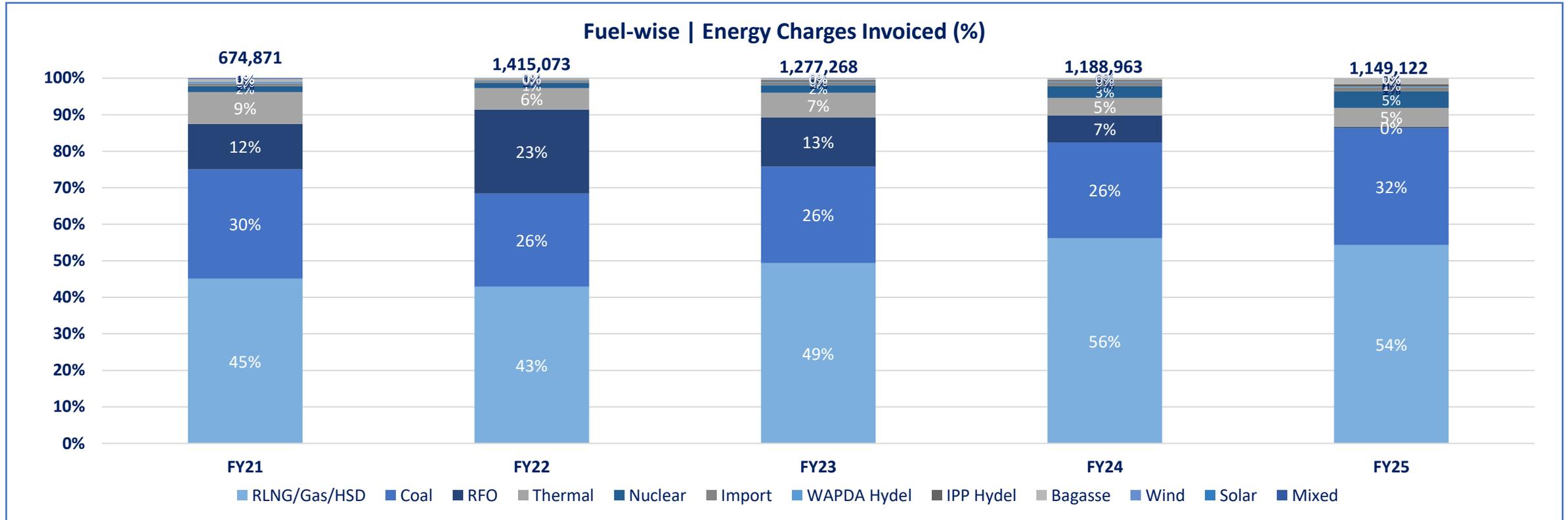
Totals stated in PKR mln.

- Most of the PPAs with base load thermal power plants are capacity-based 'Take or Pay' contracts under which capacity payments are necessarily required to be paid against available generation capacity irrespective of whether it was utilized or not.
- The 'Take or Pay' compulsion calls for maximum utilization of such power plants to avoid unnecessary capacity payments which translate into a higher per unit cost of electricity for the end-consumers.



## Local | Fuel-wise Energy Charges

Totals stated in PKR mln.



- Energy charges invoiced by IPPs declined by ~3.4% in FY25 (SPLY: ~6.9% YoY decline). RLNG/Gas/HSD, RFO, and coal collectively accounted for ~86.0% of the total energy charges.
- Among fuel categories, RLNG dispatch recorded the largest decline, decreasing by ~6.5% YoY. In contrast, energy charges related to coal-based generation increased significantly, rising by ~17.3% YoY. Coal contributed ~54.0% to total energy charges during the period (SPLY: ~56.0%).

# POWER

## Demand & Supply during Peak Hours | NTDC & KE

NTDC Network			
Year	Generation Capability (MW)	Demand During Peak Hours (MW)	Surplus/(Deficit) MW
<b>Actual</b>			
FY21	27,819	28,253	434
FY22	27,748	24,564	3,184
FY23	30,574	23,679	6,895
FY24	31,182	24,485	6,697
FY25	24,733	23,848	885

Year	Planned Generation Capability (MW)	Projected Growth Rate (%)	Demand During Peak Hours (MW)	Surplus/(Deficit) MWh
<b>Projected</b>				
FY26	34,243	2.58	27,168	7,075
FY27	34,630	2.59	27,871	6,759
FY27	37,630	6.07	29,562	8,068
FY29	39,356	3.56	30,614	8,742
FY30	39,532	2.86	31,491	8,041

KE Network			
Year	Generation Capability (MW)	Demand During Peak Hours (MW)	Surplus/(Deficit) MW
<b>Actual</b>			
FY21	3,202	3,604	(402)
FY22	3,383	3,670	(285)
FY23	3,409	3,654	(245)
FY24	3,550	3,568	(18)
FY25	3,545	3,707	(162)

Year	Planned Generation Capability (MW)	Projected Growth Rate (%)	Demand During Peak Hours (MW)	Surplus/(Deficit) MWh
<b>Projected</b>				
FY26	4,173	4.24	3,926	247
FY27	4,197	4.24	4,158	39
FY28	4,269	4.24	4,261	8
FY29	4,882	4.24	4,441	441
FY30	4,882	4.24	4,562	320

*Note: 'Generation Capability' is the maximum generation capability of any day recorded during the year and 'Demand' is the maximum demand of any day recorded during the year.*

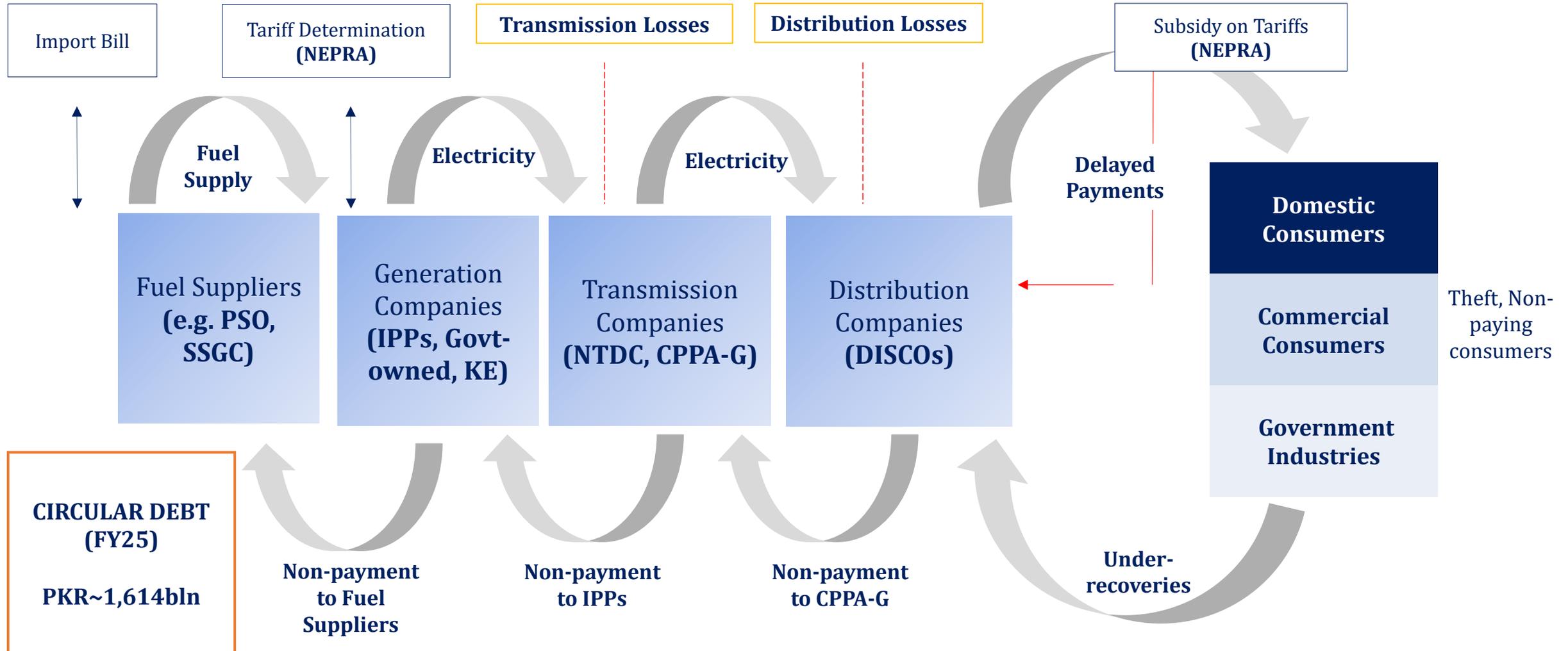
## Circular Debt | The Unfortunate Menace

- **Circular Debt is the net unfunded outstanding liability position of the power distribution companies (DISCOs) to the Central Purchasing Power Authority-Guarantee (CPPA-G)**, which further cascades into delayed settlement of payment obligations by the CPPA-G to the Power Generation Companies (GENCOs)/Independent Power Producers (IPPs). The cash gap at the CPPA-G is bridged through borrowings by Power Holding Private Limited (PHPL) to settle CPPA-G's debts.
- The **five key contributors** include, (i) High cost of power generation, (ii) delays in tariff determination, (iii) high transmission and distribution (T&D) losses and poor revenue collection by the DISCOs, (iv) partial (and often delayed) tariff differential subsidies (TDS) payment by the GoP to the DISCOs and K-Electric (KE), and (v) high financial costs on PHPL borrowing, and late-payment penalty charges on CPPA-G payables.

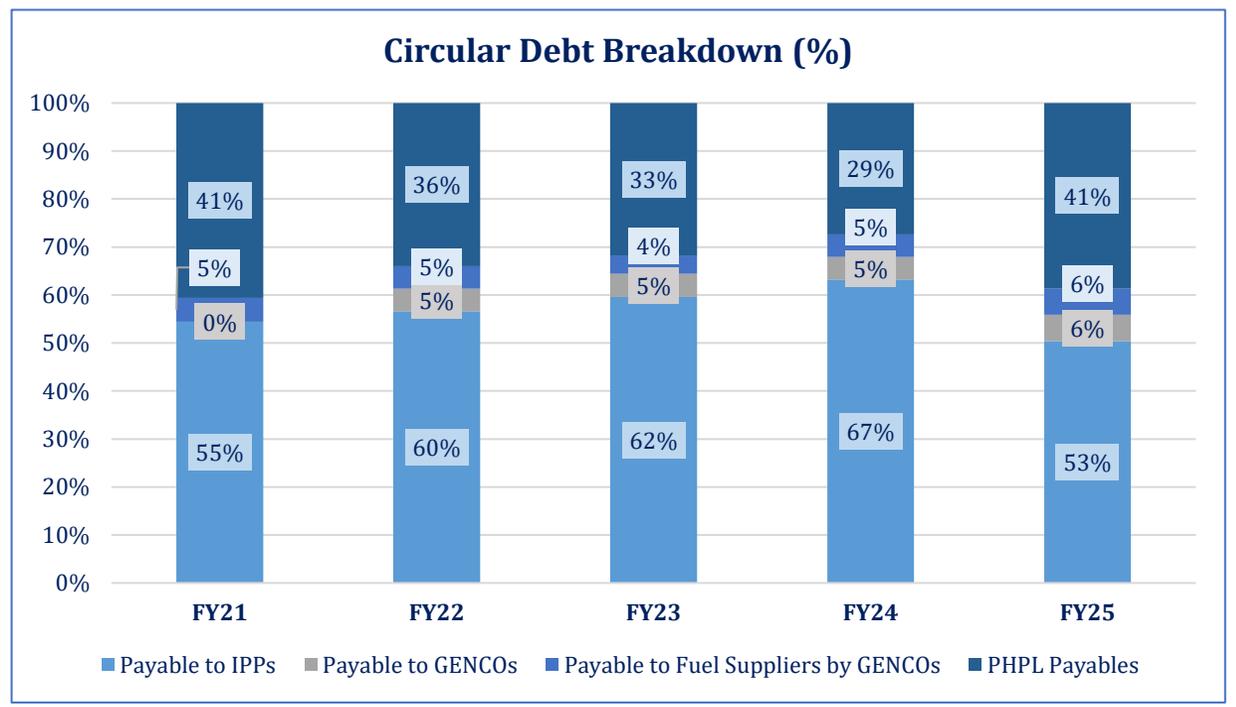
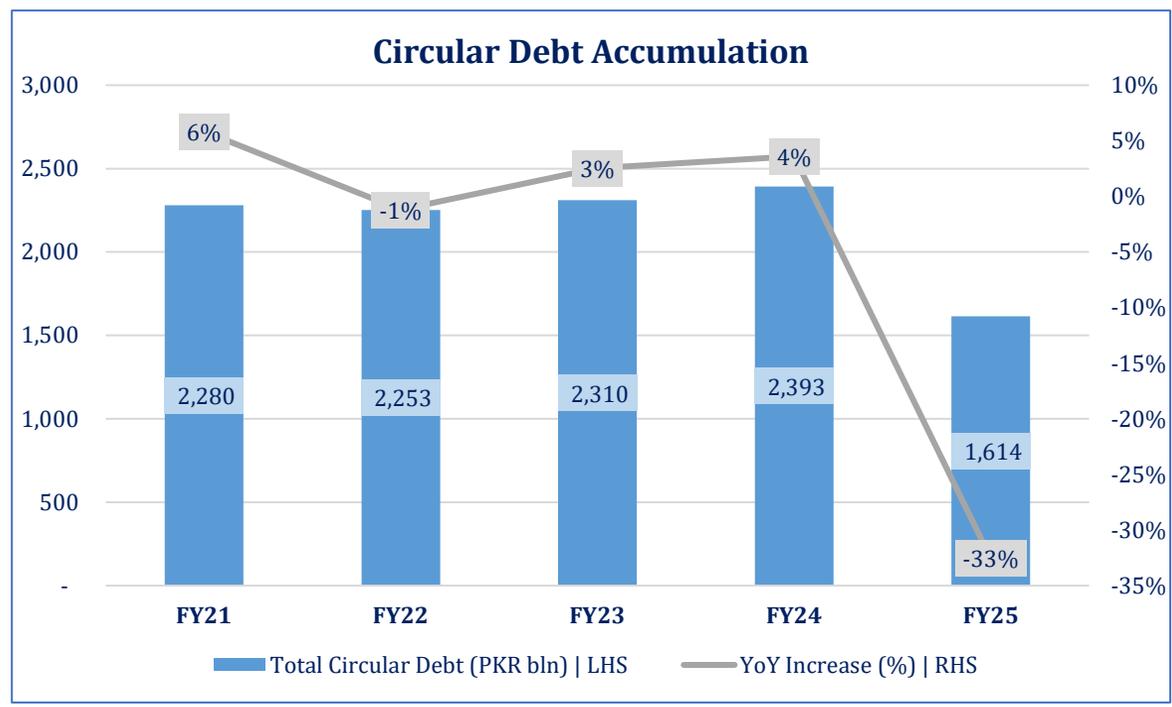


# POWER

## Circular Debt | How it Flows



## Local | Circular Debt Stock



- Pakistan’s total circular debt decreased to PKR~1,614bln in FY25, down by ~33% YoY, as the GoP made it a priority to reduce the quantum of circular debt. This underscoring ongoing improvements in the Sector’s financial management. During the said period, circular debt made up ~1.4% of the country’s GDP (taken at current prices) (FY24: ~2.3%).
- However, as of End-September’25, the stock was up by a marginal ~4.9% to PKR~1,693bln, as compared against End-Jun’25. Payables to IPPs and PHPL together accounted for ~94.0% of the circular debt stock in FY25 (SPLY: ~96.0%).

## Local | Circular Debt Flow

- Circular debt affects not only the liquidity of the fuel supplier, generation, transmission, and distribution companies but also increases the cost of electricity for the end-consumer.
- In FY25, despite DISCOs' shortfall adding PKR~397bln to the circular debt through inefficiencies in T&D losses and low recovery ratios, the overall circular debt decreased in comparison to the last year.
- T&D losses receded to ~17.6% in FY25 (FY24: ~18.3%) while, recoveries against the billed amount climbed to ~96.6% (SPLY: ~92.4%). The shortfall in the recovery and T&D losses contributed 132.5bln and 265bln respectively to circular debt.
- In FY25, receivables for DISCOs continued to surge and were registered at PKR~2,160.1bln (SPLY: PKR~2,017.1bln), an increase of PKR~129bln. Delays in subsidy payments and increasing receivables from public and private consumers are some of the major contributing factors to the mounting power circular debt.

Figures are stated in PKR bln.

Break-up of Increase/ (Decrease)	FY24	FY25	3MFY25	3MFY26
Budgeted but unreleased subsidies	0	28	71	-19
Unclaimed Subsidies	-63	0	0	0
IPPs Interest Charges on delayed payments	138	58	48	67
PHL Markup paid out of IPPs' claims				
Pending Generation Cost (QTAs + FCA)	145	-85	-13	5
Non-payment by K-Electric	-155	4	1	33
DISCOs Losses Inefficiencies	276	265	133	87
DISCOs Under Recoveries	125	132	126	84
Other Adjustments	-198	-358	-269	-178
PHL Principal Repayments	-82	-24	-	-
PHL Unpaid Markup	-	-	-	-
Stock Payments	-292	-801	-4	-
<b>Total Debt Increase/ (Decrease)</b>	<b>106</b>	<b>-780</b>	<b>73</b>	<b>79</b>

## Local | Recalibrating Circular Debt

### Circular Debt Management Plan (CDMP) 2026

- The GoP has formulated a comprehensive Circular Debt Management Plan aimed at curtailing circular debt and achieving a net-zero power sector circular debt flow by FY26, while containing sector subsidies at PKR 893bln (0.7% of GDP). As per the IMF second review of EFF, in Dec'25, the following key measures were established to achieve these targets:
  - A commercial bank loan facility of PKR 1,225bln was obtained to convert PKR 660bln PHL and other debt to lower interest bank debt and PKR 565bln in fresh financing. Waiver on interest to the tune of PKR 128bln due to the remaining IPPs.
  - Incentivizing transitioning of the Captive Power Plants to the electricity grid.
  - A three-year incremental pricing package for industrial and agricultural users.
  - Privatization of DISCOs namely IESCO, GEPCO and FESCO.
  
- The Power Sector's circular debt flow outperformed targets in FY25, driven by lower international hydrocarbon prices, improved recoveries, reduced transmission losses, and declining interest rates. These improvements generated subsidy savings for the Power Sector and strengthened overall financial performance. However, containing circular debt will be critical. The GoP is introducing "minimum fixed payment" mechanism for lower slab consumers to reduce the burden and improve collections.

## Local | Recalibrating Circular Debt

### IPPs | Amendments to the PPAs

- In CY21, the Government of Pakistan (GoP) initiated reforms in the sector to renegotiate the Power Purchase Agreements (PPAs) with the IPPs to reduce the rising power tariffs and contain the increasing accumulation of circular debt. However, most of the negotiation remained unresolved.
- In CY24, GoP resumed the negotiation process with the IPPs and formed a special task force to take charge of it. However, this time, the process did not only involve 'renegotiation' with the IPPs but also an early 'termination' of some of the PPAs.
- Furthermore, renegotiation featured a shift of these agreements from 'Take or Pay' to 'Take and Pay model'.
- In the initial phase of the process, the GoP has terminated PPAs of ~6 IPPs, which were operational under the Power Policy of 1994 and 2002. The GoP, in return, has agreed to clear all outstanding dues on its part as of End-Sep'24, in the context of capacity payments, energy purchase price and pass-through items, by End-Dec'24.
- This is expected to result in savings of PKR~411.0bln to the national exchequer over the remaining contract periods of these IPPs.
- In the second phase, the GoP has successfully negotiated revised agreements with ~8 bagasse based IPPs and ~14 additional IPPs established under the 1994 and 2002 Power Policies.
- These IPPs will be transitioned from a 'Take or Pay' model to a 'Hybrid Take and Pay' model, aiming to improve efficiency and reduce financial burdens. However, the government has yet to reveal whether additional IPPs terminations are planned as part of this restructuring.

## Local | Recalibrating Circular Debt

### IPPs | Amendments to the PPAs | Salient Features of 'Take or Pay' to 'Take and Pay Model'

The Amendment Agreement shall be effective from November 01, 2024.

- Indexation mechanism of O&M has been changed;
- Tariff of Cost of working capital and O&M has been rebased.
- Return on Equity tariff component will be paid in a hybrid take-and-pay mode.
- Insurance premium tariff is capped at 0.9% of EPC Cost.
- The Company will share profits till FY23 and it will be adjusted against receivables from CPPA.
- GOP will unconditionally withdraw Arbitration under Arbitration Submission Agreements (ASA).
- The undertaking provided to the Power Purchaser by the Company to retain its receivables till the conclusion of Arbitration under ASA shall be returned.
- Payment of outstanding receivables as of End-Oct'24, within ~90 days of approval of the Agreement by the Cabinet.
- Waiver of Delay Payments till End-Oct'24.
- The London Court of International Arbitration (LCIA) clause in PPA will be substituted with Islamabad-seated Arbitration under the local laws.

## Policy Framework | Recent Developments

### ▪ **National Electricity Plan 2023-2027 (Proposed Amendments November 2025)**

- Transfer of integrated energy planning responsibility to the Integrated Energy Planning Secretariat instead of the Power Planning and Monitoring Company.
- Privatization of selected DISCOs during FY26, strengthened monitoring of Distributed Energy Resources through Geographic Information System-based assessments with support from SPARCO and updated timelines for Supervisory Control and Data Acquisition (SCADA) deployment and electricity market development.

### ▪ **Fast Track Solar PV Initiatives 2022**

The main objectives of these initiatives are as follows:

- Substitute expensive imported fossil fuels used for power generation with Solar PV energy deployments.
  - Utilize existing transmission networks to the maximum for offtake of electric power for Federally-owned public power utilities (FPU's).
  - Easing the pressure on foreign exchange reserves through reduced reliance on imported fossil fuels.
  - Solarization of Public Buildings.
  - Solar PV Generation on ~11 kV Feeders
- In continuation with the above, the GoP now aims to increase the share of renewable energy in the power mix from ~46%(including hydel) in CY25, having already exceeded its earlier CY25, to an ambitious ~60 % by CY30, supported by rapid deployment of solar, wind and other clean energy sources to reduce electricity costs and enhance sustainability.

## Indicative Generation Capacity Expansion Policy (IGCEP 2025-35)

- The IGCEP 2025–35, prepared under NEPRA Grid Code 2023, provides a 10-year least-cost generation expansion roadmap (2025–2035) integrating demand forecast, generation planning and dispatch optimization.
- Long-term demand projections under Low, Medium and High growth scenarios indicate electricity demand could reach ~219 TWh with peak demand of ~43 GW by CY35; DSM measures aim to improve load factor from ~58% to ~70%.
- Four expansion pathways were evaluated, No Addition, Unconstrained, Forced, and Rationalized Capacity Addition (Reference Case), alongside multiple policy sensitivities including high net-metering (8,120 MW) and market-based procurement.
- The Reference Rationalized scenario signals a structural shift in the energy mix, with ~34% hydropower and ~27% wind & solar by 2035, significantly increasing the share of indigenous and renewable resources.
- Dependence on imported fuels is reduced materially, with imported coal (~7%) and RLNG (~13%) forming a limited portion of the future capacity mix, while RFO becomes negligible.
- Total installed capacity under the reference pathway reaches ~62.7 GW by 2035, ensuring adequate firm capacity from hydro, nuclear, local coal and gas to maintain system reliability.
- Integration of large-scale renewables is supported through hourly demand modeling, Battery Energy Storage System (BESS) assessment, and key transmission reinforcements including NGC–KE interconnection.
- The Present Value (PV) cost of the Reference pathway is estimated at USD ~47bln by CY35. This represents the discounted lifetime cost of generation investments, fixed charges, fuel, and O&M expenses over the planning horizon, evaluated in today's USD terms to enable comparison across alternative expansion scenarios.

# POWER

## Local | Business Risk

This Sector Study focuses on the Business & Financial Risk of Independent Power Producers (IPPs).

**Plant Performance Risk:** This includes, but is not limited to, plant availability, dependable capacity, efficiency measured in terms of electricity generated per type of fuel, penalty payments under the PPA, higher operational costs and loss of revenue due to breakdown of machinery.

**Completion & Performance Risk:** Completion Risk is the pre-COD risk related to the physical construction of the power plant and process parameters. Performance Risk, although begins even before COD, generally refers to the challenges relating to the operations & maintenance of the power plant post-COD.

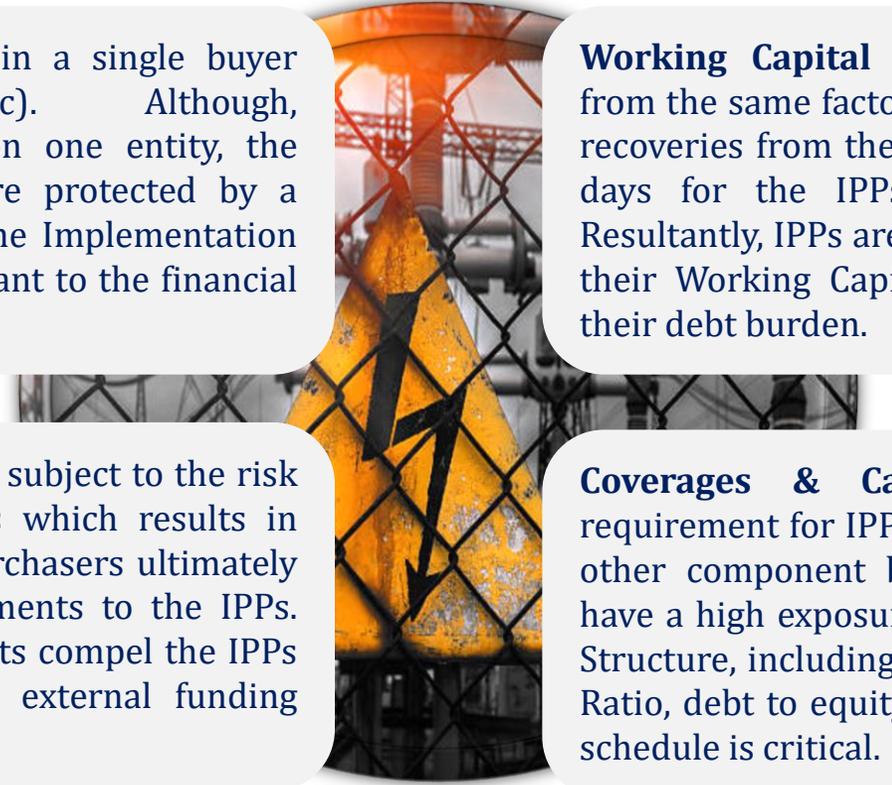
**Fuel Supply Risk (thermal):** In the event of non-performance of the Fuel Supply Agreement (FSA), the IPPs may be subject to operational risks due to underutilization or even closure of plants. This can further include risks associated with the supply of fuels, distance from the source, reserve availability, contractual obligation of the seller and price of supply.

The Government of Pakistan does not guarantee the fuel supplier's obligations. Risks for renewable sources may include wind speed, solar irradiation, and the availability of sufficient crops for bagasse.



# POWER

## Local | Financial Risk



**Off-taker Risk:** IPPs operate in a single buyer market (CPPA-G/K-Electric). Although, dependence is concentrated on one entity, the obligations of the off-taker are protected by a Sovereign Guarantee through the Implementation Agreement. This acts as a mitigant to the financial risk relating to the off-taker.

**Working Capital Financing:** This risk emanates from the same factor as for liquidity risk. Volatility in recoveries from the off-taker balloons the receivable days for the IPPs – a component of the CD. Resultantly, IPPs are forced to obtain STBs to manage their Working Capital Needs, exerting pressure on their debt burden.

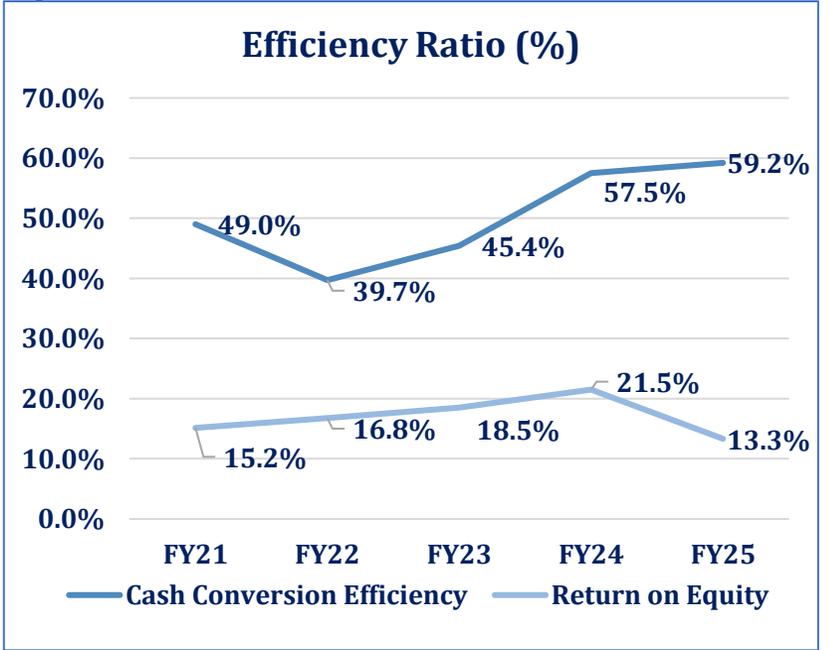
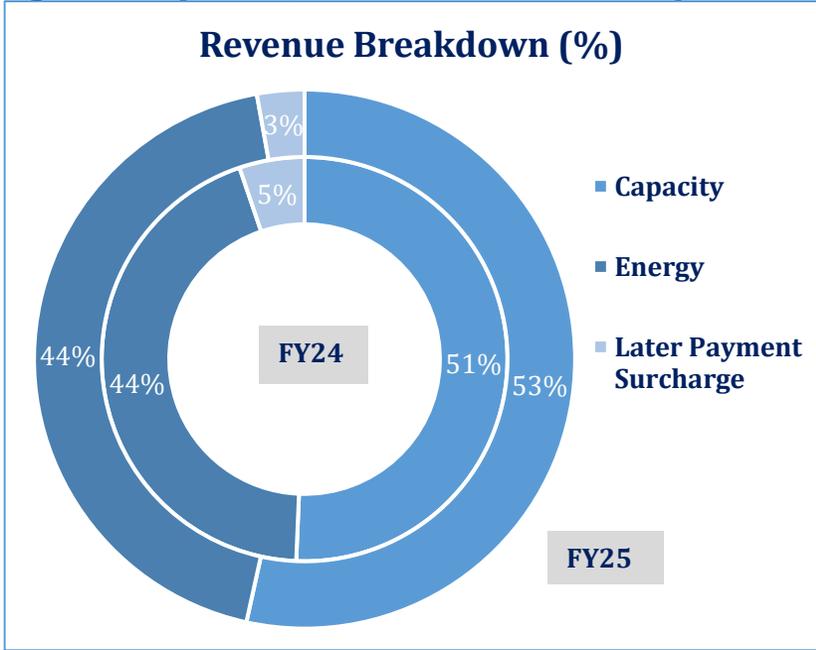
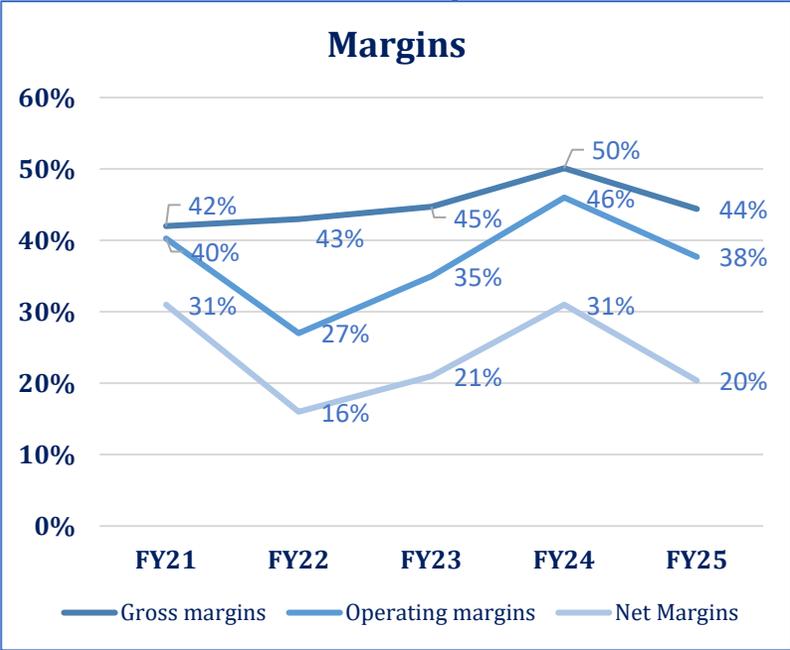
**Liquidity Risk:** The DISCOs are subject to the risk of non-payment by consumers which results in delayed payments to power purchasers ultimately creating volatility in cash payments to the IPPs. Any extended delays in payments compel the IPPs to obtain a Sponsor Loan or external funding (short-term borrowing).

**Coverages & Capital:** The minimum equity requirement for IPPs is ~20% of the project cost, the other component being debt. The IPPs, therefore, have a high exposure to External Funding. Financing Structure, including Minimum Debt Service Coverage Ratio, debt to equity movement and debt repayment schedule is critical.

# POWER

## Business Risk | Margins

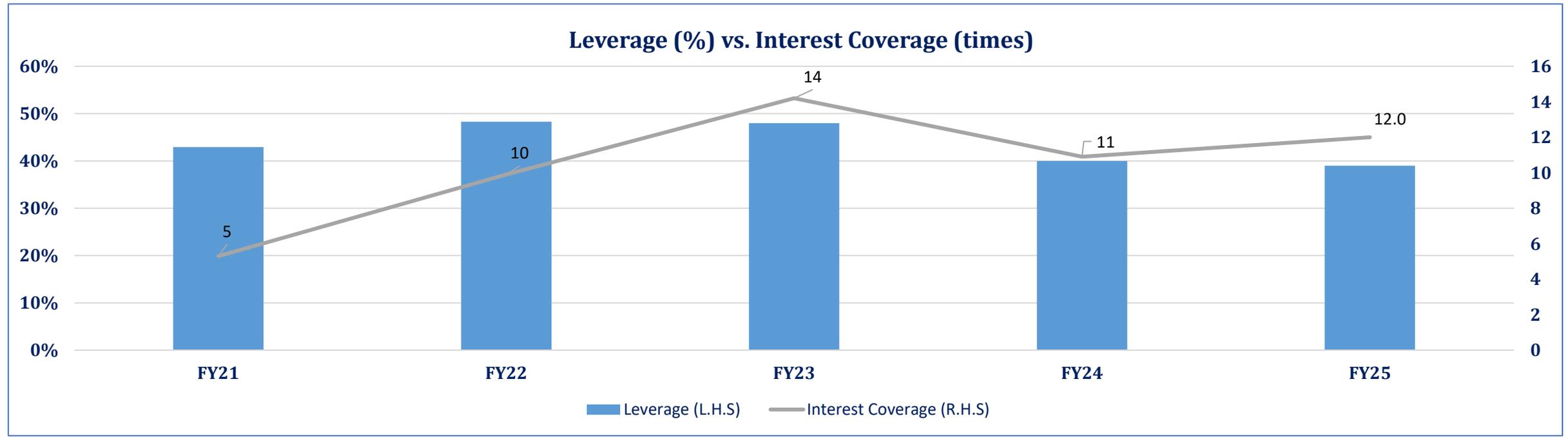
- A breakdown of the revenue in FY25 reveals that energy and capacity payments comprised ~97% of the overall revenue earned, with the mix staying relatively stable compared to FY24. Moreover, raw materials comprised ~55.3% of the total costs incurred by the sector (FY23: ~57.6%), whereas energy made up ~10.2% in FY25 compared to ~7.8% in FY24. Raw materials usually include Coal, Furnace Oil, HSD, RLNG and others depending on the type of fuel used. The fuel prices are “pass through”.
- With the transition from a ‘Take or Pay’ model to a ‘Take and Pay’ model, capacity charges would no longer represent a guaranteed revenue stream, as revenues would be contingent upon actual power offtake. This shift would increase revenue variability and reduce earnings visibility, thereby exerting pressure on margins as witnessed during FY25. While returns on equity may continue to be determined as per the relevant policy framework, the recovery of fixed costs, including O&M expenses, would become more dependent on plant utilization levels.



Note: Data is reflective of ~36 rated sector players.

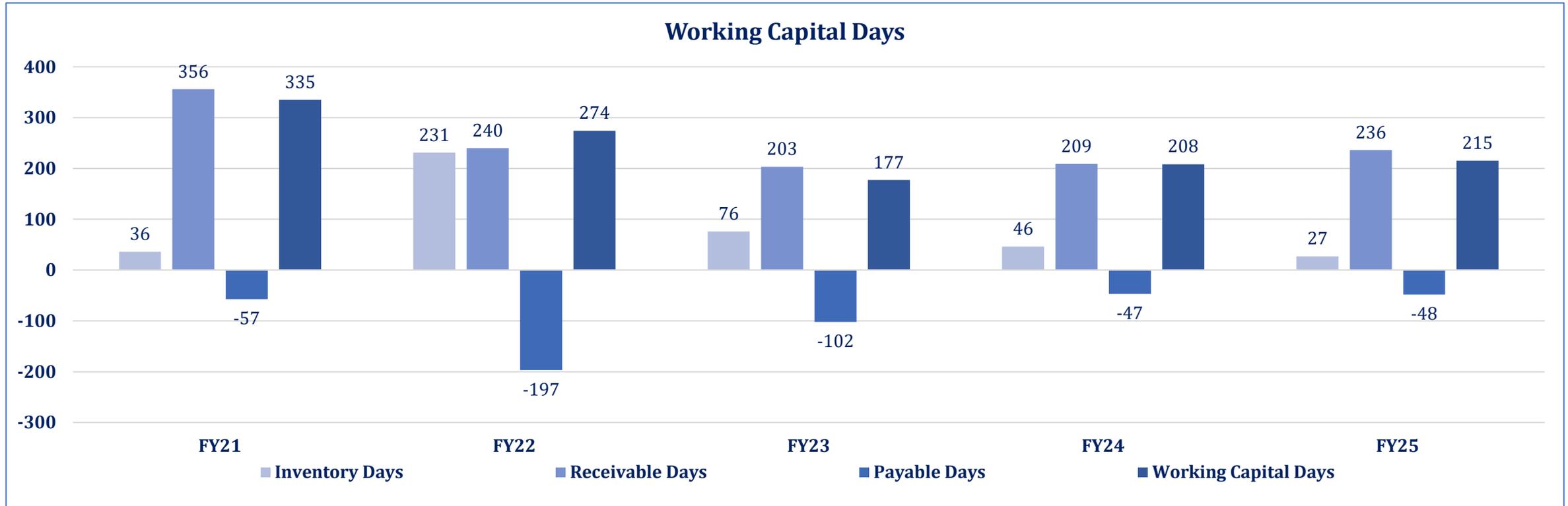
## Financial Risk | Leverage & Interest Coverage

- The debt servicing capacity of Independent Power Producers (IPPs) remains strong as majority of the project related long-term debt has been paid off. The lower interest rates have further aided coverages.
- The total leverage of the sector went down from ~40.0% in FY24 to ~39% in FY25, reflecting lower reliance on borrowing on the back of cash flow being generated vis-à-vis regular payments by the power purchaser.
- The GoP, under its sovereign guarantee, covers all obligations of the aforementioned power purchasers provided that IPPs meet their performance parameters. As is the case of any other sovereign, GoP is not likely to default on its local currency obligations. This acts as a mitigant of financial risk related to the Sector players.



*Note: Data is reflective of ~36 rated sector players from FY22 onwards. For the previous years, data is reflective of ~29 rated players.*

## Financial Risk | Working Capital Management

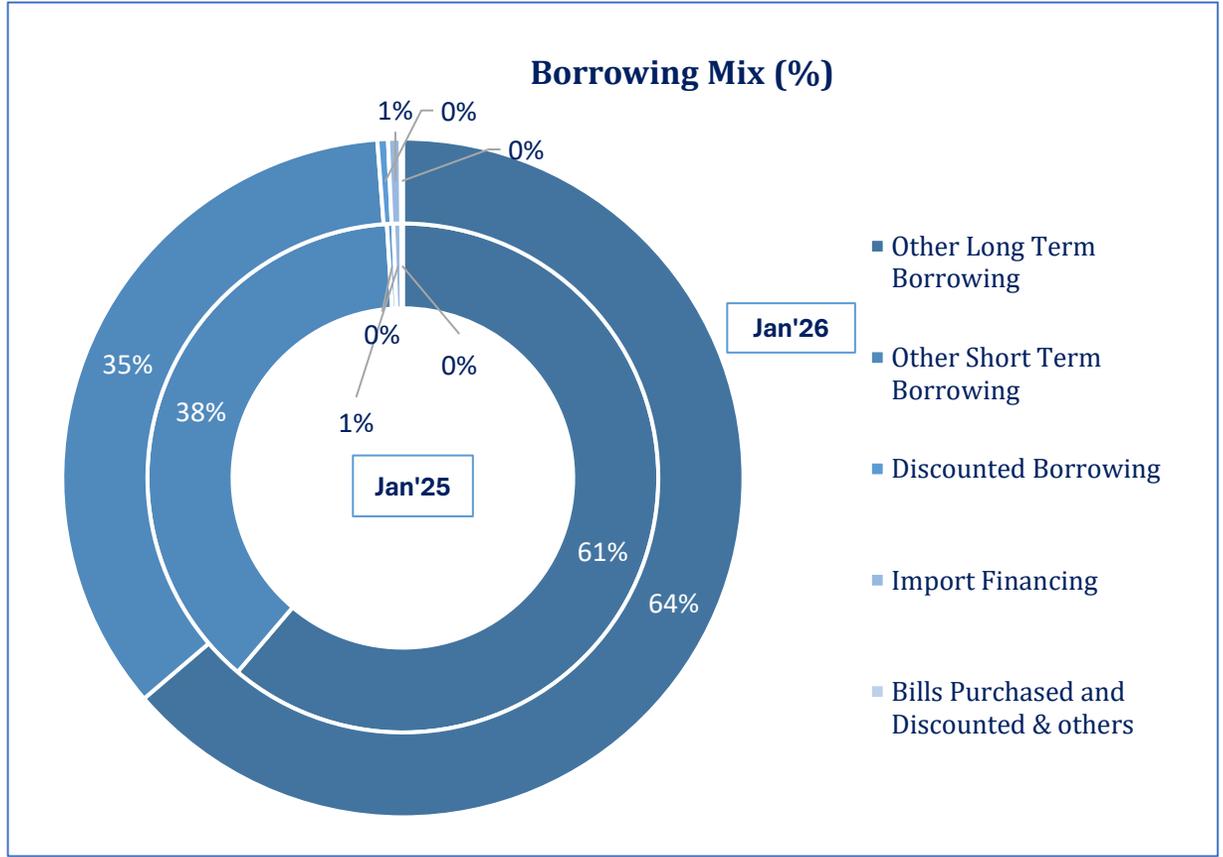


- The Working Capital Cycle of IPPs is majorly a function of their receivables and payables. Receivables of the sector rely on the CPPA-G payments in return for the electricity being supplied according to the Power Purchasing Agreements (PPAs).
- Receivable days remain elevated but are expected to come down in FY26 as the GoP intends to settle a large chunk of outstanding dues of the sector.

# POWER

## Financial Risk | Borrowing Mix

- The total borrowing of the Sector stood at PKR~363,622mln as End-Jan'26 (SPLY: PKR~454,854mln), down ~20.1% YoY.
- The largest component of borrowing comprises the fixed long-term loans which constituted ~64.2% of the total borrowing and stood at PKR~232,931mln as of End-Jan'26 (End-Jan'25: PKR~279,735mln).
- Meanwhile, the short-term borrowing formed ~35.8% of the total borrowing and stood at PKR~130,476mln as at End-Jan'26.
- The total outstanding loans in the renewable power sector (excluding Hydel) stood at PKR~56,253mln as at End-Jan'26. This is ~15.5% of the total outstanding loans of the power sector.



## Financial Risk | Borrowing Mix

PKR millions

Fuel Type	Total Borrowings		YoY Change (%)	Short-term Borrowing			Long-term Borrowing		Foreign Bills Discounted
	Jan'26	Jan'25		Import Financing	EFS	Other Short-term	LTFB	Other Long-term	
Hydel	8,900	25,045	-64.5%	0	0	3,536	0	5,350	0
Thermal	78,782	92,244	-14.6%	0	0	49,471	0	29,310	0
Coal	100,535	120,492	-16.6%	0	0	38,991	41	46,569	0
Wind	38,900	46,876	-17.0%	0	0	472	0	38,428	0
Solar	17,353	14,597	18.9%	867	0	3,470	937	11,775	0
Others	119,153	155,600	-23.4%	1,284	700	26811	128	82,885	215
<b>Industry Total</b>	<b>363,622</b>	<b>454,854</b>	<b>-20.1%</b>	<b>2,150</b>	<b>700</b>	<b>122,751</b>	<b>1,106</b>	<b>214,317</b>	<b>215</b>

## SWOT Analysis

- Backbone of the economy.
- Players operate in a regulated environment.
- Low business risk due to risk mitigating factors such as sovereign guarantees on payment by purchasers and Performance Guarantees by the Contractors.



- Single Buyer Market with two generation baskets, creating inefficiency in the generation system.
- Under-utilization of efficient plants: GENCO's efficiency scale has deteriorated over the years.
- Low Available Capacity Factor.
- Delay in commissioning of cheap indigenous fuel power plants.
- Weak governance of DISCOs.

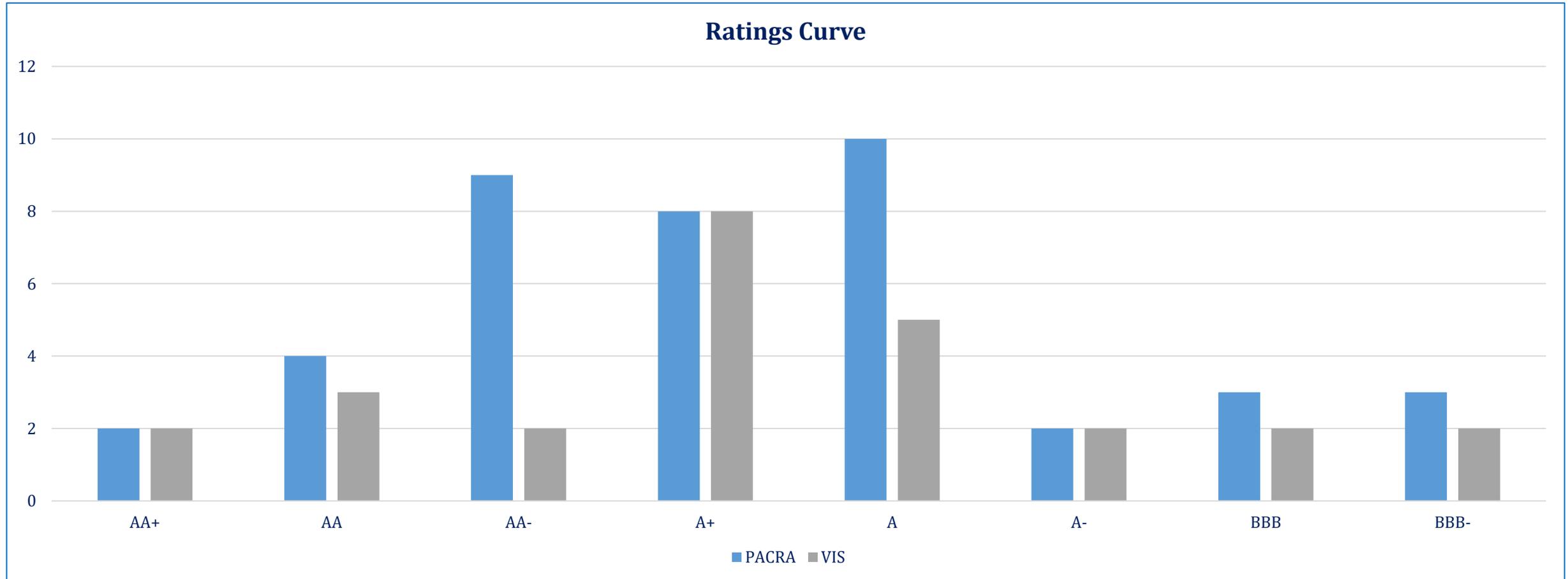
- Circular debt pile-up.
- T&D Losses weaken the financial discipline of the power supply chain.
- Liquidity Damages (LDs) on account of non-performance of FSA.
- Change in the regulatory environment leading to lower or no guaranteed off-take for new plants and change of terms for existing ones.

- Revival in Industrial Activity resulting in increased demand.
- Amendment to PPAs in the process of revising the payment and tariff structure for power purchase from IPPs.
- Exploration of Coal reserves leading to significant coal-based power projects; coal is a cheaper fuel of energy.
- Investments in the Hydel and Renewable Energy Power plants.

# POWER

## Rating Curve

- PACRA rates ~37 entities in Pakistan’s Power Sector, within the rating bandwidth of AA+ to BBB-.



## Outlook: Watch - Developing

- Pakistan's Power Sector remains central to economic stability and industrial revival. However, structural imbalances continue to weigh on sustainability. Continued circular debt, high consumer-end tariffs, weak demand growth, and inefficiencies across generation, transmission, and distribution persist despite reform momentum. Under the program supported by the International Monetary Fund (IMF), upward tariff adjustments and fiscal discipline have helped contain the flow of circular debt, while a PKR~1.2trn commercial bank restructuring for CPPA has provided short-term liquidity relief. Nonetheless, structural corrections remain work-in-progress.
- The GoP continues renegotiation of IPPs' Power Purchase Agreements (PPAs), aiming to shift from rigid "Take-or-Pay" structures toward "Take-and-Pay" arrangements to rationalize capacity payments. During the recent round, six IPPs (Hubco, Rousch, Lalpir, Atlas, Saba and Pakgen) were terminated, while ~14 others have agreed and signed revised PPAs. The authorities estimate fiscal savings and lower unit costs over the remaining contract tenors; however, negotiations, particularly with CPEC-related Chinese IPPs, remain ongoing, and clarity on final outcomes is awaited.
- Capacity payments remain the core structural stress. Despite installed capacity of ~41,000+ MW, system utilization remains low (near one-third), elevating per-unit costs. Capacity payments have grown materially (FY24: ~PKR 2.1trn), with upward pressure continuing in FY25. Transmission bottlenecks, operational inefficiencies of certain public-sector plants, and suboptimal dispatch merit order continue to constrain cost optimization.
- Energy transition efforts are gradually improving the generation mix, with higher penetration of renewables particularly solar. The GoP is encouraging distributed generation and solarization (including agricultural tube wells) to reduce fuel import dependence and ease DISCO burden. However, grid readiness, integration capacity, and financial sustainability of net-metering frameworks remain key considerations.
- Going forward, sector stability hinges on: (i) sustained tariff discipline under IMF oversight, (ii) measurable reduction in T&D losses, (iii) clarity and completion of IPP renegotiations, (iv) transmission upgrades to enhance utilization efficiency, and (v) demand recovery aligned with macroeconomic stabilization.

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