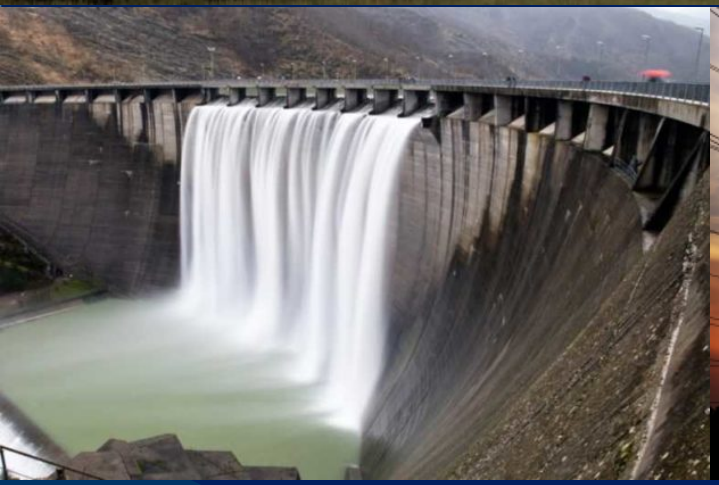

POWER GENERATION

An Overview

January 2021

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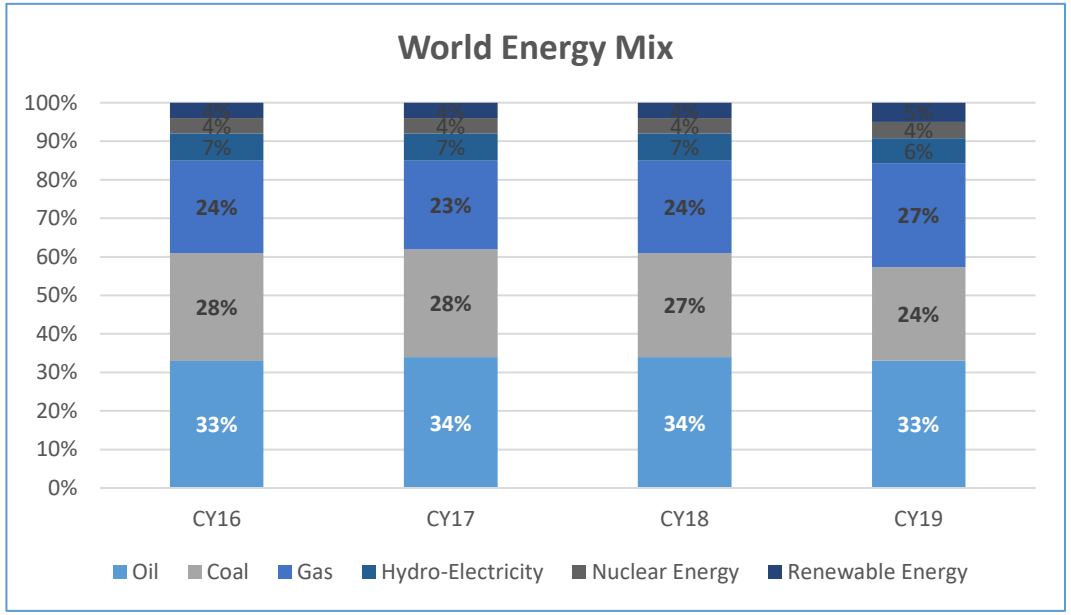
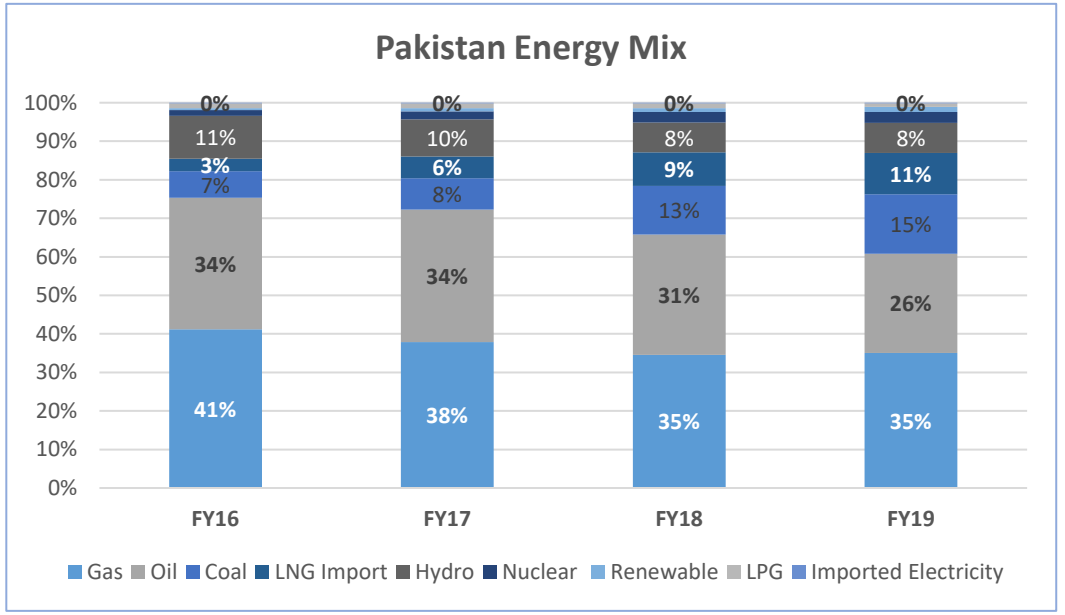
POWER GENERATION

ENERGY MIX | A Comparison





- World Energy Mix is dominated by fossil fuels, particularly oil (~33%) coal (~24%) and natural gas (27%), despite increasing need to shift towards cleaner fuels for environment safety and depleting world oil reserves.

- Pakistan's energy mix is diversified in comparison to global mix of fuels. Though fossil fuels dominate Pakistan's mix too, it consists of a fair share of hydel energy (~8%). Moreover, Pakistan has lately been relying on imported LNG for meeting its energy demand whose share has increased to a prominent 11% in total fuel mix of the country.

Source: BP Statistical Review of World Energy - 2020

POWER GENERATION

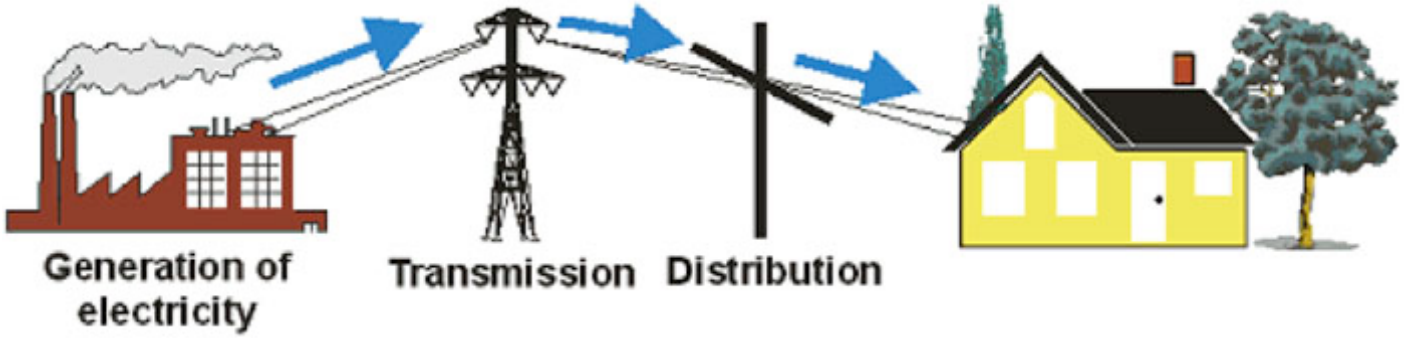
Overview

- Energy is the engine of all Sectors of the economy. Energy consumption needs are directly related to the GDP growth of a country.

- Pakistan's GDP contracted by ~0.4% in FY20, owing to the unprecedented outbreak of Covid-19 pandemic (~1.2% growth in FY19).

- Pakistan's primary energy supplies (forms of energy converted to final energy) comprise of oil, gas, coal, nuclear electricity and hydro-electricity net generation, while final energy products (converted from primary energy supplies) consist of gasoline, diesel, purified coal, purified gas, **electricity** and mechanical energy.

- The Country's Power Sector is classified into three verticals (i) Generation, (ii) Transmission and (iii) Distribution. This Sector Study shall focus on the statistics and analysis of the **Power Generation System**.



Source: Pakistan Energy Year Book and Pakistan Economic Survey

POWER GENERATION

Structure of the Industry

- Power Sector is regulated by National Electric Power Regulatory Authority (NEPRA). The Generation Vertical comprises Public and Private sector entities involved in power production. The fuel mix for producing power includes Thermal, Nuclear, Hydel, Renewable and Mixed Fuels. Additionally, Pakistan also imports some electricity from Iran.
- Thermal Power Producing Companies mainly include Independent Power Producers (IPPs) and Public Owned Generation Companies (GENCOs). In Hydel sector, WAPDA operates and administers a major share of the hydopower plants.
- Thermal IPPs are governed by the Private Power & Infrastructure Board (PPIB), while Renewable projects are overseen by the Alternative Energy Development Board (AEDB). Development of nuclear power remains the responsibility of the Pakistan Atomic Energy Commission (PAEC).
- The Power Sector is operated through a Market Operator, the Central Power Purchasing Agency (CPPA-G), which was formed to facilitate the power market transition from single buyer to a competitive market. CPPA-G is responsible for the procurement of electricity from power producers as well as on behalf of DISCOs and for billings and settlements.
- Another Vertical in the Power Sector is Karachi Electric (KE). Unlike other Entities of the Power Sector, KE operates in all three segments of the Power Sector and is responsible for the generation, transmission and distribution of electricity to all residential, commercial, industrial and agricultural areas of Karachi and a few of its outskirts.

<table>
<tr><th colspan="3">Generation</th><th>Transmission</th><th>Distribution</th><th>Consumption</th></tr>
<tr><td rowspan="4">Thermal</td><td>Furnace Oil</td><td rowspan="4">Independent Power Plants (IPPs), Generation Companies (GENCOs), K-Electric</td><td rowspan="4">National Transmission & Dispatch Company (NTDC)</td><td>Distribution Companies (DISCOs)</td><td rowspan="2">Domestic</td></tr>
<tr><td>Gas/RLNG</td><td>- FESCO</td></tr>
<tr><td>Coal</td><td>- GEPCO</td><td rowspan="2">Industrial</td></tr>
<tr><td>Nuclear</td><td>- HESCO</td></tr>
<tr><td colspan="3"></td><td></td><td>- IESCO</td><td rowspan="2">Commercial</td></tr>
<tr><td rowspan="6">Renewable</td><td>Water</td><td rowspan="3">WAPDA</td><td rowspan="8">K-Electric Limited</td><td>- LESCO</td></tr>
<tr><td>Solar</td><td>- MEPCO</td><td rowspan="2">Agriculture</td></tr>
<tr><td>Wind</td><td>- PESCO</td></tr>
<tr><td>Bagasse</td><td rowspan="3">IPPs</td><td>- QESCO</td><td rowspan="4">Others</td></tr>
<tr><td rowspan="2">Hydel</td><td>- SEPCO</td></tr>
<tr><td>- TESCO</td></tr>
<tr><td>K-Electric Limited</td></tr>
</table>

Source: NEPRA

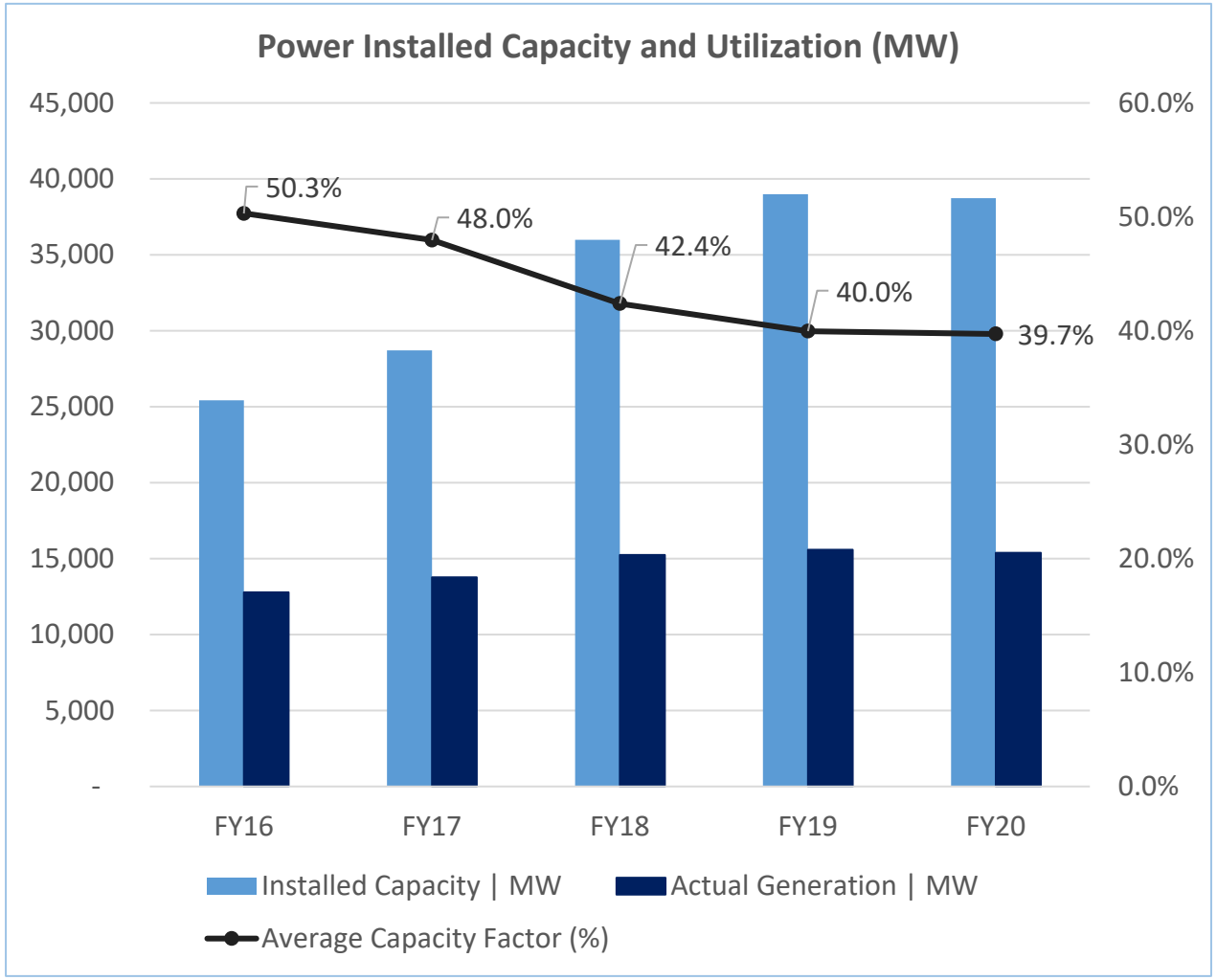
POWER GENERATION

Installed Capacity and Utilization

- The power generation sector comprises power plants set up in the Public Sector as well as Private Sector. Share of public and private sector power plants is almost equal (~50%). Based on energy source type, these plants include hydropower plants, thermal power plants, nuclear power plants and renewable energy (RE – wind, solar, bagasse/biomass). In addition, Pakistan also imports electric power from Iran.

- The total installed generation capacity was recorded at ~38,719MW as at June 30, 2020 (~38,995MW June 30, 2019) down ~0.7% YoY basis, while actual power generation was recorded at 134,746GWh in FY20 (136,532GWh in FY19), down ~1% YoY basis.

- Annual Capacity Factor of the Sector was recorded at ~40% in FY20 (~40% FY19). Capacity Factor measures the percentage of installed capacity that is utilized. A low capacity factor indicates inefficiency in system usage. The country's annual capacity factor has declined gradually from ~50% in FY16 to ~40% in FY20 reflecting reduction in efficient system utilization on a timeline basis.

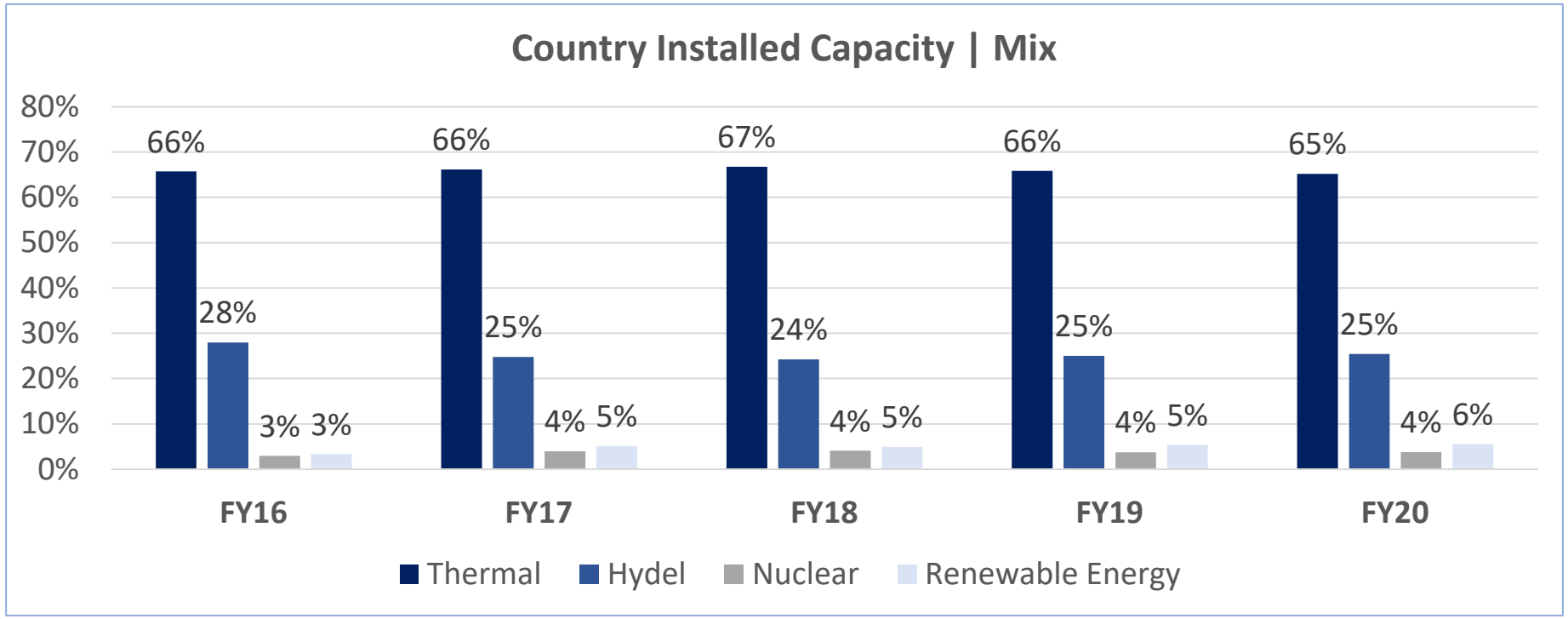


Source : NEPRA 'State of the Industry Report' 2020

POWER GENERATION

Fuel Mix in Installed Capacity

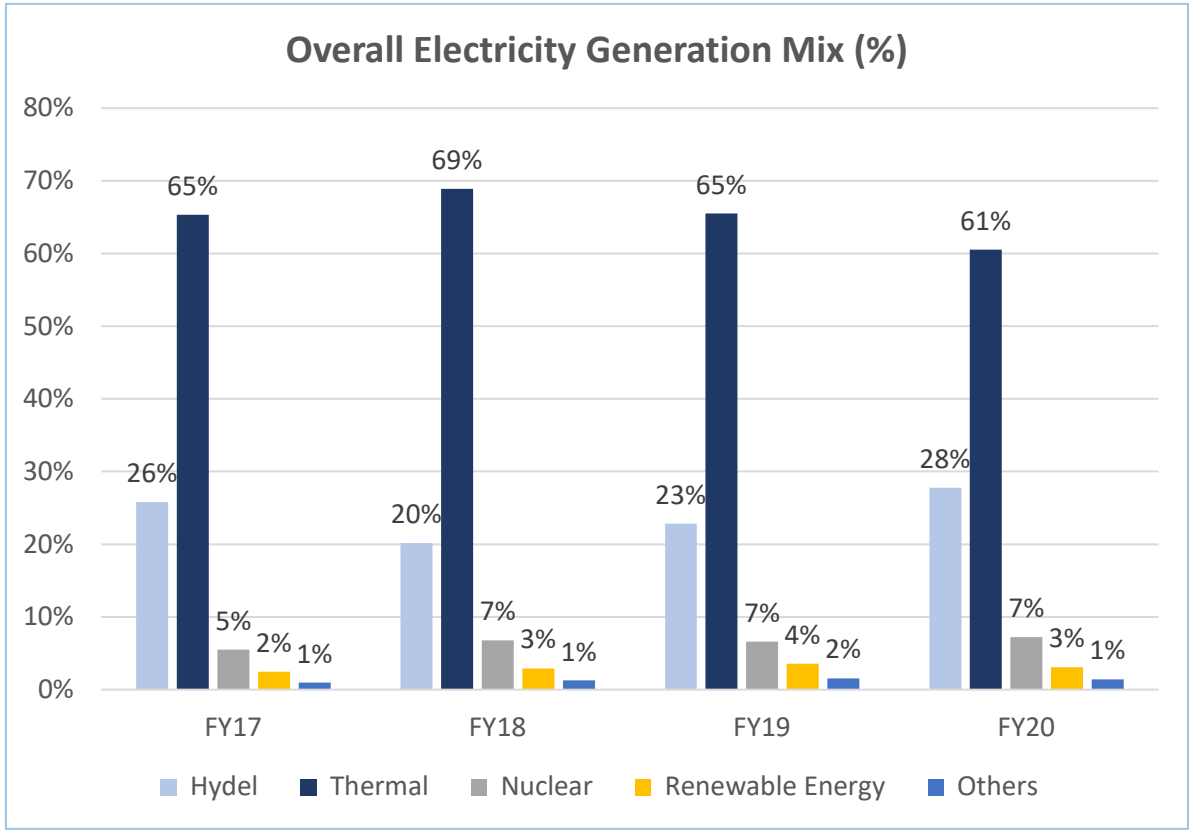
- Thermal Energy Mix continues to contribute the highest to the installed power generation capacity of the country, followed by hydel electricity capacity which now stands at ~25% of the total Installed Capacity of the country.

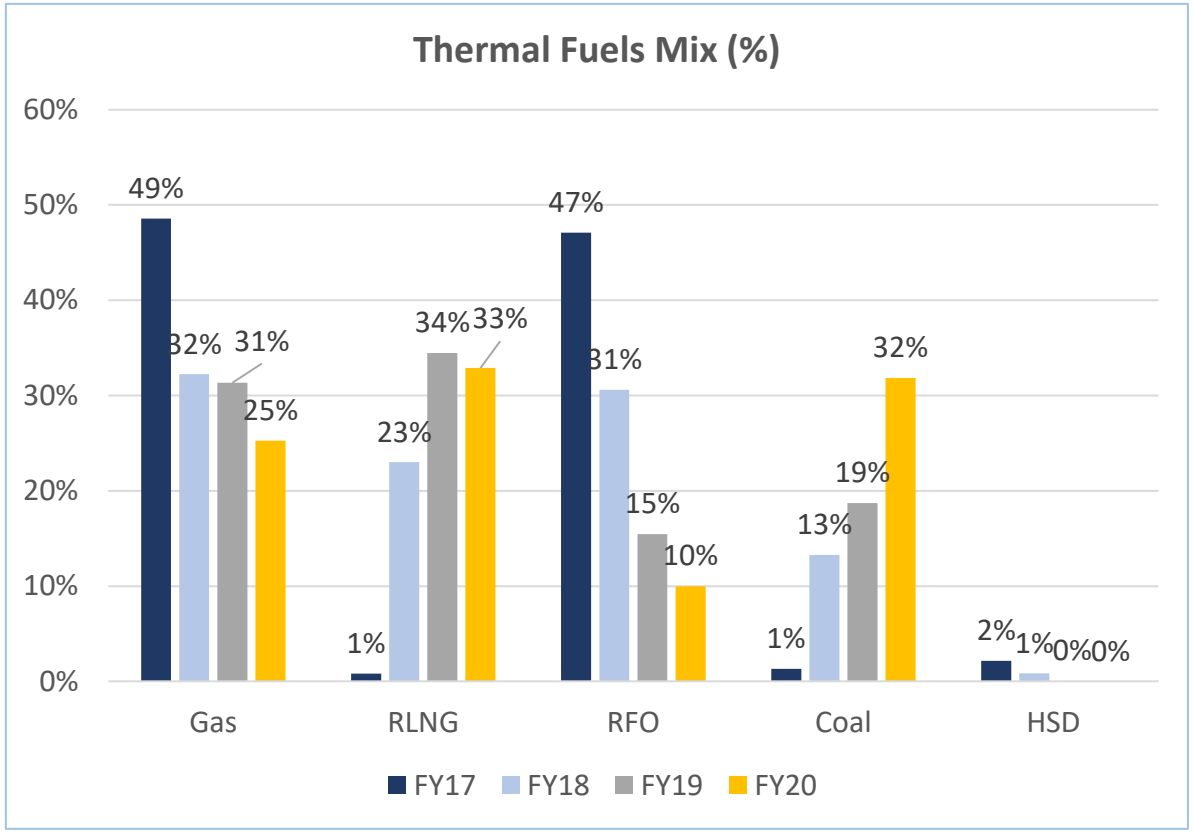


Source : NEPRA 'State of the Industry Report' 2020

POWER GENERATION

Fuel Mix in Electricity Generation



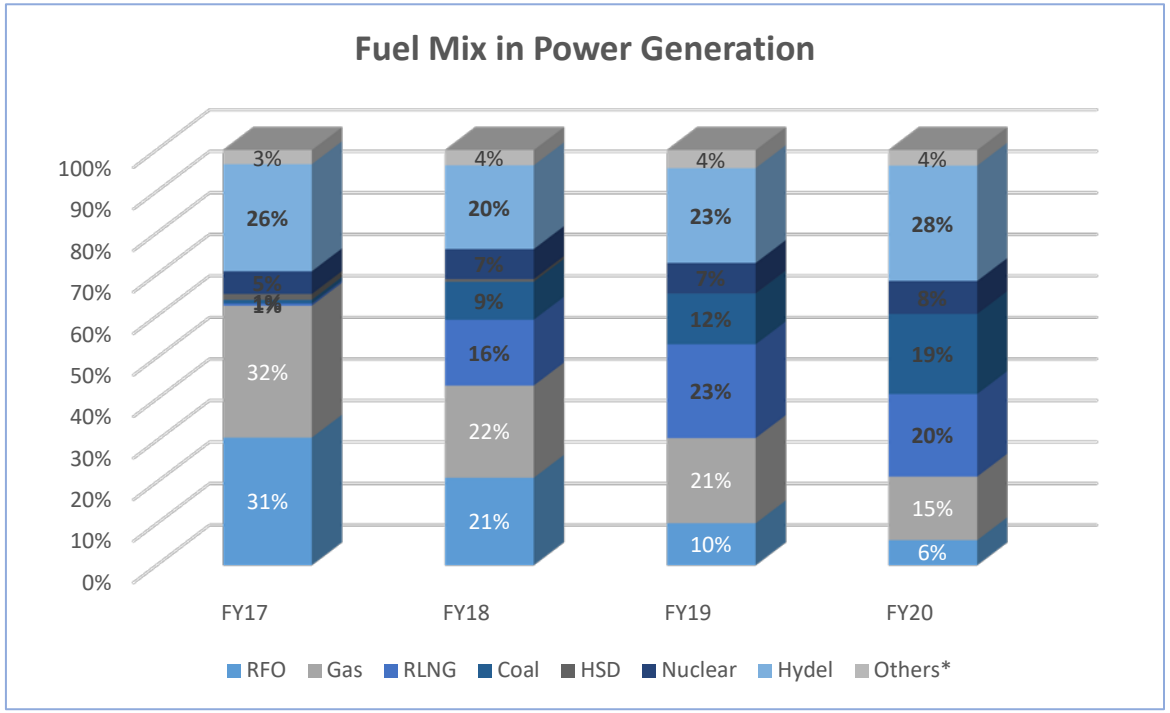


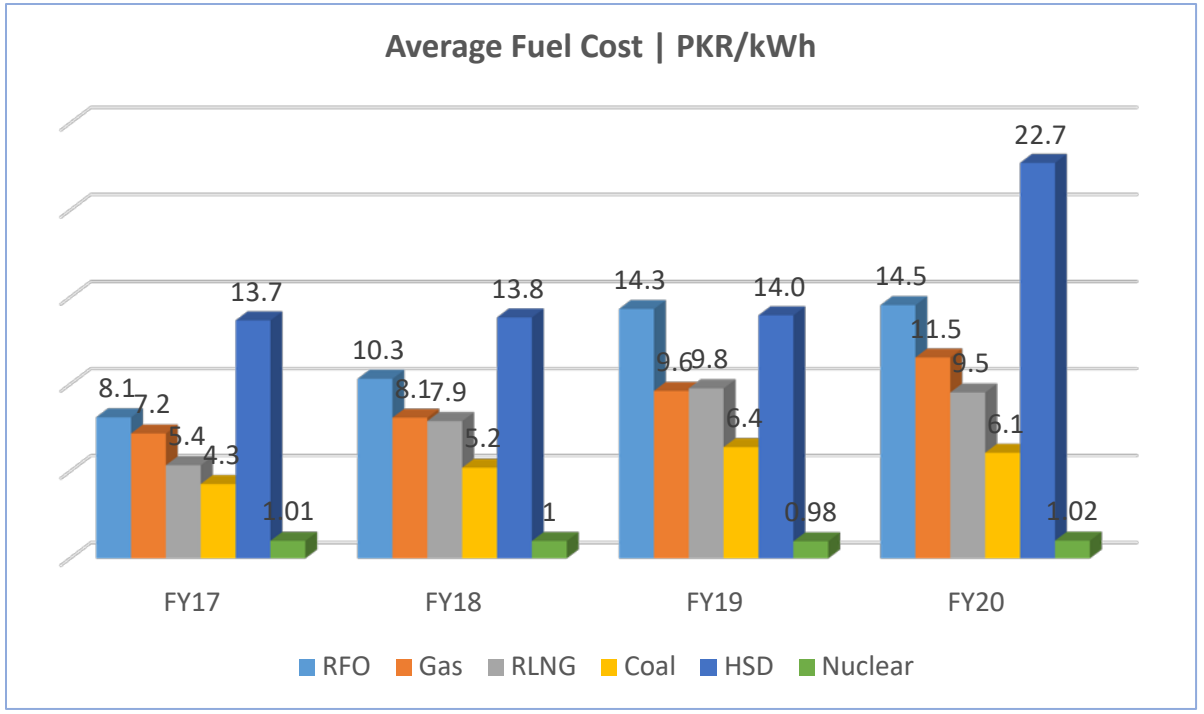
- Like Installed capacity, thermal energy also contributes the highest to the generation mix. However, a recent increase in hydel power generation has led to a drop in thermal mix from ~65% in FY19 to ~61% in FY20 . Likewise, Within the thermal segment, a shift is being observed from Gas and RFO to alternate fuels, i.e., RLNG and Coal, the first due to its depleting reserves and the latter due to high cost of generation.

Source : NEPRA State of the Industry Report

POWER GENERATION

Fuel Wise Generation Mix and Cost





- Share of RFO in total power generation has dropped significantly from ~31% in FY17 to ~6% in FY20.
- The country's depleting natural gas reserves are necessitating a shift of fuel from gas to imported RLNG and coal, first imported in 2015. Additionally. Imported RLNG has a comparatively lower fuel cost as compared to other costlier fuels, i.e., RFO and HSD.
- HSD is the most expensive source of fuel for electricity supply. Its share in country generation mix is restricted to ~1% and lower.
- The cheapest source of fuel are renewable energy sources followed by hydel energy. The fuel cost component in these energy sources is almost negligible. While hydel power contributes around ~28% to the electricity generation, renewable energy sources together (solar, wind, bagasse) make up a nominal share of ~3%.

*Others include import from Iran and mixed fuels

Source : NEPRA 'State of the Industry Report

POWER GENERATION

Entity Wise Share in Installed Capacity

Pakistan's electricity generation system is divided into two separate generation baskets (i) CPPA-G Basket and (ii) K-Electric Basket. CPPA-G Basket covers all Power Generation Plants of the Country except those falling in the ambit of K-Electric (KE). KE is responsible for the generation, transmission and distribution of electricity to all residential, commercial, industrial and agricultural areas of Karachi and its outskirts.

% Share in Installed Capacity	FY17	% Share	FY18	% Share	FY19	% Share	FY20	% Share
CPPA-G System	**26,389**	**92%**	**33,096**	**92%**	**36,061**	**92%**	**35,735**	**92%**
Hydel	**7,116**	**25%**	**8,713**	**24%**	**9,761**	**25%**	**9,861**	**25%**
- WAPDA	6,902	**24%**	8,341	**23%**	9,389	**24%**	9,389	**24%**
- IPPs	214	**1%**	372	**1%**	372	**1%**	472	**1%**
Thermal	**17,808**	**62%**	**22,604**	**63%**	**24,253**	**62%**	**23,827**	**62%**
- GENCOs	5,897	**21%**	5,637	**16%**	5,637	**14%**	4,881	**13%**
- IPPs	10,566	**37%**	15,297	**43%**	16,946	**43%**	17,276	**45%**
- SPPS/CPPs	340	**1%**	340	**1%**	340	**1%**	340	**1%**
- Nuclear	1,005	**3%**	1,330	**4%**	1,330	**3%**	1,330	**3%**
Renewable	**1,465**	**5%**	**1,779**	**5%**	**2,047**	**5%**	**2,047**	**5%**
K-Electric System	**2,350**	**8%**	**2,884**	**8%**	**2,934**	**8%**	**2,984**	**8%**
KE - Own	1,874	**7%**	2,294	**6%**	2,294	**6%**	2,294	**6%**
IPPs	252	**1%**	366	**1%**	366	**1%**	366	**1%**
SPPs/CPPs	87	**0%**	87	**0%**	87	**0%**	87	**0%**
KANUPP	137	**0%**	137	**0%**	137	**0%**	137	**0%**
Solar	-	**0%**	-	**0%**	50	**0%**	100	**0%**
Total (CPPA-G + KE)	**28,739**	**100%**	**35,980**	**100%**	**38,995**	**100%**	**38,719**	**100%**

Share of Thermal IPPs in total electricity generation has increased over the years (37% in FY17 to 45% FY20) after the emergence of Power Policy, 2002, which was introduced to encourage private sector investment in the power sector.

Source : NEPRA State of the Industry Report

POWER GENERATION

An Overview of Power Plants

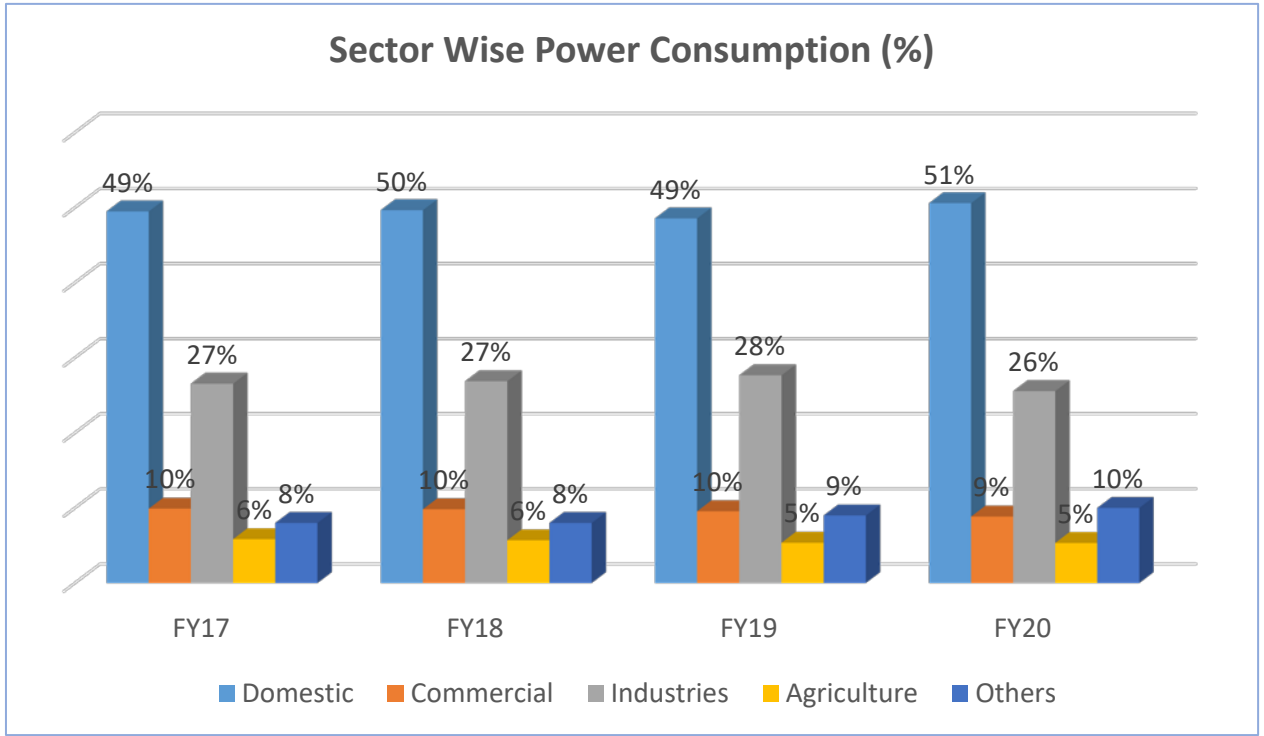
Generation Type	Nature of Entities - Public/Private Sector	No. of Power Plants	% Share in Country Installed Capacity*	Major Power Plants
HYDEL				
WAPDA	Public	22	24%	Major Hydropower units include Tarbela, Ghazi Barotha, Mangla Warsak and Chashma units
IPPs	Private	8	1%	
		30	**25%**	
THERMAL				
GENCOs	Public	12	14%	Major GENCOs include TPS Muzaffargarh and Jamshoro
IPPs	Private	37	46%	Major IPPs include KAPCO, Hub Power, Huaneng Shandong Ruyi, NPPMCL, Port Qasim Electric and China Power Hub
KE-Own	Public	5	6%	Major plant includes Bin Qasim TPS-I
		54	**65%**	
NUCLEAR				
CHASHNUPP & KANUPP	Public	5	4%	
		5	**4%**	
RENEWABLE				
Wind IPPs	Private	24	3%	Currently, all Wind Power projects have individual installed capacities of less than 100MWs.
Solar IPPs	Private	6	1%	Currently, all Solar Power projects have individual installed capacities of 100MWs or less.
Bagasse/Biomass	Private	9	1%	Currently, all Solar Power projects have individual installed capacities of 100MWs or less except Fatima Energy (installed capacity of 120MWs).
		39	**6%**	
TOTAL INSTALLED POWER PLANTS		**128**	**100%**	

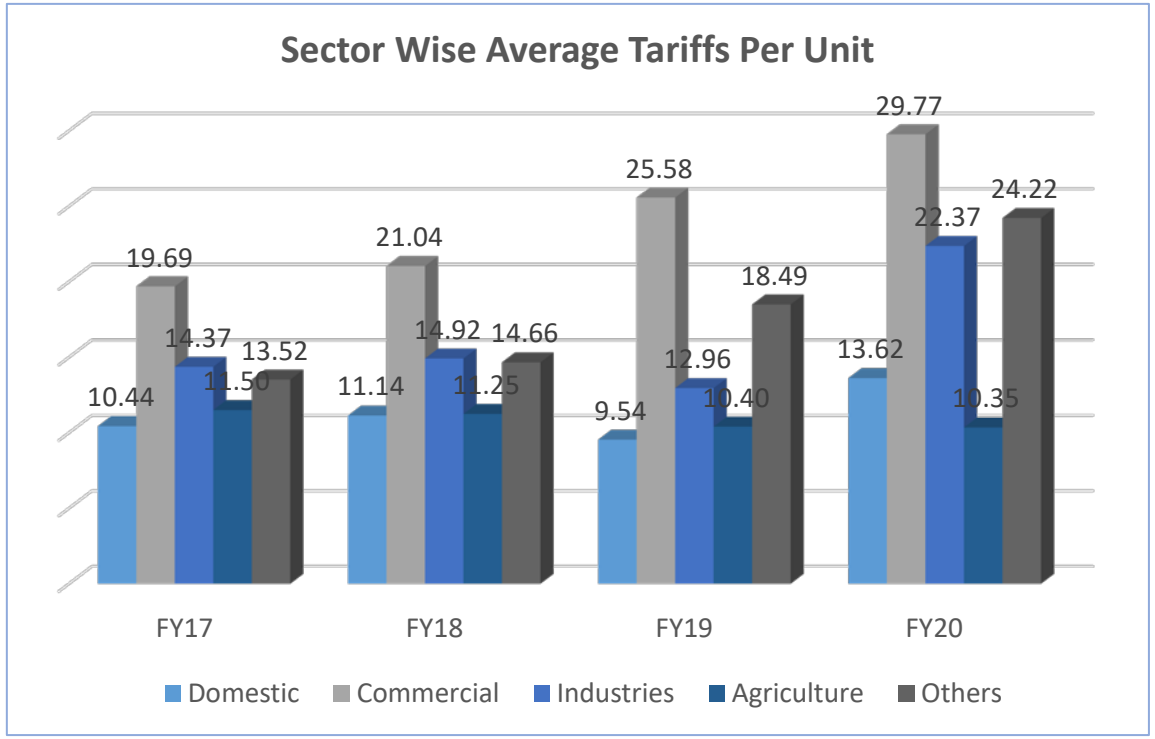
as at June 30, 2020

Source : NEPRA State of the Industry Report

POWER GENERATION

Sector Wise Power Consumption Share & Average Tariffs





- Pakistan's overall electricity consumption was recorded at ~112,069GWh for FY20 (~113,142GWh in FY19), down ~1% YoY basis. This is equivalent to ~83% of the total electricity generated for FY20 (~134,746GWh). Almost 87% of the Energy Sales is made through the CPPA-G System while the remaining ~13% is sold to the KE System. Pakistan's average per capita electricity consumption hovers around ~4,000GWh.
- The household sector contributes the highest towards electricity consumption (~51% in FY20) while its tariff structure is on a fairly lower side, due to its dependence on hydro-electricity.

Sector wise consumption includes CPPA-G + KE Average, while tariff chart includes PEPCO only.
Others refer to 'public lighting and bulk supply'

Source : NEPRA State of the Industry Report

POWER GENERATION

WAPDA – What you need to know

A Brief History

- Pakistan Water & Power Development Authority (WAPDA) was established through an Act of Parliament in 1958. It is an autonomous and statutory body under the control of the Federal Government.
- WAPDA has four verticals – (i) Power Wing (ii) Water Wing (iii) Finance Wing and (iv) Administration Wing. WAPDA was unbundled in 2007 whereby the functions of its Power Wing were redefined as Hydel Power Generation and Operation & Maintenance (O&M) of power houses.
- Following this unbundling, WAPDA's mandate is now focused on the development of water and hydropower resources in an efficient manner. The Power Wing of WAPDA is now split up into 15 different companies, i.e., NTDC, 10 DISCOs and 4 GENCOs, each having separate management.

- Currently WAPDA is operating 22 Hydel Power Plants with an installed capacity of ~9,861MW (~24% share overall). Hydro-electricity is a cheaper source of fuel in relevance to thermal generation. Therefore, thw GoP is keenly focused on undertaking new hydel power projects in order to supply electricity at cheaper rates.

- Several New Hydro Power Projects are under construction while some are ready to be constructed including Mohmand Dam, Diamer Basha Dam and Tarbela 5th Extension.

Source: WAPDA

POWER GENERATION

Demand & Supply During Peak Hours

- Pakistan's total generation capacity has surpassed the country's total electricity consumption need in recent times. In FY20, the country's "generation capability, i.e., the maximum electricity that could be generated in a day has also gone into surplus as against the highest demand that could peak in a day. This means, that the country's generation system is now sufficient enough to meet requirements of the highest demand of a day. This is true for NTDC Network.

- It is projected that by FY25, the Country's NTDC Generation capability will exceed the demand during peak hours by ~3,735MW and by FY30.

- On the K-Electric front, there is still a supply deficit of ~402MW in generation capability and peak demand. This deficit is expected to turn into surplus in 2022.

Year	Generation capability (MW)	Demand during peak hours (MW)	Surplus / (Deficit) (MW)
Actual			
FY16	17,261	22,559	-5,298
FY17	19,020	25,117	-6,097
FY18	23,766	26,741	-2,975
FY19	24,565*	25,627*	-1,062
FY20	27,780*	26,252*	1,528
Projected			
FY21	30,582	29,325	1,257
FY22	32,989	30,921	2,068
FY23	35,896	31,953	3,943
FY24	37,918	33,696	4,222
FY25	39,157	35,422	3,735

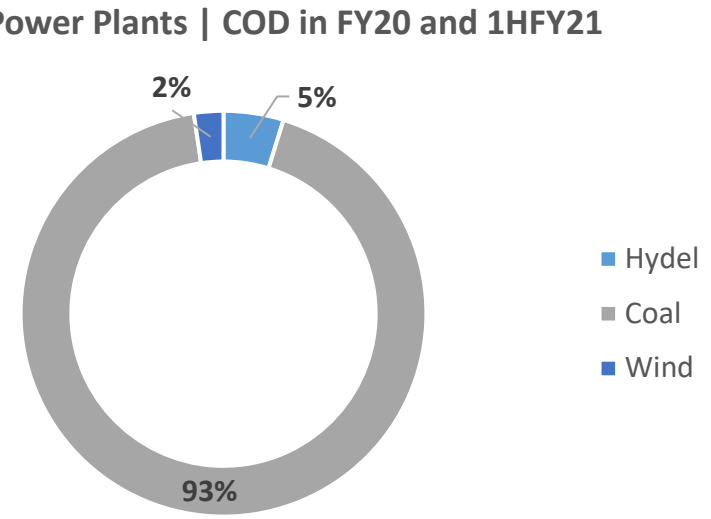
**'Generation capability' is the maximum generation capability of any day recorded during the year and 'Demand' is the maximum demand of any day recorded during the year. - NTDC only.*

Source : NEPRA State of the Industry Report

POWER GENERATION

Generation License & CODs | FY20 and 1HFY21

Capacity – Generation Licenses						
Type	FY18		FY19		FY20	
	No. of Licenses	Capacity	No. of Licenses	Capacity	No. of Licenses	Capacity
Thermal		-		-	4	316
Hydel	6	30	1	11.8	2	117
Wind	8	410	1	50	4	138.7
Solar	6	450	3	66.2	16	621.4
Nuclear		-		-	1	1145
Bagasse	8	237	4	148	-	-
Coal	2	65	2	336.5	-	-
Solid waste		-	1	40	-	-
RLNG	1	1279		-	-	-
	31	**2,471**	**12**	**653**	**27**	**2,338**



- During FY20 and 1HFY21, the following power plants achieved Commercial Operations Date (COD):

➢ **Hydel:** Gulpir Hydropower Project – Capacity 102MW – COD 10th March, 20
➢ **Coal"** Engro Powergen Thar Coal Power Project – Capacity 660MW – COD – 10th July, 19. HUBCO Imported Coal Power Project – Capacity 1,320MW – COD 17th Aug,19.
➢ **Wind:** Master Green Energy Limited – Capacity 50MW – COD Nov'20.

Source : NEPRA State of the Industry Report

POWER GENERATION

Upcoming Projects | Hydel | WAPDA

WAPDA Hydel Power Plants | Under Construction					
Under Construction	**No.of Power Plants**	**Expected Capacity (MW)**	**Location**	**Expected Completion Date**	**Status**
Dasu Hydropower Project	1	4,320	Dasu Town, Indus River	Feb'23	Under Construction - Physical Progress 3.25%
Kurram Tangi	1	83	Kurram River, Waziristan	June'21	Under Construction - Physical Progress 46%
TOTAL	**2**	**4,403**			

**Other Upgradations in process include Warsak Power Rehabiliation and Mangla Rehabilitation*

WAPDA Hydel Power Plants | Ready for Construction					
Ready for Construction	**No. of Dams/Project**	**Expected Capacity (MW)**	**Location**	**Expected Completion Date**	**Status**
Mohmand Dam	1	800	Swat River,Mohmand District KP	May'25	Ready For Construction
Diamer Basha Dam	1	4,500	Indus River, Chilas KP	9 Years after commencement	To be commenced
Bunji	1	7,100	Indus River, Gilgit	9 Years after commencement	To be commenced
Harpo	1	35	Harpo Nullah, Indus River	Phase-1: June'21 Phase-II: 48 months after Phase-I	Ready For Construction
Tarbela Extension	1	1,410	Swabi, KP	4.5 Years	Ready For Construction
	5	**13,845**			

Power Plants in Operation	FY20	
	No.of Power Plants	**Installed Capacity (MW)**
WAPDA Hydel Power Plants	22	9,389
IPPs Hydel Plants	8	472
TOTAL	**30**	9,861

- Currently, Hydel power contributes ~25% to the total Installed Capacity, of which WAPDA has almost ~95% of the share. WAPDA further envisages to increase installed hydropower capacity by ~18,248MWs of which projects worth ~4,403MWs are already under construction.

Source : WAPDA

POWER GENERATION

Upcoming Projects | Hydel | IPPs

IPPs | Upcoming Projects					
Projects	**No. of Plants**	**Expected Capacity (MW)**	**Location**	**Expected Completion Date**	**Status**
Karot Hydropower Project**	1	720	Jehlum River, Rawalpindi	Dec'21	Financial Close Achieved - Under Construction
Suki Kinari Hydropower	1	884	Kunhar River, Mansehra KP	Dec'22	Financial Close Achieved - Under Construction
Raili - II Hydropower	1	7	Ghori Wala Nullah, Muzafarrabad AJK	Jan'23	LOS issued under Financial Close - Under Construction
Kathai-II Hydropower	1	8	Kathai Nullah Hattian, AJK	May'24	LOS issued - FC in progress
Azad Pattan Hydropower	1	701	Jhelum River, Sudhnoti, AJK	Sep'26	LOS issued - FC in progress
Kohala Hydropower	1	1,124	Jhelum River, Kohala, AJK	Dec'27	LOS issued - FC in progress
Athmuqam Hydropower	1	450	Neelum River, AJK	Dec'28	LOI Issued - Tariff determination process
Turtonas- Uzghor Hydropower	1	82	Golen Gol River, Chitral, KP	Dec'28	LOI Issued - Tariff determination process
Mahi Hydropower	1	640	Jhelum River, AJK/PUNJAB	June'29	LOI Issued - LOS in progress- Tariff determination process
Ashkot Hydropower	1	300	Neelum River, AJK	Dec'30	Under Evaluation
	10	**4,916**			

***CPEC Project*

Dated: Dec, 04 -2020

- Alongside WAPDA, Hydel IPPs also embark on significant additions to their installed capacity in the next 10 years. Most of the projects are located in the KP and AJK regions.
- Together, WAPDA and Hydel IPPs are projecting to uplift the Hydel Installed Capacity of the country to ~33,025MWs in the next 10 years.

Source : PPIB

POWER GENERATION

Upcoming Projects | Thermal | IPPs

Thermal Power Plants | Under Construction						
Under Construction	**Sponsor**	**Expected Capacity**	**Location**	**Fuel**	**Expected Completion**	**Status**
Thar Coal Based Power Project	Lucky Electric Company Limited	660	Port Qasim, Khi	Coal	Mar'21	FC Achieved - Under Construction
1263 MW RLNG based Project	PTPL	1,263	Trimmu Barrage, Jhang	RLNG	Open Cycle by June'21 Combined Cycle by Dec'21	FC Achieved - Under Construction
Thar Coal Based Power Project	Thar Energy Limited	330	Thar Block-II Sindh	Coal	Dec'21	FC Achieved - Under Construction
Thar Coal Based Power Project	Thar Coal Block-I Power Generation Co. Ltd.	1,320	Thar Block-I Sindh	Coal	May'22	FC Achieved - Under Construction
Thar Coal Based Power Project	Thal Nova Power Thar (Pvt.) Ltd.	330	Thar Block-II Sindh	Coal	June'22	FC Achieved - Under Construction
300 MW Imported Coal Based Power Project	CIHC Pak Power Co. Ltd	300	Gwadar, Balochistan	Coal	June'23	LOS issued, FC In progress
330 MW Coal Based Power Project	SiddiqSons Energy Limited	330	Thar Block-I Sindh	Coal	July'23	LOS issued, FC In progress
1320 MW Coal Based Power Project	Oracle Coal Fields PLC England	1,320	Thar Block-VI Sindh	Coal	Dec'26	Project Proposal Under Evaluation
TOTAL		**5,853**				

- Thermal IPPs contribute around 46% to the Country's total Installed Capacity for power generation.
- Pakistan has the 5th largest coal reserves in the world, i.e., total ~185bln tons and around ~176bln tons in the Tharparkar District of Sindh. The Thar Blocks possess an immense potential for electricity generation. Therefore, almost ~78% of the Upcoming Thermal Power Projects are coal based.

Source : PPIB

POWER GENERATION

Upcoming Projects | Renewable | Solar IPPs

Solar Power Plants | Under Construction			
Project Name	**Expected Capacity (MW)**	**Location**	**Status**
M/S Access Electric Pvt. Ltd.	10	Pind Dadan Khan	Process of Achieving FC Underway
M/S Bukhsh Solar Pvt. Ltd.	10	Lodhran	Process of Achieving FC Underway
M/S Safe Solar Pvt. Ltd.	10.28	Bahawalnagar	Process of Achieving FC Underway
M/S Access Solar Pvt. Ltd.	11.52	Pind Dadan Khan	Process of Achieving FC Underway
TOTAL	**41.8**		

Solar Power Plants | To be Constructed			
Project Name	**Expected Capacity (MW)**	**Location**	**Status**
IPS Solar Park - IPS 22 Pvt. Ltd.	50	Nooriabad, Sindh	Project Development
IPS Solar Park - JA 23 Pvt. Ltd.	50	Nooriabad, Sindh	Project Development
IPS Solar Park - SB 24 Pvt. Ltd.	50	Nooriabad, Sindh	Project Development
R.E Solar I Pvt. Ltd	20	Dadu, Sindh	Project Development
R.E Solar II Pvt. Ltd	20	Dadu, Sindh	Project Development
ET Solar Pvt. Ltd.	25	Thatta, Sindh	Project Development
ACT Solar Pvt. Ltd.	50	Thatta, Sindh	Project Development
Janpur Energy Limited	12	Sultanabad, RYK	Project Development
Lalpir Solar Energy Limited	12	Mehmood Kot, Muzzafargarh	Project Development
Siddiqsons Solar Ltd.	50	Kalar Kahar, Chakwal	Project Development
ET Solar Pvt. Ltd.	50	Fateh Jang, Attock	Project Development
Asia Petroleum Limited	30	Bahawalnagar	Project Development
TOTAL	**419**		

Source: AEDB

POWER GENERATION

Upcoming Projects | Renewable | Wind IPPs

Wind Power Plants | Under Construction			
Project Name	**Expected Capacity (MW)**	**Location**	**Status**
Lakeside Energy (Pvt.) Ltd.	50	Jhampir District, Thatta	FC Achieved in Nov'19 - Under Construction
Artistic Wind Power (Pvt.) Ltd.	50	Jhampir District, Thatta	FC Achieved in Nov'19 - Under Construction
Liberty Wind Power 1 (Pvt.) Ltd.	50	Jhampir District, Thatta	FC Achieved in Nov'19 - Under Construction
Indus Wind Energy Limited	50	Jhampir District, Thatta	FC Achieved in Nov'19 - Under Construction
Act2 Wind (Pvt.) Limited	50	Jhampir District, Thatta	FC Achieved in Nov'19 - Under Construction
Metro Power Company Ltd.	50	Jhampir District, Thatta	FC Achieved in Nov'19 - Under Construction
Liberty Wind Power 2 (Pvt.) Ltd.	50	Jhampir District, Thatta	FC Achieved in Nov'19 - Under Construction
Master Green Energy Ltd.	50	Jhampir District, Thatta	FC Achieved in Nov'19 - Under Construction
Gul Ahmed Electric Limited	50	Jhampir District, Thatta	FC Achieved in Nov'19 - Under Construction
Din Energy Limited	50	Jhampir District, Thatta	FC Achieved in Nov'19 - Under Construction
Nasda Green Energy (Pvt.) Ltd.	50	Jhampir District, Thatta	FC Achieved in Nov'19 - Under Construction
Tricom Wind Power (Pvt.) Ltd.	50	Jhampir District, Thatta	FC Achieved in Nov'19 - Under Construction
TOTAL	**600**		

Wind Power Plants | To be Constructed			
Project Name	**Expected Capacity (MW)**	**Location**	**Status**
Western Energy Pvt. Ltd.	50	Jhampir District, Thatta	Project Development
Burj Wind Energy Pvt. Ltd	14	Gujju District, Thatta	Project Development
Shaheen Foundation	51	Jhampir District, Thatta	Project Development
Trans Atlanstis Energy Pvt. Ltd	50	Jhampir District, Thatta	Project Development
TOTAL	**165**		

Source: AEDB

POWER GENERATION

Upcoming Projects | Renewable | Bagasse IPPs

Bagasse/Bio-mass Plants | To be Constructed			
Project Name	**Expected Capacity (MW)**	**Expected COD**	**Status**
Shahtaj Sugar Mills Ltd.	32	FY22	**LOS Stage**
Hunza Power (Pvt.) Ltd.	49.8	FY22	
Bahawalpur Energy Limited	31.2	FY22	
Indus Energy Limited	31	FY22	
Ittefaq Power (Pvt.) Ltd.	31.2	FY22	
Kashmir Power (Pvt.) Ltd.	40	FY22	
Alliance Sugar Mills Ltd.	30	FY22	
RYK Energy Limited	25	FY22	
Two Star Industries (Pvt.) Ltd.	48.9	FY22	
Mirpur Khas Energy Ltd.	26	FY22	
TAY Powergen Co. Pvt. Ltd.	30	FY22	
Hamza Sugar Mills Unit-II	30	FY22	
Faran Power (Pvt.) Ltd.	26.5	FY22	
Shiekhoo Power Ltd.	30	FY22	
Mehran Energy Ltd.	26.5	FY22	
Habib Sugar Mills Ltd.	26.5	FY22	
Sadiqabad Power (Pvt.) Ltd.	45	FY22	**Tariff and Generation License required**
Gothki Power (Pvt.) Ltd.	45	FY22	
TOTAL	**604.6**		

Expected COD of Bagasse based Power Projects is subject to the outcomes of the Court decision as the projects are sub-judice and subject to review of the Tariff Determination by NEPRA.

- Pakistan is the fifth largest sugarcane producer in the world and has a potential to generate more than ~2,000MW of electricity through Co-Generation.

Source: AEDB

POWER GENERATION

THE RISK MATRIX

- **High Cost of Electricity:** With the induction of substantial amount of generation capacity during last few years, though the availability of electricity has improved significantly but the cost of electricity for end-consumers has increased owing to various reasons like high T&D losses, low recovery, circular debt, huge capacity payments, currency devaluation, fuel cost, under-utilization of efficient power plants etc.

- **Circular Debt:** (Covered in detail in the next sheet).

- **Inefficiency in Power Generation:** The availability factor of gas/RLNG power plants is 92%, coal power plants is 85% and RFO power plants is 88%. Under utilization of efficient power plants increases the cost of electricity and also spikes the burden of capacity payments for un-utilized capacity. The efficiency of GENCO power plants has also deteriorated over time which increases burning of more fuel and thus cost of generation.

- **Non-Availability of RLNG to Power Plants:** RLNG is a cheaper source of fuel being imported in the country due to depleting gas reserves. Non-availability of RLNG to gas based plants results in under-utilization or non-utilization of power plants.

- **Centralized Control of DISCOs and GENCOs:**

- **Transmission Constraints:** Overloading of transmission lines, insufficient transformation capacity of transformers, outages and faults are a few of the constraints in transmission system.

- **Two Generation baskets in the Country:** CPPA-G and KE. Efficiency can be achieved through one generation basket.

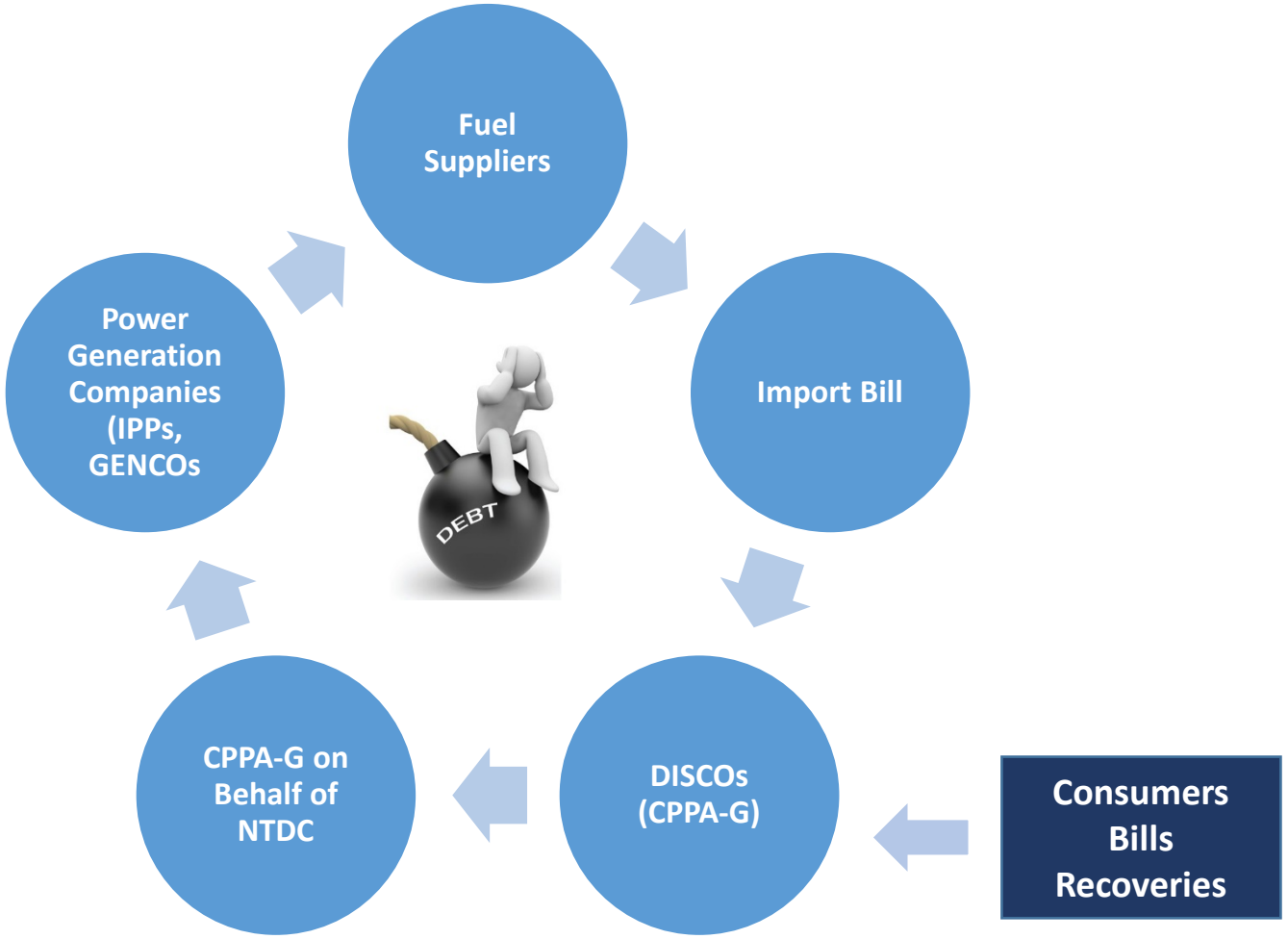
- **Transmission & Distribution Losses:** Transmission and Distribution (T&D) losses are not unusual in electrical power system but losses exceeding the acceptable limits increase the price of electricity unnecessarily for consumers.

Source : NEPRA State of the Industry Report

CIRCULAR DEBT | THE UNFORTUNATE MENACE

What is Circular Debt?

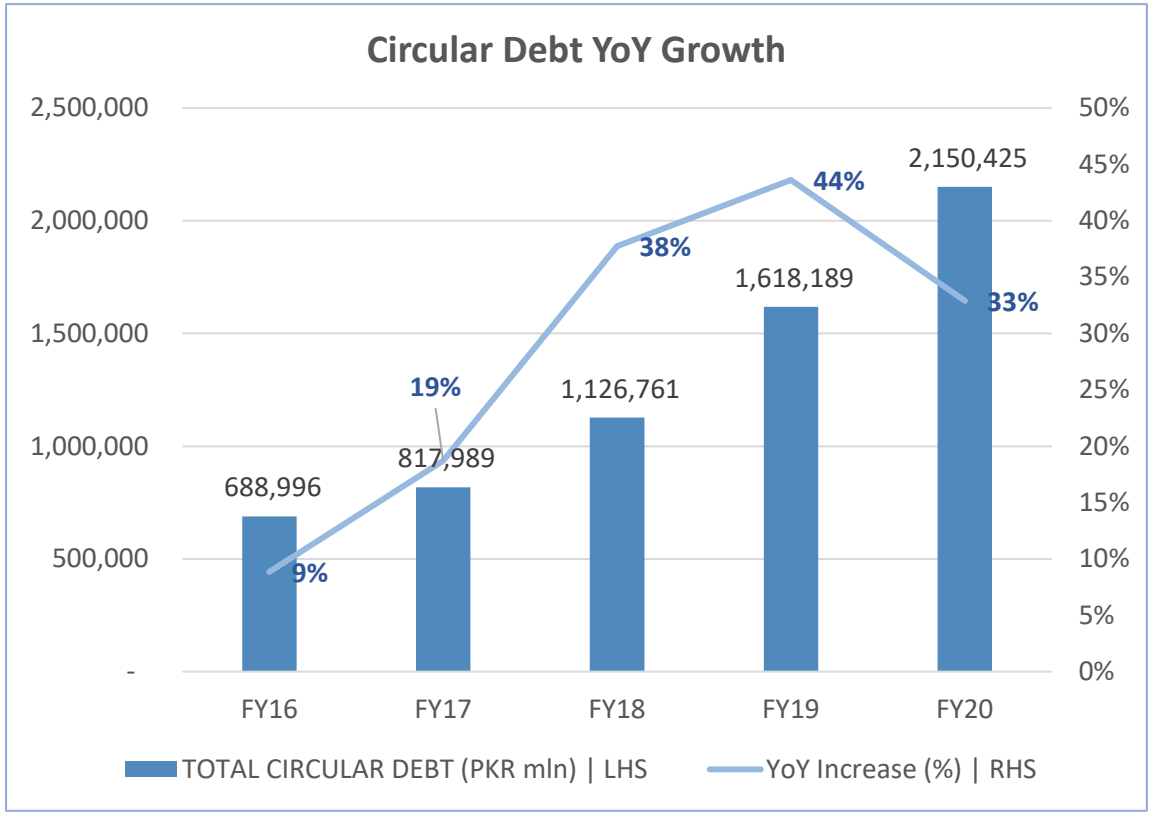
- The Power Generation Companies produce electric power which is sold to CPPA-G on behalf of DISCOs through the transmission Company – NTDC. The DISCOs supply the electric power to the end consumers.
- The CPPA-G has to make payments to the power producing Companies and NTDC on behalf of DISCOs within a given timeframe.
- The problem stems from the DISCOs being unable to make timely payments due to reasons including low recoveries from end consumers and T&D losses. This in turn hinders CPPA-G in making payments to power producing Companies and transmission Companies. The cycle goes on as the power producing Companies are unable to make payments to fuel suppliers. Under the PPAs, the delayed payments to power companies bears mark-up and increases financial liability.

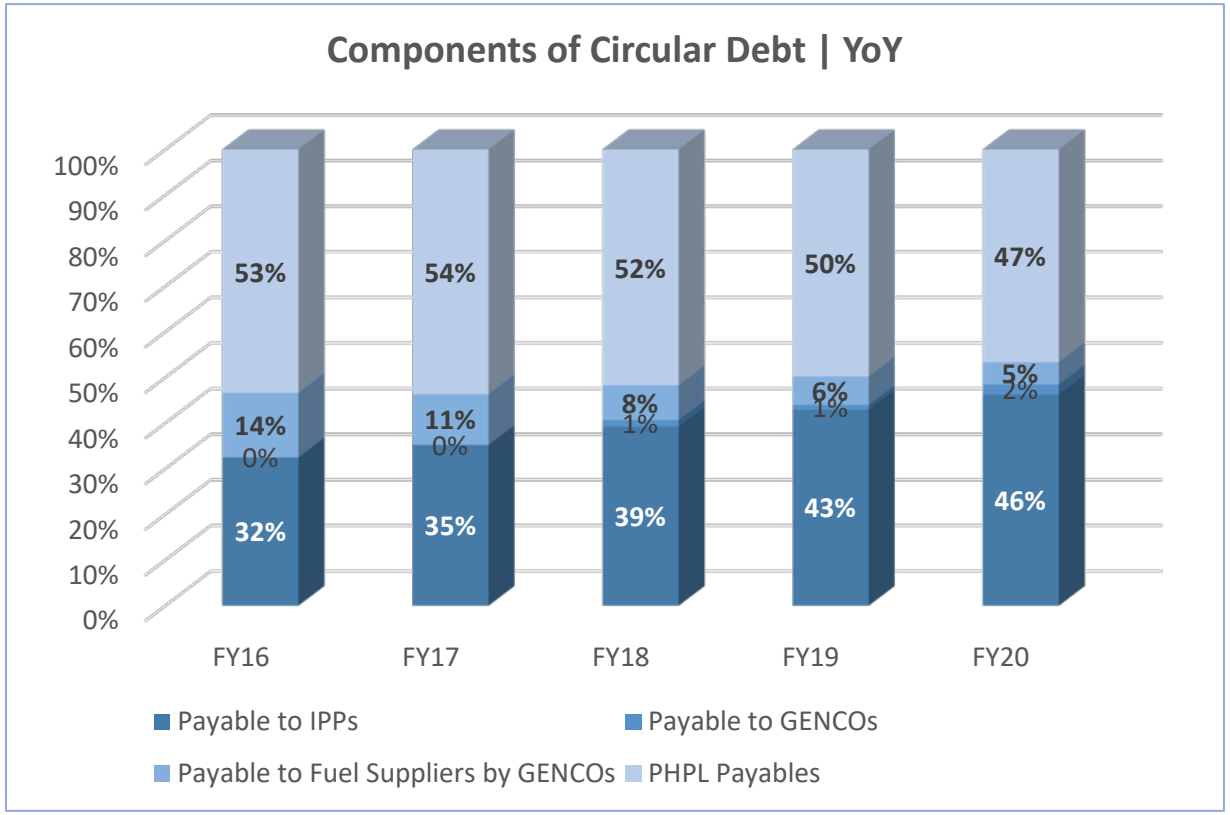


Source : NEPRA State of the Industry Report

POWER GENERATION

Accumulation of Circular Debt





- The total amount of circular debt has increased to PKR~2.3trn as at End-Nov'20, representing an increase of PKR~156bln in 5MFY21, a monthly run rate of PKR~32bln addition to the misnomer pile.

Source : NEPRA State of the Industry Report

POWER GENERATION

Circular Debt – Initiatives to stop accumulation

- In recent years, the major build-up in the circular debt has been caused by capacity payments to large power projects set up since 2015, primarily as part of the multibillion-dollar CPEC initiative, with Chinese money.
- Circular debt is not only affecting the liquidity of the fuel supplier, generation, transmission and distribution companies but also increasing the cost of electricity for the end-consumer.
- Higher T&D losses, low recoveries from DISCO's, delay is subsidy payments, increasing receivables from public and private consumers are some of the major reasons contributing to mounting circular debt.
- The strategies listed in the adjacent table are in consideration by the GoP to address the circular debt menace.

Major Components of Circular Debt - PKR bln	FY20
Operational Inefficiencies	752
Non-Payment by QESCO Agriculture Tubewell	306
Limitations & Delays in Regulatory Approval	270
Non-payment of subsidies	260
Non-Payment by K-Electric	212
Outstanding Amounts by AJK	144
Others	140
Interest Payment on Power Sector Debt by PHPL	66
Total Debt	**2,150**

Issue	Way Forward
Excess/expensive generation capacity	-Negotiation with IPPs -Reduction of RoE of govt. owned power plants -Shut down of inefficient GENCOs -CPEC projects
Non-payment by K-Electric	Early signing of PPA by K-Electric based on commercially viable terms
Outstanding amount of AJK	Removal of GaP of AJ&K tariff differential-summary initiated
Delay tariff determinations	Tariff rebasing to be announced by NEPRA to reduce the gap
Quetta Agriculture tube wells	Provincial govt. support required for recovery drive and installation
Non-payment of subsidies	Full amount of summary to be budgeted and released
PHPL interest charges	Amendments of NEPRA Act

Source : NEPRA State of the Industry Report

POWER GENERATION

IPPs – What you need to know

A Brief History

- Until 1980s, Pakistan was continually facing the chronic issue of power shortage due to rapidly increasing power demand (7-8% YoY) and lower supply. The disruption in power supply was impeding the industrial progress of the country. This situation called for an immediate intervention by the GoP.

- Considering the fact that developing power generation capacity is capital intensive and could absorb a high portion of the allocated federal budget, the GoP made in principle 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.

- Currently, there are 84 IPPs operational in the country. Private Power Projects include Foreign-Local partnerships, including groups like Nishat, Saphhire, Attock, Engro and Fauji group from the local side.

Key Features

- **Minimum Equity Requirement:** The minimum equity requirement for IPPs is 20% of the total project cost.

- **Bulk Power Tariff:** A Bulk Power Tariff of US Cents 6.5/kWh (in PKR) is offered to the IPPs by the GoP as an average for the first 10 years of sale of electricity. Additionally, a minimum levelized tariff of US Cents 5.9/kWh (PKR1.776/kWh) is set as the final parameter for the acceptance of the tariff. The tariff is indicative and is calculated on an annual plant factor of ~60%. The actual tariff has two components: **Capacity Price** & **Energy Price.**
- Capacity Price is paid to the IPPs on a monthly basis: it covers the debt servicing cost, fixed O&M costs, insurance expense and ROE. This monthly capacity price keeps the IPPs' investors insulated against variations in energy purchased ('Take or Pay').
- The Energy Price is paid in PKR/kWh on actual energy sold by IPPs.
- Moreover, a mechanism has been provided for indexation/adjustment of the certain tariff components based on Rupee/Dollar exchange rate, fuel price variations and inflation.

Source : PPIB

POWER GENERATION

Power Tariffs – How they are determined

In accordance with NEPRA Tariff Standard & Procedure Rules, 1998, NEPRA is responsible for determining the tariffs for all generation, transmission and distribution companies of the Sector. In order to understand the tariff system, it is divided into three levels (i) the generation level (ii) transmission level and (iii) distribution level.

Generation:

- At the generation level, the 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 price of fuel and (3) Variable Operations & Maintenance Costs (O&M).
- The Capacity Charge is indexed with parameters such as exchange rates and interest rates. Also, the capacity charge is based on 'take or pay' method, which implies that power producers are allowed to impose it irrespective of the amount of electricity produced and sold, unlike variable charges which are based on the amount of electricity produced and sold, reference fuel mix and their price.

Transmission:

- At the transmission level, the 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 maximum demand index of all DISCOs and bulk power consumers connected to the NTDC transmission network.

Distribution

- Finally, the retail tariff is determined at the distribution stage. This includes tariff 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 Government to unify tariff across all DISCOs.

Note: This is a general overview of the tariff structure and does not include details such as prior year adjustments, NEPRA fuel price benchmarking, etc.

Source: https://www.sbp.org.pk/reports/quarterly/fy19/Third/Special-Section-1.pdf

POWER GENERATION

Business Risk – An Overview

- This Sector Study focuses on the Business & Financial Risk of Independent Power Producers (IPPs).
- IPPs are Special Purpose Companies that operate in a firmly regulated environment, which shields them from multiple business and financial risks. Some cushions available against business risk are listed below:

❖ IPPs enjoy tax-free status.

❖ All IPPs are governed by project agreements (Implementation Agreement (IA), Power Purchase Agreement (PPA) and fuel/gas supply agreements), by way of which they are protected against multiple business and financial uncertainties.

❖ The long term nature of PPAs spanning over a period of 25-30 years shields the IPPs from economic vicissitudes. Also, the underlying take-or-pay mechanism in the PPAs insulates them from the 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 respect 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 fulfill its payment obligations towards the IPPs is secured by the Government Guarantee.

- The business risk of IPPs is largely linked to qualitative issues which can impede their operational performance. One of the key risks is the **fuel supply risk**. In the latest PPAs, the GoP does not guarantee the fuel supplier's obligations underlying in the Fuel Supply Arrangement (FSA). In the event of non-performance of an FSA, the IPPs may be subject to operational risks due to underutilization or even closure of plants.
- **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.

Source: PACRA Database

POWER GENERATION

Business Risk | Latest Developments

- Pakistan has been able to achieve power capacity surplus by far but at a very heavy cost of growing Circular Debt (CD) mammoth. IPPs, the foreign-local partnerships, have historically been awarded guaranteed returns, fixed capacity payments and dollar indexation of the tariff. These increased capacity payments (specially on idle power plants), difficulty in cost pass through to end consumers and delayed tariff adjustments have resulted in a drastic spike to the CD menace. In order to arrest the growing concern, the GoP in Aug'20, had signed MoUs with 47 IPPs to address issues relating to mechanism of their payments, terms of tariff structure and other pertinent modalities. A snapshot of the major amendments to the PPAs with reference to tariff structure is given below:

Impact	Revision	Original
Tariff Component – ROE and ROEDC | Local Investment	17% per annum (PKR) Current USD Equity shall be converted to PKR @ an exchange rate of PKR/USD 148.	15% (USD)
Tariff Component – ROE and ROEDC | Foreign Equity	12% USD per annum	
Tariff USD Indexation	**No**	**Yes**
Late Payment Surcharge (LPS) (Revised Rates shall be effective only subject to ensuring that payments follow the PPA mandated FIFO payment principles)	Reduce to KIBOR + 2.0% for the first sixty days and then revert to KIBOR + 4.5% as per the PPA.	KIBOR + 4.5%
O&M Savings**	To be shared with the Power Purchaser	Retained by the IPP
Receivables of the IPPs	Essential	Not an essential feature

NEPRA Tariff Components – IPPs	Impact
Capacity Charges	**> Downward Impact on IPPs' Incomes due to:** - Tariff delink with USD. - Revised Rates of ROE and ROEDC. **> Positive Impact on IPPs' cash flow due to:** - Payments of IPPs' receivables made an essential feature of the MoUs.
Fixed O&M – Foreign and Local	
Working Capital Costs	
Return on Equity (ROE)	
Return on Equity During Construction (ROEDC)	
Variable O&M	
O&M – Foreign and Local	

- Tariff delink with USD is expected to lower the income of the IPPs. On the contrary, the amendment obliging the payment of IPPs' receivables is a positive development for the cashflows of the IPPs. According to news sources, the GoP has agreed to pay PKR~450bln outstanding dues to IPPs within a year, the modalities of which are being worked out.

Source: PACRA Database

POWER GENERATION

Financial Risk – An Overview

- **Off-taker Risk:** Unlike most other Corporates, IPPs operate in a single buyer market (CPPA-G/K-Electric). The off-taker for the IPPs is this single buyer. Although, dependence is concentrated on one Entity, the obligations of the off-taker are protected by a Sovereign Guarantee through the IA. This acts as a mitigant to the financial risk relating to the off-taker.

- **Liquidity Risk:** The financial discipline of the Power Sector is relatively weak. The DISCOs are subject to risk of non-payment by consumers which results in delayed payments to power purchaser ultimately creating volatility in cash payments to the IPPs. Any extended delays in payments compels the IPPs to obtain Sponsor Loan or external funding (short term borrowings (STBs)).

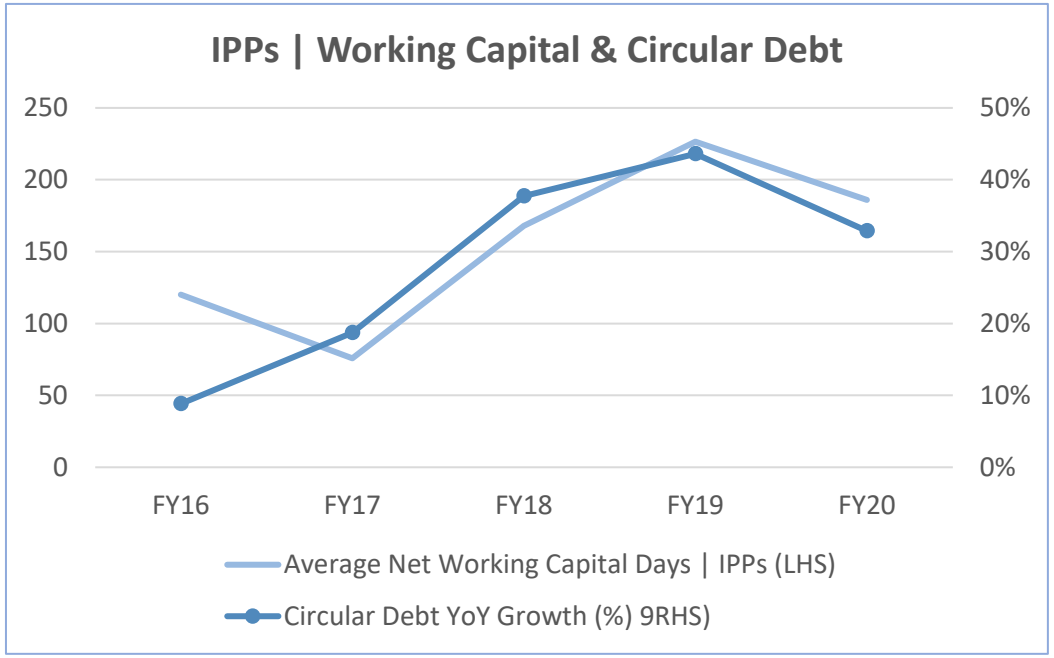
- **Working Capital Financing:** This risk emanates from the same factor as for liquidity risk. Volatility in recoveries from the off-taker balloons the receivable days for the IPPs – a component of the CD. Resultantly, IPPs are forced to obtain STBs to manage their Working Capital Needs, exerting pressure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

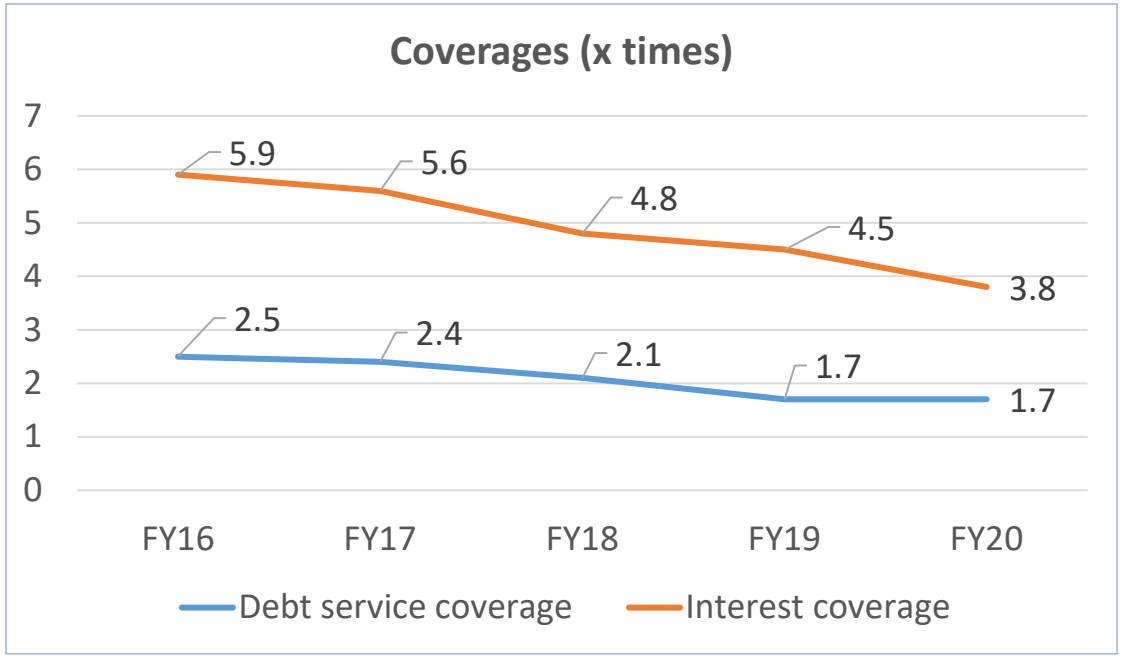
- **Coverages & Capital:** The minimum equity requirement for IPPs is ~20% of the project cost, the other component being debt. The IPPs, therefore, have a high exposure to External Funding. Financing Structure, including Minimum Debt Service Coverage Ratio, debt to equity movement and debt repayment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

Source: PACRA Database

POWER GENERATION

Financial Risk – An Insight





- The Working Capital Cycle of IPPs is largely a function of their receivables which is one component of the CD. As witnessed in the first table, the annual percentage increase in CD has a direct correlation with the Net Working Capital days of the IPPs.
- The debt servicing capacity of the IPPs has reduced over the years due to increasing finance expense resulting from the need to manage larger receivables on the backdrop of blocked recoveries in the power sector. The coverages are, however, expected to improve going forward due to lower interest charge on account of policy rate cut by 625 bps.

Source: PACRA Database

POWER GENERATION

Latest Developments

- **Covid-19 Response:** 2020 has been a tough year for the local and global economy owing to the outbreak of unprecedented pandemic Covid-19 across the globe. Many major economies have trembled over the shocks caused by the virus and faced downturns like never before. Pakistan, has too absorbed the adversity but with a relatively lesser intensity than the developed countries. Being responsive to the crisis, the GoP, through the Power Division, provided relief measures to the masses to ensure provision of affordable power supply to the consumers.

❖ A stimulus package of PKR~381bln was provided to ease the financial burden of residential consumers at the start of pandemic. Furthermore, the government launched another package recently to cater the SMEs. Some salient features of the new package for SMEs are: 1) Peak hours have been removed 2) Small and medium industries using additional power — as compared to their previous bills — will be provided electricity at a discount of 50pc till June 30, 2021 3) For next three years, all industries will be given a discount of 25pc for using additional units as compared to their previous bills. Additionally, bill deferments were allowed to masses to protect against financial crunch.

- **IPPs | Amendments to the PPAs:**

❖ 19 IPPs out of the 47 who signed the MoUs in Aug'20 have agreed to enter into the legally binding contracts with the GoP, the first of which were Solar and Bagasse IPPs. The development may still take time to become fully effective in shape of new agreements. Nevertheless, once the legal agreements are signed, it would be a turning point for the power sector. The 'take-or-pay' method of tariff structure will be revised as the O&Ms Savings shall be shared with the Power Purchaser. On the other hand, delinking components of tariff to USD index will also reduce the burden of capacity payments and related mounting debt financing costs. The other silo of this transaction - clearance of IPPs dues considered essential, is expected to resolve the circular debt issue to an extent. Meanwhile, this will also improve liquidity position of IPPs.

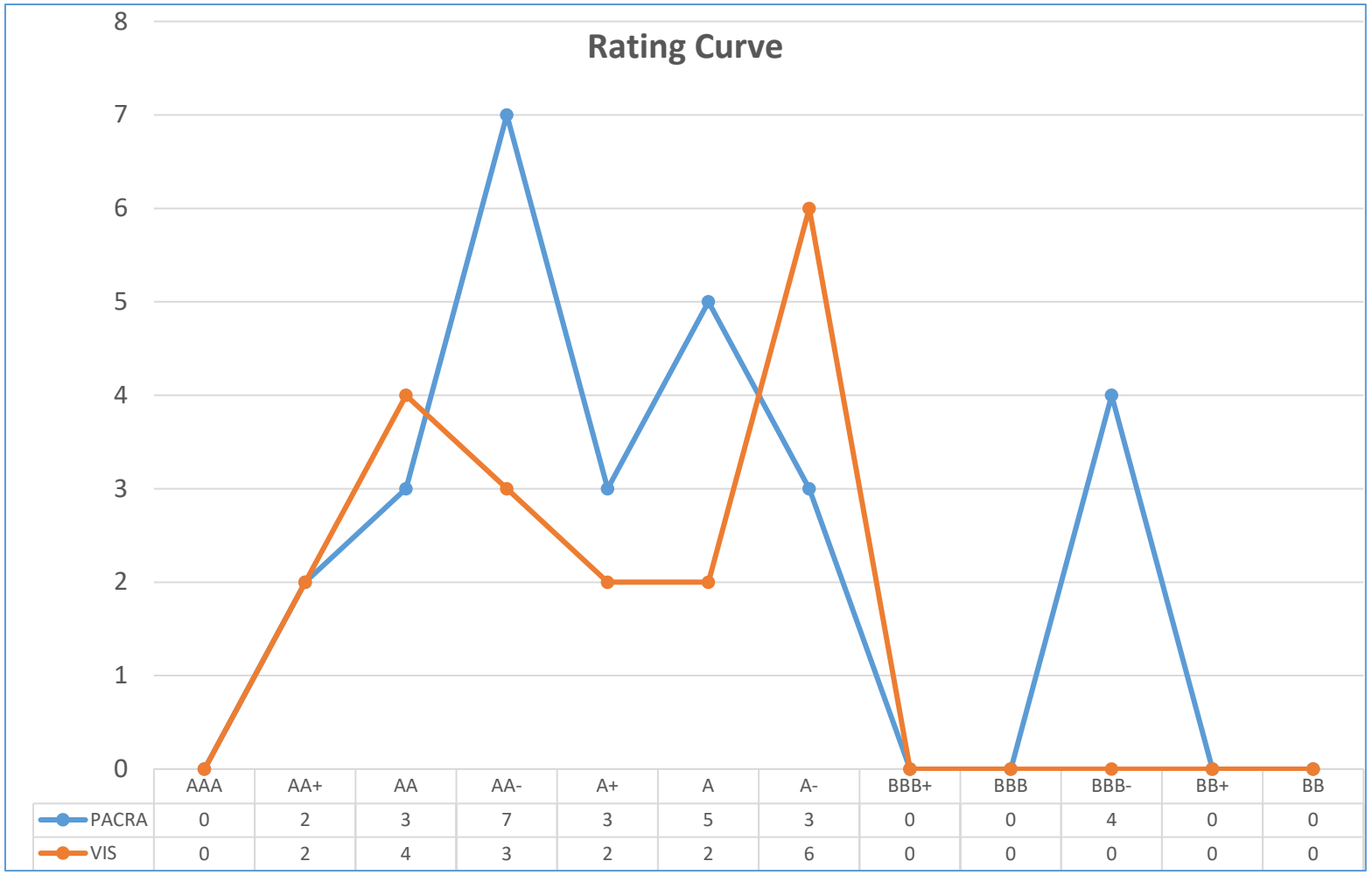
- **Progress towards Hydel & Renewable Energy:**

❖ With sufficient resources available, the GoP is focused on increasing proportion of cleaner and cheaper fuel in the power generation of the country. Resultantly, 22 out of 27 licenses issued during FY20 pertained to Renewable and Hydropower plants. The mix of Power generation from Hydel energy has also improved during FY20. Mohmand Dam and Diamer Basha Dam, two of the mega projects in the hydel power, are also ready for construction.

Source: PACRA Database

POWER GENERATION

Rating Curve



	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB
PACRA	0	2	3	7	3	5	3	0	0	4	0	0
VIS	0	2	4	3	2	2	6	0	0	0	0	0

- PACRA rates 27 entities in the Pakistan's Power industry

POWER GENERATION

SWOT Analysis

- Backbone of the Economy
- Players operate in a regulated environment.
- Low Business Risk due to Risk Mitigants such as Sovereign Guarantees on payment by purchaser and Performance Guarantees by the Contractors.

- Single Buyer Market with two generation baskets, creating inefficiency in the generation system.
- Under-utilization of efficient plants: GENCOs efficiency scale has deteriorated over the years.
- Low Available Capacity Factor.
- Use of High Cost fuels (RFO) results in increased cost of generation.

- Rising Circular Debt
- Increased T&D Losses weakening the financial discipline of power supply chain (Power Purchase Price accounts for only ~65% of the end-consumer tariff).
- Liquidity Damages (LDs) on account of non-performance of FSA
- Change in 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 process to revise 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 GENERATION

Outlook: Watch

- Pakistan's Power Sector is confronting deep-routed issues since long. The key risks being weak financial discipline and inefficiencies in all three verticals of the System. The Sector is, however, considered the backbone of economy and the GoP is keen on developing long term sustainable solutions to the ingrained power issues. Apart from the rising circular debt, some positive developments have surfaced on the economic and power sector level in the recent times.
- Industrial activity has picked up in various sectors with the Large Scale Manufacturing Industries output increasing ~5.46% YoY during the first four months of FY21. The sectors which have contributed to this growth are textiles, food & beverages, pharmaceuticals and chemicals.
- 19 IPPs out of the 47 who signed the MoUs in Aug'20 have agreed to enter into the legally binding contracts with the GoP, the first of which were Solar and Bagasse IPPs. The development may still take time to become fully effective in shape of new agreements. Meanwhile, payment of circular debt related dues under this agreement will improve liquidity position of IPPs.
- The decision taken by the State Bank of Pakistan (SBP) to lower the policy rate by 625bps to 7% in the last quarter of FY20 has lowered the finance costs incurred by power producers for financing availed to bridge liquidity gap.
- The inflation level in the country has also declined. The average inflation rate during the 1HFY21 stood at ~8.74% as compared to an average inflation rate of ~10.7% during FY20. Moreover, the exchange rate is also expected to remain stable in the near future.
- With sufficient resources available, the GoP is focused on increasing proportion of cleaner and cheaper fuel in the power generation of the country. Resultantly, 22 out of 27 licenses issued during FY20, pertained to Renewable and Hydropower plants. The mix of Power generation from Hydel energy has also improved during FY20. Mohmand Dam and Diamer Basha Dam, two of the mega projects in the hydel power, are also ready for construction.

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