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KP POWER SECTOR BUSINESS PLAN

March 2021

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Acronyms

ADB	Asian Development Bank
ADP	Annual Development Programme
AEDB	Alternative Energy Development Board
AIP	Accelerated Implementation Program
AJ&K	Azad Jammu and Kashmir
AKRSP	Aga Khan Rural Support Programme
AP	Affected Persons
APCMA	All Pakistan Cement Manufacturers Association
ARE	Alternate Renewable Energy
BHU	Basic Health Unit
BPC	Bulk Power Consumer
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditure
CBO	Community Based Organizations
CCOE	Cabinet Committee on Energy
CM	Chief Minister
COD	Commercial Operations Date
CPEC	China-Pakistan Economic Corridor
CPI	Consumer Price Index
CPP	Captive Power Plants
CPPA	Central Power Purchasing Agency
CSR	Corporate Social Responsibility
CTBCM	Competitive Trading Bilateral Contract Market
DISCO	Distribution company
DLI	Disbursement Link Indicator
ED	Electricity Duty
EDF	Energy Development Fund
EHV	Extra High Voltage
EIA	Environmental Impact Assessment
EPA	Energy Purchase Agreement
ESCO	Energy Supply Companies
ESMAP	Energy Sector Management Assistance Programme
EWA	Energy Wheeling Agreement
FC	Fuel Charge
FESCO	Faisalabad Electric Supply Company
FY	Financial Year
GDP	Gross Domestic Product
GEPCO	Gujranwala Electric Power Company
GHI	Global Horizontal Irradiance
GoKP	Government of Khyber Pakhtunkhwa
GoP	Government of Pakistan
GPP	Gross Provincial Product
GS	Grid Station
GST	General Sales Tax
GW	Gigawatt
HDF	Hydel Development Fund

Acronyms

HESCO	Hyderabad Electric Supply Company
HIES	Household Income and Expenditure Survey
HPP	Hydropower Project
HVAC	High Voltage Alternating Current
IEE	Initial Environmental Examination
IESCO	Islamabad Electric Supply Company
IGCEP	Indicative Generation Capacity Expansion Plan
IMF	International Monetary Fund
IP	Indigenous Peoples
IPP	Independent Power Producer
IR	Involuntary Resettlement
JDA	Joint Development Agreement
KE	K-Electric Limited
KHRE	Khyber Pakhtunkhwa Hydropower and Renewable Energy Development Program
KM	Kilometre
KP	Khyber Pakhtunkhwa
KPEZDMC	Khyber Pakhtunkhwa Economic Zones Development & Management Company
KPTGCL	Khyber Pakhtunkhwa Transmission and Grid System Company Limited
kV	Kilovolt
LESCO	Lahore Electric Supply Company
LOI	Letter of Intent
LSMI	Large-scale Manufacturing Industries
MEPCO	Multan Electric Power Company
MHP	Micro Hydel Project
MIS	Management Information System
MMHP	Mini Micro Hydel Project
MOE	Ministry of Energy
MSD	Multi-Sector Development
MW	Megawatt
NEPRA	National Electric Power Regulatory Authority
NGC	National Grid Company
NJ	Neelum-Jhelum
NTDC	National Transmission & Dispatch Company
O&M	Operations & Maintenance
P&D	Planning & Development
PDWP	Provincial Development Working Party
PEDO	Pakhtunkhwa Energy Development Organization
PEPA	Pakistan Environmental Protection Agency
PESCO	Peshawar Electric Supply Company
PGC	Provincial Grid Company
PHPP	Pehur Hydropower Project
PHS	Pumped Hydro Storage
PKR	Pakistan Rupees
PPDCL	Punjab Power Development Company Limited
PPP	Public Private Partnership
PV	Photovoltaic

Acronyms

QESCO	Quetta Electric Supply Company
RE	Renewable Energy
RFP	Request for Proposal
ROEDC	Return on Equity During Construction
SBP	State Bank of Pakistan
SEPCO	Sukkur Electric Power Company
SEZ	Special Economic Zone
SRSP	Sarhad Rural Support Programme
ST&DCPL	Sindh Transmission & Dispatch Company Private Limited
T&D	Transmission & Distribution
TERF	Temporary Economic Refinance Facility
TESCO	Tribal Electric Supply Company
UNIDO	United Nations Industrial Development Organization
UOSC	Use of System Charge
VRE	Variable Renewable Energy
WAPDA	Water And Power Development Authority

Section 01: Economic Outlook

Economic Outlook

Pakistan Real GDP Growth Rate in comparison to world economies

Key Facts

Name: Islamic Republic of Pakistan
Capital: Islamabad
Major Languages: Urdu, English
Major Religion: Islam (98%)
Currency: Pakistani Rupee

AREA
881,913 sq. km

ECONOMY SIZE (GDP)
US$ 278 billion
(Current US$)

POPULATION
220.8 million

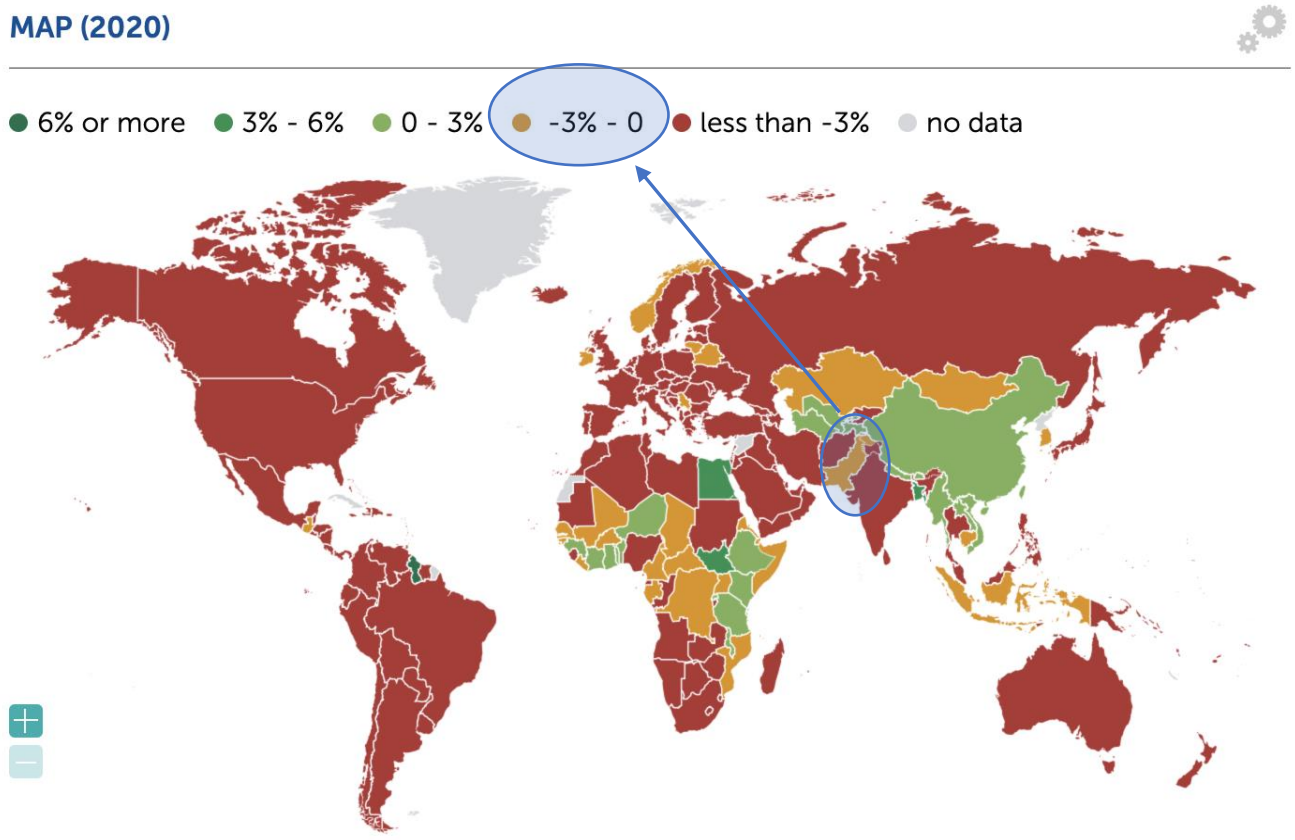
LABOUR FORCE
75.86 million *(World Bank)*

POPULATION GROWTH
2.0% *(World Bank)*

UNEMPLOYMENT RATE
4.5% (IMF)

As per IMF Oct 2020 outlook, Pakistan stands as one of the least affected economies from the affects of COVID-19.

In August 2020, Moody upgraded Pakistan's outlook from 'under review' to 'stable', maintaining a B3 rating, amidst COVID-19. Standard & Poor and Fitch's credit ratings for Pakistan stand at B- with stable outlook.



Source: https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/SAQ/BGD/BTN/IND/MDV/NPL/PAK/AFG

Economic Outlook

Pakistan's economic stabilization and growth amidst COVID – 19 environment

Over the last decade, Pakistan's GDP growth rate has hovered at around 4 per cent.

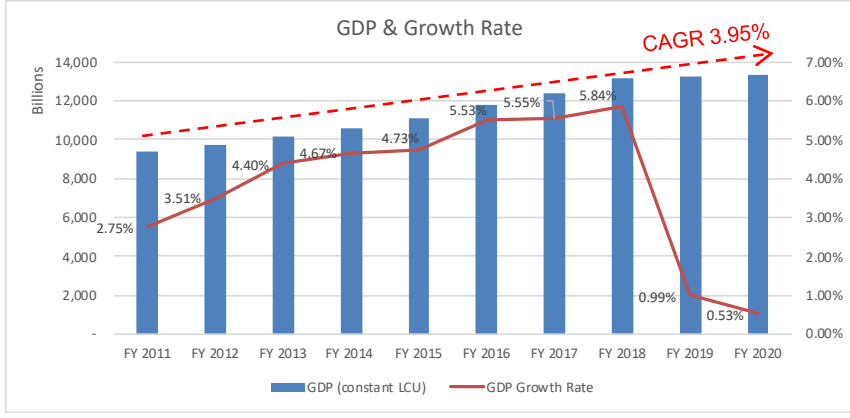
The higher economic growth rates witnessed over 2016 to 2018 were buttressed by an overvalued pegged exchange rate and an expansionary monetary policy that induced short-term domestic demand and growth at the cost of weakened macroeconomic fundamentals.

By late 2019, signs of economic recovery became apparent as the exchange rate stabilized, international credit outlook and doing business indicators improved and the twin deficits began to shrink.

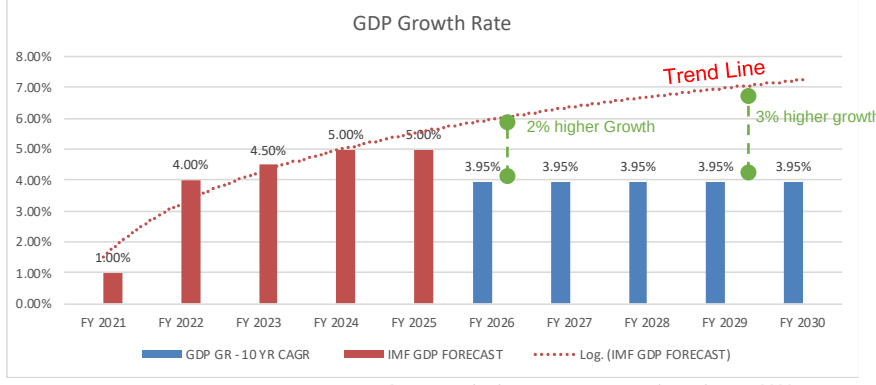
Yet the transition from stabilization to growth was interrupted by the outbreak of COVID-19, and the economy went into partial lockdown from March to May 2020.

However, considering Pakistan's fast recovery from COVID-19 environment, IMF's projected trend suggests recovery of GDP growth rate to 5% by FY 2025.

Post 2025 (subsequent to COVID) Pakistan's GDP growth rate is expected to be around 6% to 7.2%, that is 1.5x to 1.75x of current CAGR of 3.95%.



Source: 2011-2019 Data- World Development Indicators
Source 2020 data - SBP Annual Report 2020



Source: Red columns IMF Forecasted Trend – Dec 2020

Economic Outlook

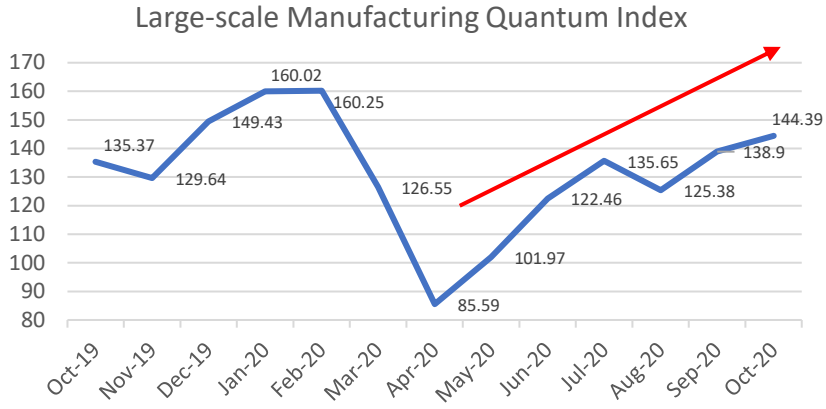
Recovery of Pakistan's Industrial Sector

In light of COVID-19's impact on the economy, SBP allowed financing under Temporary Economic Refinance Facility (TERF) for modernizing or expanding manufacturing and production units to stimulate investment in Pakistan, with an end user mark-up rate of 5%.

TERF has shown substantial growth over the last nine months as indicated by increase in requested amount from Rs. 36.1 billion by end April 2020 to Rs. 517.4 billion by Dec 10, 2020 while over the same period approved financing has reached to Rs. 222.7 billion from Rs. 0.5 billion.

Large-scale Manufacturing Industries (LSMI) output increased by 6.66% for October 2020 compared to October 2019, and by 3.95% if compared to September 2020. This is also evident from the 17% year-on-year increase in cement dispatches based on first five months data (of FY 2021). All Pakistan Cement Manufacturers Association (APCMA) reported an increase in exports by 22%, while domestic demand rose by 6%.

Taking into account the visible rebound in economic activity due to concessionary schemes and eased mobility restrictions, SBP projects GDP growth to be between 1.5-2.5% in FY 2021, which is higher than IMF's forecast of 1%. The Planning Commission of Pakistan targets GDP growth at 7-8% based on Vision 2025 and Vision 2030.



Source: SBP Data: Production of Selected Large-scale Manufacturing

Projected GDP Growth Rate Scenarios of Pakistan

	FY 2021	FY 2026	FY 2030/31	CAGR
Conservative	1.00%	5.00%	5.00%	4.11%
Base Case	1.00%	6.00%	7.20%	4.97%
Targeted	2.50%	7.00%	8.00%	5.56%

**target GDP growth rate for 2030 is based on the average of growth rate projections by "Vision 2025" and "Vision 2030" reports by Planning Commission.*

Source: The State of Pakistan's Economy. Annual Report 2019-20. State Bank of Pakistan.
Source: Global Cement News. Available at https://www.globalcement.com/news/item/11702-pakistani-five-month-cement-dispatches-rise
Source: Pakistan in the 21st Century. Vision 2030. Planning Commission

Economic Outlook

KP Historical GPP Level and Projected Trend

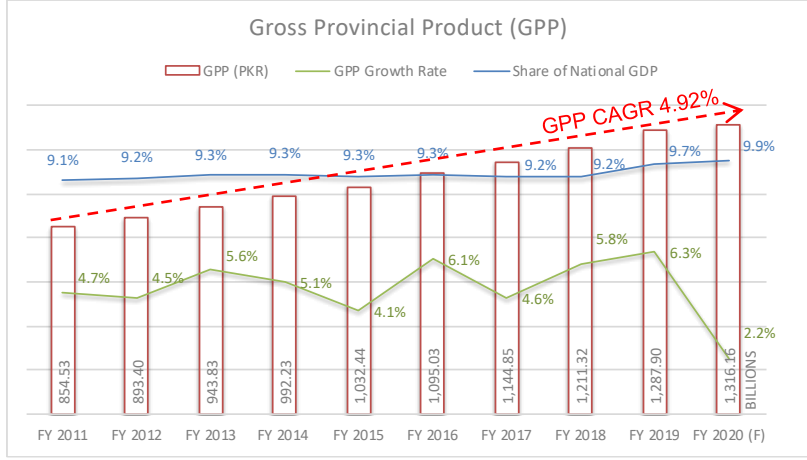
In initial eight years of the last decade (FY 2011 - FY 2018), KP has maintained its share in National GDP at around 9.2%. However, in FY 2019 KP was able to increase its GDP contribution to 9.7% while in FY 2020 it is expected that it will almost be touching 10%.

This is primarily because of increasing growth rate of Gross Provincial Product (GPP) from 4.6% in FY 2017 to 6.3% in FY 2019, while 10-Year CAGR of GPP is at 4.92% which is higher than 10-Year CAGR of Pakistan GDP.

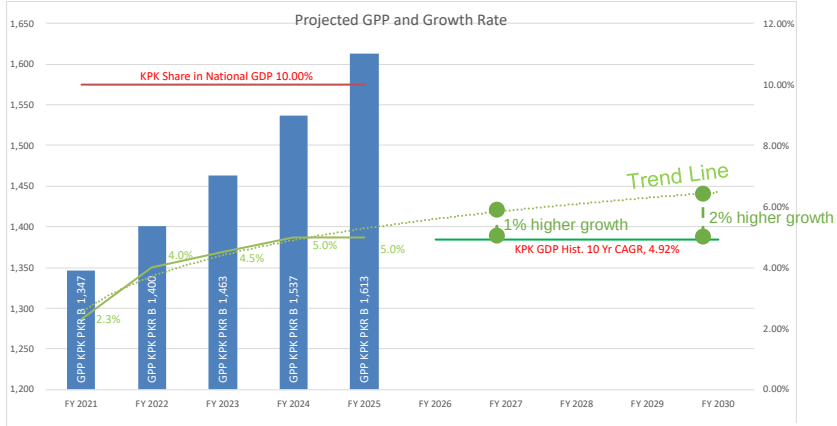
In FY 2020 it is expected that GPP growth rate will drop to 2.2% because of COVID-19 impact, however the negative impact is significantly lower than the impact on national economy (SBP 0.5%, IMF -0.4%).

Considering past trend, it is projected that even in a conservative scenario KP will be able to maintain its GPP growth rate and 10% share during FY 2021, and in next 5 years KP's share in Pakistan's GDP will remain intact, though KP's planning targets are even higher.

Based on above, KP will regain its growth momentum post COVID 2019 and is projected to achieve GPP growth rate of 5% in next five years. During FY 2026 to FY 2030, it is projected that KP growth rate will be around 6%-6.8%.



Source: 2011- 2018 data - KP Gross Domestic Product (GDP) 2017-18 from KP Bureau of Statistics , P&D
Source 2019- 2020 data is based on Coping strategy mitigating adverse impact of covid-19 on the economy & job market in KP by Bureau of Statistics , P&D



Source: Bridge Factor Analysis

Economic Outlook

KP Industrial Sector

The Government of Khyber Pakhtunkhwa aims to boost the economy of the province by focusing on the industrial sector. Khyber Pakhtunkhwa Economic Zones Development & Management Company (KPEZDMC) recently approved the launch of economic zones in Ghazi, Chitral, Jalozai and extension of the Nowshera economic zone. These new Economic Zones will create industrial growth & job opportunities for locals, and also spur economic activity slowed down by COVID-19.

KP's draft industrial policy targets balanced and sustainable growth by encouraging investment in the province in the context of China-Pakistan Economic Corridor (CPEC). In comparison to the growth projections previously mentioned, the new draft policy targets GPP growth of 3.5% in 2021 and 16% 5-10 years down the road.

The Rashakai SEZ is the key milestone and the first project for implementation of industrial cooperation under CPEC. China Road and Bridge Corporation plans to develop 1,000 acres of land as SEZ at Rashakai. A significant impact of CPEC on the Economic Zones will be taking advantage of the geostrategic position of KP because of its linkage to CPEC routes and access to natural resources. In the next 15 years, KPEZDMC forecasts that these Economic Zones will become the central hubs because of CPEC routes and SEZ's infrastructure, incentives and amenities.

However KP industry is also threatened by higher freight cost because of distance from port compared to SEZ's in other provinces while market size and access to central Asian states is limited, it is essential that KP industry is supported by provision of low cost electricity through wheeling from own hydel generation resources of KP.

Projected GPP Growth Rate Scenarios of KP				
	FY 2021	FY 2026	FY 2031	CAGR
Conservative	2.30%	5.00%	5.00%	4.22%
Base Case	2.30%	6.00%	6.92%	4.89%
Targeted	3.50%	10.00%*	16.0%	9.47%

Assumed

Source: Khyber Pakhtunkhwa Economic Zones Development & Management Company – Company Profile
Source: KP Government Unveils Draft of New Industrial Policy. Retrieved from https://www.pakistantoday.com.pk/2020/03/02/kp-government-unveils-draft-of-new-industrial-policy/
Source: KP Government Keen on Bringing About Industrial Revolution. Retrieved from https://www.thenews.com.pk/print/480881-kp-government-keen-on-bringing-about-industrial-revolution

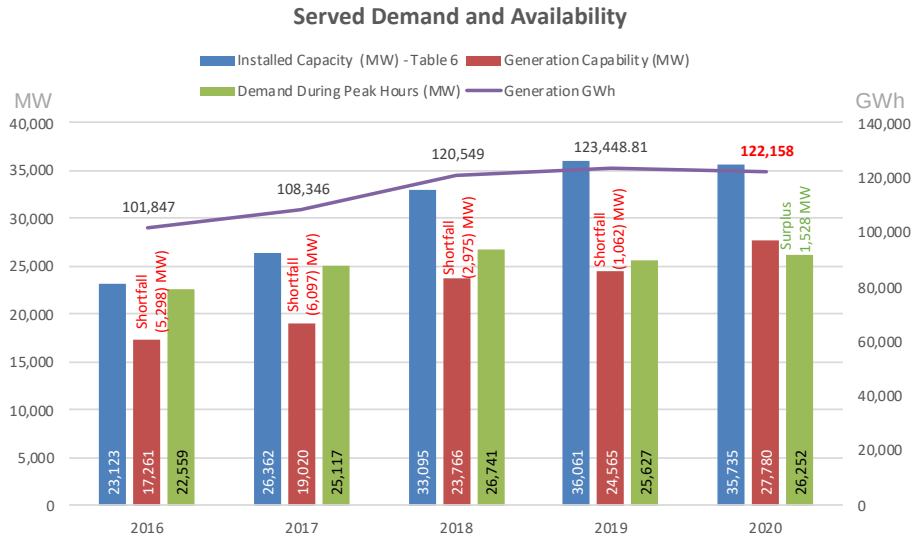
Section 02: Pakistan Power Sector

The Power Sector

Existing Generation Portfolio & Availability

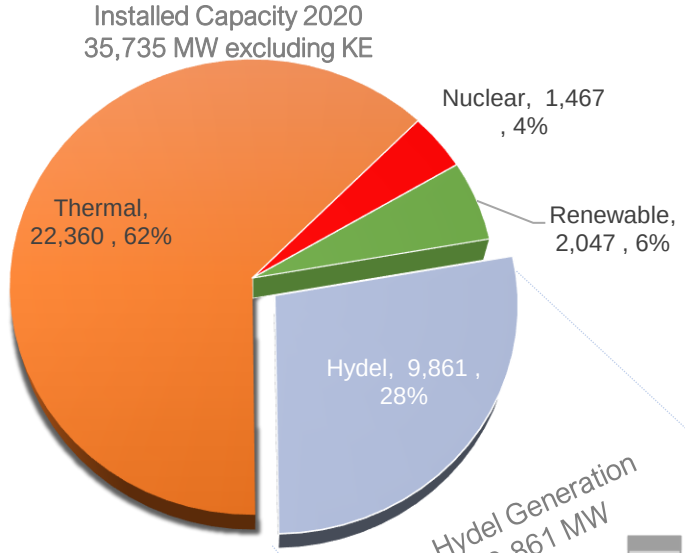
Trend of Peak Demand, Installed Capacity and Capability

Pakistan's generation capability (availability) had remained lower than the peak demand in last decade, however in FY 2020 generation capability has crossed peak demand and regulators are now more focused on cost of electricity and use of indigenous resources like coal, hydro, wind and solar etc. within generation segment.

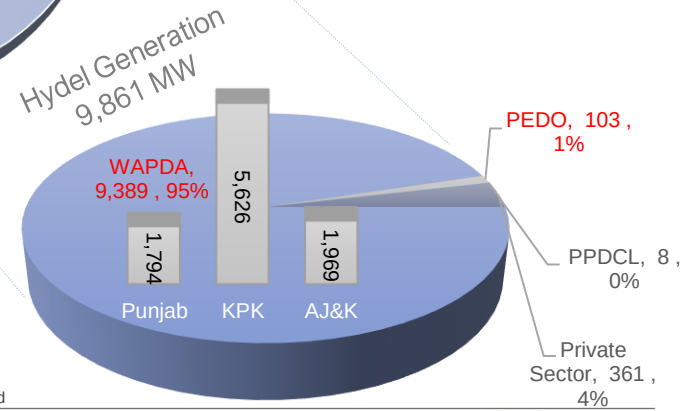


Generation Capability is the maximum generation capability of any day recorded during the year and Peak Demand is the maximum demand of any day recorded during the year.

Pakistan's Generation Portfolio – 2020 (CPPAG / NTDC)



Pakistan's installed generation capacity of 35,735 MW is heavily skewed towards thermal (62%) with hydel sources accounting for 28% of the total capacity.



A bulk of the operational hydel generation capacity i.e. 9,389 MW is owned by WAPDA.

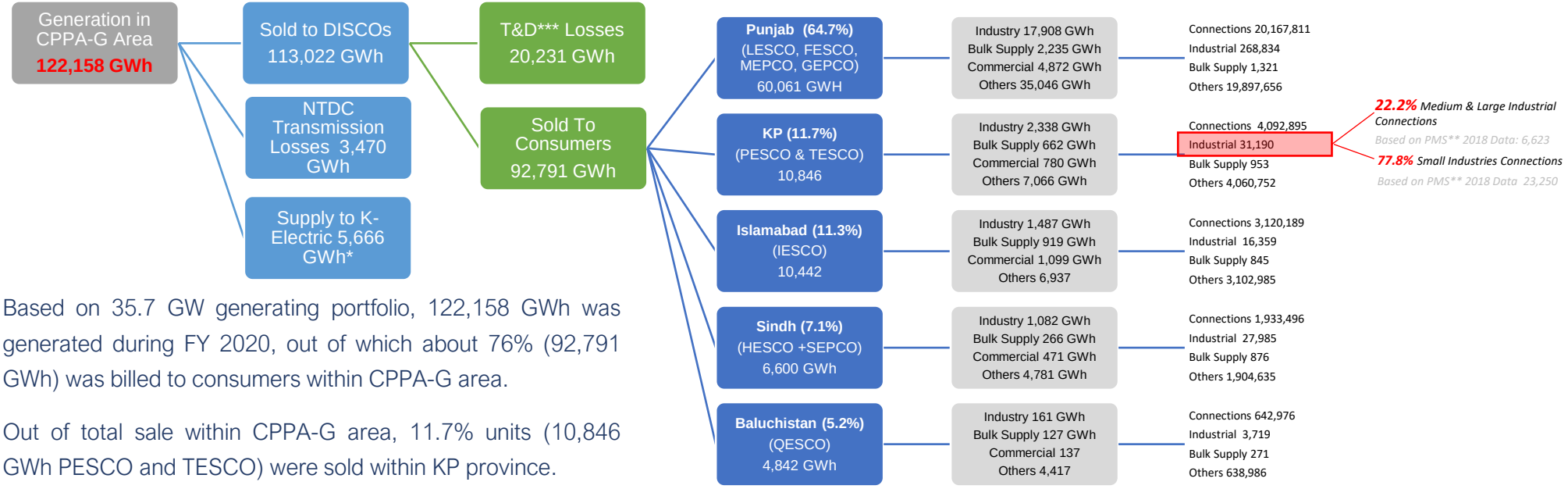
PPDCL = Punjab Power Development Company Limited

Source: State of Industry Report 2020 Table 5, 6 and 49

The Power Sector

Electricity Consumption Status -2020

Going forward, the GoP intends to accelerate adoption of renewables, and the focus is thus now shifting towards optimization and expansion of the country's transmission & distribution network which is widely seen as the key bottleneck towards ensuring reliable electricity supply to households, businesses and industries. The electricity consumption status as of June 30. 2020 is provided hereunder:



Based on 35.7 GW generating portfolio, 122,158 GWh was generated during FY 2020, out of which about 76% (92,791 GWh) was billed to consumers within CPPA-G area.

Out of total sale within CPPA-G area, 11.7% units (10,846 GWh PESCO and TESCO) were sold within KP province.

Within KP, industrial sector is the 2nd largest consumer (after domestic category) and accounts to 21.6% (excl. bulk supply) out of total billed units in KP.

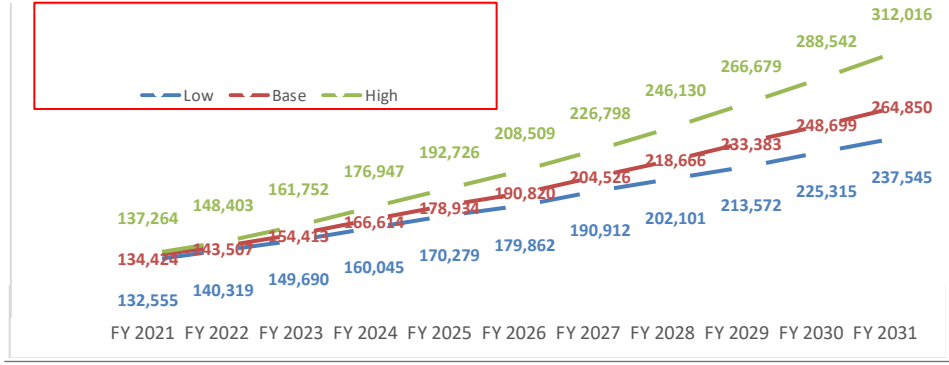
KP Industrial Electricity consumption has increased at the rate of 6.2% over FY 2016 to FY 2019, however it dipped by 14% in FY 2020 because of partial lock-down during COVID-19 environment.

Source: State of Industry Report 2020 Table 67 & 60
**240 GWh of unreconciled electricity has been included inn K-Electric supply*
*** Power Market Survey published in Aug 2019*
**** T&D Losses = Transmission & Distribution Losses*

The Power Sector
Demand Forecast

Forecasted demand (served) trends based on economic growth rates

Scenario	2020 Peak Demand (MW)	Growth %age (CAGR)	2026 Peak Demand (MW)	Growth %age (CAGR)	2031 Peak Demand (MW)	Growth %age (CAGR)
Indicative Generation Capacity Expansion Plan (IGCEP) 2018-40						
Low	26,251	3.94%	33,099	4.25%	40,759	4.08%
Base	26,251	5.23%	35,636	5.29%	46,115	5.26%
High	**26,251**	**6.41%**	**38,109**	**6.32%**	**51,777**	**6.37%**
Variable Renewable Energy Integration and Planning Study (VRE Study) 2019						
Low	26,251	4.72%	34,615	5.50%	45,235	5.07%
Base	**26,251**	**5.74%**	**36,697**	**6.56%**	**50,426**	**6.11%**
High	**26,251**	**7.30%**	**40,057**	**8.20%**	**59,393**	**7.70%**



Factors not considered in demand scenarios

Industrial Package - Discounted price on additional use of Electricity to enhance consumption and global competitiveness (incremental on electricity consumption).

Policy for reduction of subsidies on gas for captive power plants and efficiency audits of these captives is at final stages at federal level. Stringent efficiency level requirements on gas based captives will have an adverse impact on the use of captive power plants (5,000 MW estimate) and will further enhance use of electricity under industrial package in coming months (shift of industrial load from captives to grid will have incremental impact on electricity consumption).

National Electric Vehicle Policy - Based on the announced policy targets and incentives, it is envisaged that electric vehicles will capture 30% of all the passenger vehicle and heavy-duty truck sales by 2030, and 90% by 2040. It sets even more ambitious goals for two- and three-wheelers and buses; 50% of new sales by 2030 and 90% by 2040 (shifting from fuel to electric charging will have incremental impact on electricity consumption requirement).

Construction Industry Package - Includes markup subsidy for housing, finance and tax benefits provided to contractors and developers through finance bill 2020. Mandatory portfolio deployment in housing and finance by SBP.

Source: IGCEP 2018-2040 by Power System Planning NNTDC, Feb 2019
Source: VRE Study by Tractebel Engineering GmbH (Funded by Word Bank released in Nov 2020
Source: 2020 numbers are based on State of Industry Report 2020 by NEPRA

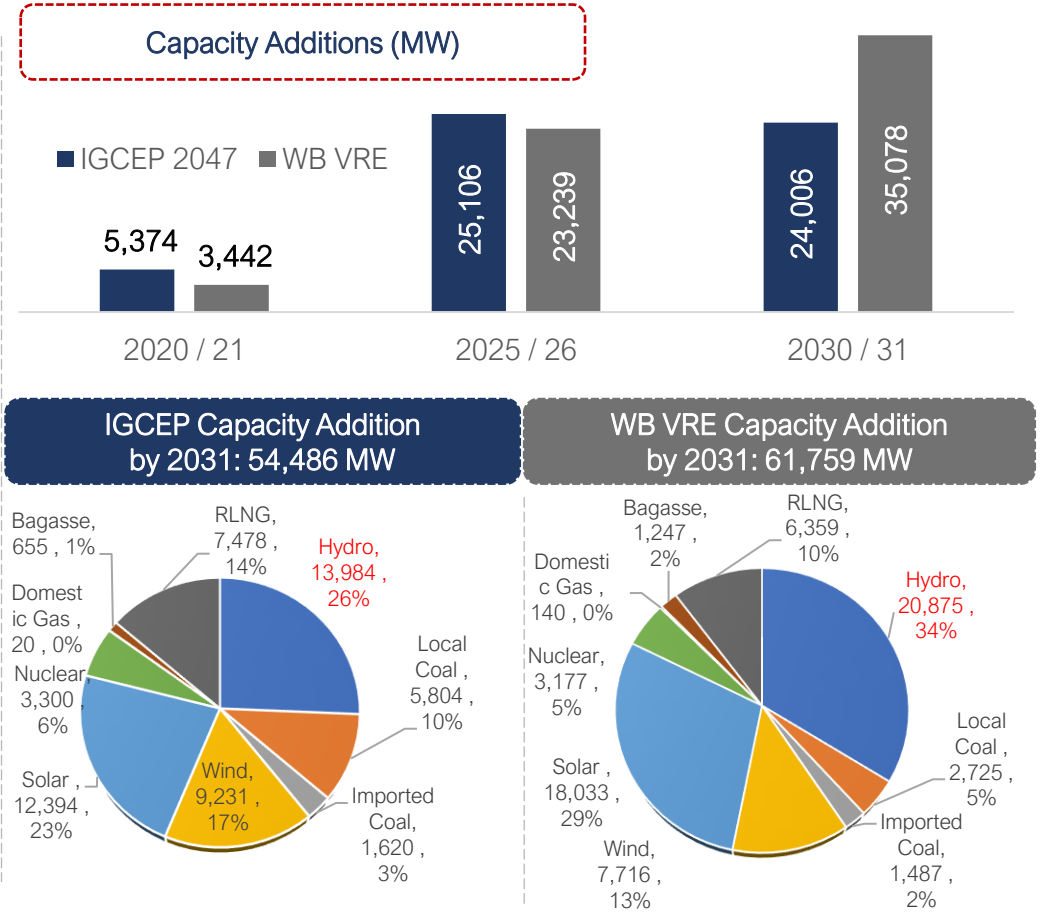
The Power Sector

Supply Forecast

The forecasted demand is expected to be met through significant enhancement in the country's generation capacity by the year 2031.

This expansion is to be primarily driven by the GoP's target [1] to have at least 20% of its generation capacity based on alternative and renewable energy by 2025 and 30% by 2030.

The IGCEP 2047 and WB's VRE Report suggest somewhat contrasting generation expansion plans in order to meet electricity demand in the base case scenario till the year 2031 as detailed herein.



Generation capacity enhancement by 2031 is expected to comprise of the following technologies.

I. Hydro: 13,984 – 20,875 MW
II. Wind: 7,716 – 9,231 MW
III. Solar: 12,394 – 18,033 MW
IV. Others: 15,135 – 18,877 MW

KP's share of supply forecast

- Solar: 6,199 MW of candidate projects to be undertaken through competitive bidding
- Wind: 489 MW of candidate projects to be undertaken through competitive bidding
- Hydro: 19,690 MW of KP projects are considered in the forecast as detailed in the ensuing pages.

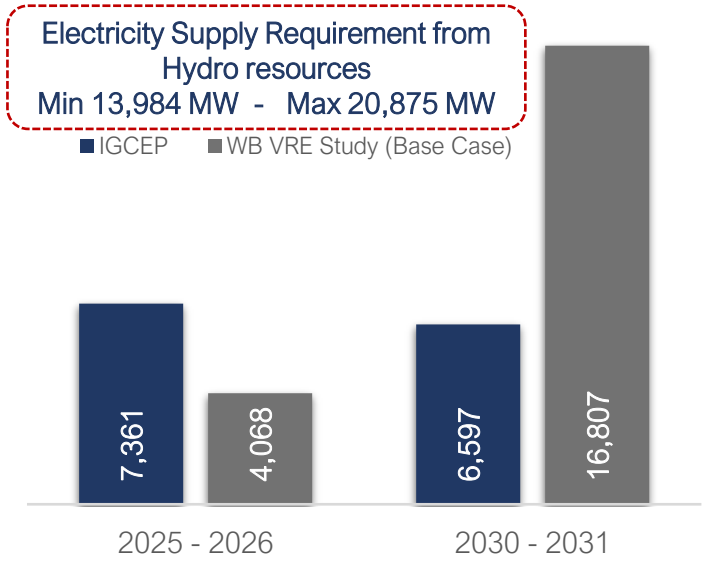
[1] Alternative and Renewable Energy Policy 2019

The Power Sector

Supply Requirement Vs Existing Pipeline

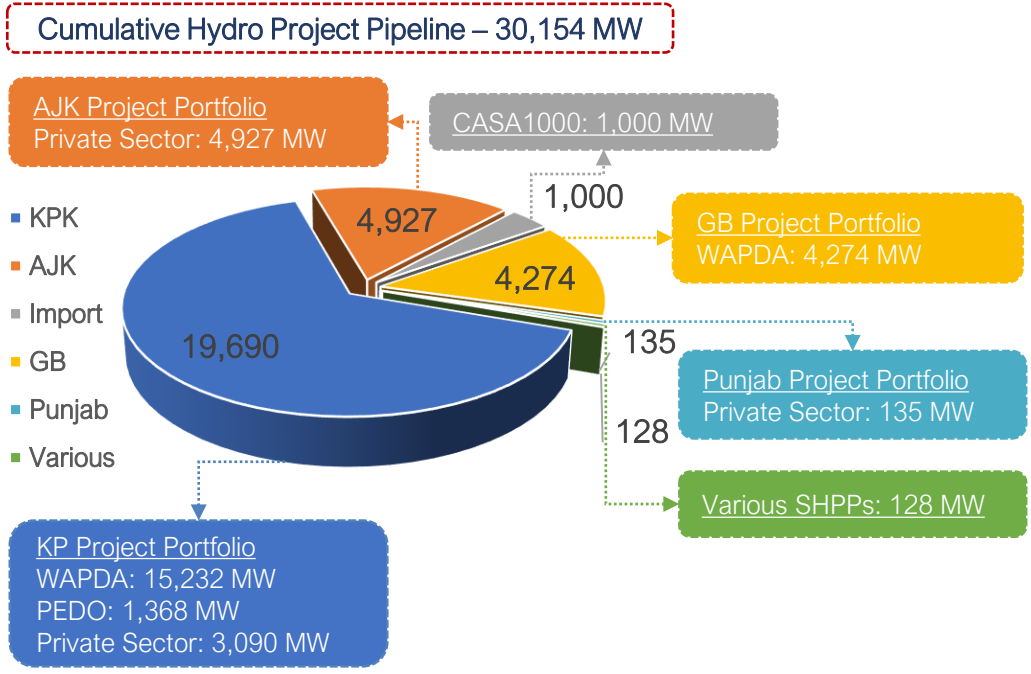
Supply Requirement from Hydro Resources

The IGCEP 2047 envisions hydro generation capacity addition of 13,984 MW by 2031 whereas the WB VRE study suggests a more aggressive hydro addition of 20,875 MW in the base case.



This proposed addition is based on an identified cumulative project pipeline of **30,154 MW** under various stages of development across the country. The extended candidate projects are only considered in the high demand and high VRE scenarios in the WB VRE study, in which can case 100% of existing development pipeline can be accommodated.

Existing hydro pipeline Under-development and recognized by NTDC/VRE Study



It is evident that by the year 2031, addition of a considerable quantum of hydro power generation is envisaged, a significant percentage of which is based in KP. However under development portfolio is about 1.5x to 2x of the supply requirement under existing studies.

The Power Sector

Status of major projects considered in supply

Project Name	Capacity (MW)	Location	Comment
Taunsa	135	Punjab	
Gumat Nar	49	AJK	
Lower Palas Valley	658	KP	Feasibility Stage
Lower Spat Ga	496	KP	Feasibility Stage
Phander	80	GB	Project at initial stages
Ashkot	293	AJK	Project at initial stages
Patan	2,400	KP	Project at initial stages
Thakot I	2,154	KP	Project at initial stages
Thakot III	1,686	KP	Project at initial stages
Shyok	640	GB	Project at initial stages
Bhasha	4,500	KP	Delays expected as no funding in place
Chakoti Hatian	500	AJK	Project at initial stages
Mahl	640	AJK	Project at initial stages
Bunji 1	3,520	GB	Project at initial stages
Riali III	3	AJK	
Blue Star	3	KP	
Duber Kalay	66	KP	Prefeasibility Stage
Dhander	56	AJK	Prefeasibility Stage
Nerai Dubair	46	KP	Prefeasibility Stage
Rajdhani	132	AJK	Project at initial stages

Section 03: KP Legal & Policy Framework

Legal & Policy Framework

Constitutional rights & KP Hydro Policy

Electricity Generation, transmission & distribution by province

Article 157 of the Constitution of Pakistan, 1973 allows the Provinces to develop their own power generation projects, lay transmission lines, distribute electricity, and even set their own tariffs, if the power generated is for use within the boundary of the relevant province and the project for electricity generation using alternative and renewable energy technology is not connected to the national grid.

The Federal Government may in any Province construct or cause to be constructed hydro-electric or thermal power installations or grid stations for the generation of electricity and lay or cause to be laid inter-Provincial transmission lines, however, under Article 157 the Federal Government, prior to taking a decision to construct or cause to be constructed, hydro-electric power stations in any Province, shall consult the Provincial Government concerned. In case of any dispute, the same will be taken to the Council of Common Interests for resolution of the dispute.

Khyber Pakhtunkhwa Hydropower Policy 2016

Khyber Pakhtunkhwa Hydropower Policy 2016 (the "Power Policy"), promotes and provides procedures for development and implementation of power generation projects and transmission lines in the province of Khyber Pakhtunkhwa, by (a) Private Sector; (b) Public sector under the Independent Power Producer (IPP) model (c) Public Private Partnerships (d) Captive Power Plants.

Under the Power Policy, PEDO is encouraged establishment of power projects in public private partnership. In line with the objectives set forth in the Power Policy, the incentives/concessions available to private power projects will also be available to projects implemented under public-private partnership. The Public Private Partnership will be affected through the legal framework of Joint Development Agreement (JDA), Shareholders Agreement and the Security Package Documents.

Whilst the Khyber Pakhtunkhwa Power Hydropower Policy 2016 refers to the development of projects under a 'public private partnership' mode, it envisions such public private partnerships to be undertaken pursuant to the said policy and not the Khyber Pakhtunkhwa Public Private Partnership laws. Nonetheless, it may be possible to develop power projects under the Khyber Pakhtunkhwa Public Private Partnership Act, 2020 (PPP Act). A Project to be undertaken pursuant to the PPP Act is defined as "any new and existing project developed or implemented in the physical, infrastructure, socio- economic and services sectors in the Public Private Partnership".

Legal & Policy Framework

Role of PEDO

Reorganization of PEDO

Under the recent Pakhtunkhwa Energy Development Organization Act, 2020, PEDO has been reconstituted as a body corporate having perpetual succession and a common seal, with power, subject to the provisions of the Pakhtunkhwa Energy Development Organization Act, 2020 (PEDO Act), to enter into agreements and contracts, acquire, hold and sell property, both movable and immovable, undertake projects, generate, transmit, distribute and regulate electricity, issue licenses and determine tariff within the Province and shall have the power to sue and be sued.

Exclusivity of GoKP

Under the Pakhtunkhwa Energy Development Organization Act, 2020, it has been clarified that all the hydro power project sites, within the Province of KP, exclusively vest in the KP Government. The hydro power project sites shall be developed by the KP Government in the public sector or on public private partnership basis and the hydro power project sites may be allocated to the private sector for hydro power projects development with the permission of the KP Government.

Major functions & powers of PEDO

- approve and undertake the projects of any financial value;
- regulate, generate, transmit and distribute the electric power services;
- construct, maintain, own, operate and control the power houses, grids and micro grids, transmission and distribution lines;
- conduct feasibility studies, surveys, detailed designs, detailed engineering and researches;
- establish one or more companies with the approval of the KP Government, under the Companies Act;
- establish thermal, solar, wind, hydro, waste to energy or other alternate renewable energy based power house,
- distribution and sale of energy to industries and domestic consumers, manage demand, issue licenses, cause setting of tariff, recover and collect charges and fees;
- acquire land or any interest in land which shall be deemed to be an acquisition for a public purpose within the meaning of the Land Acquisition Act, 1894 (Act No. 1 of 1894);
- perform any other function or exercise any other power as may be incidental or consequential for the performance of any of its functions

Section 04: KP Hydel Power Generation Pipeline

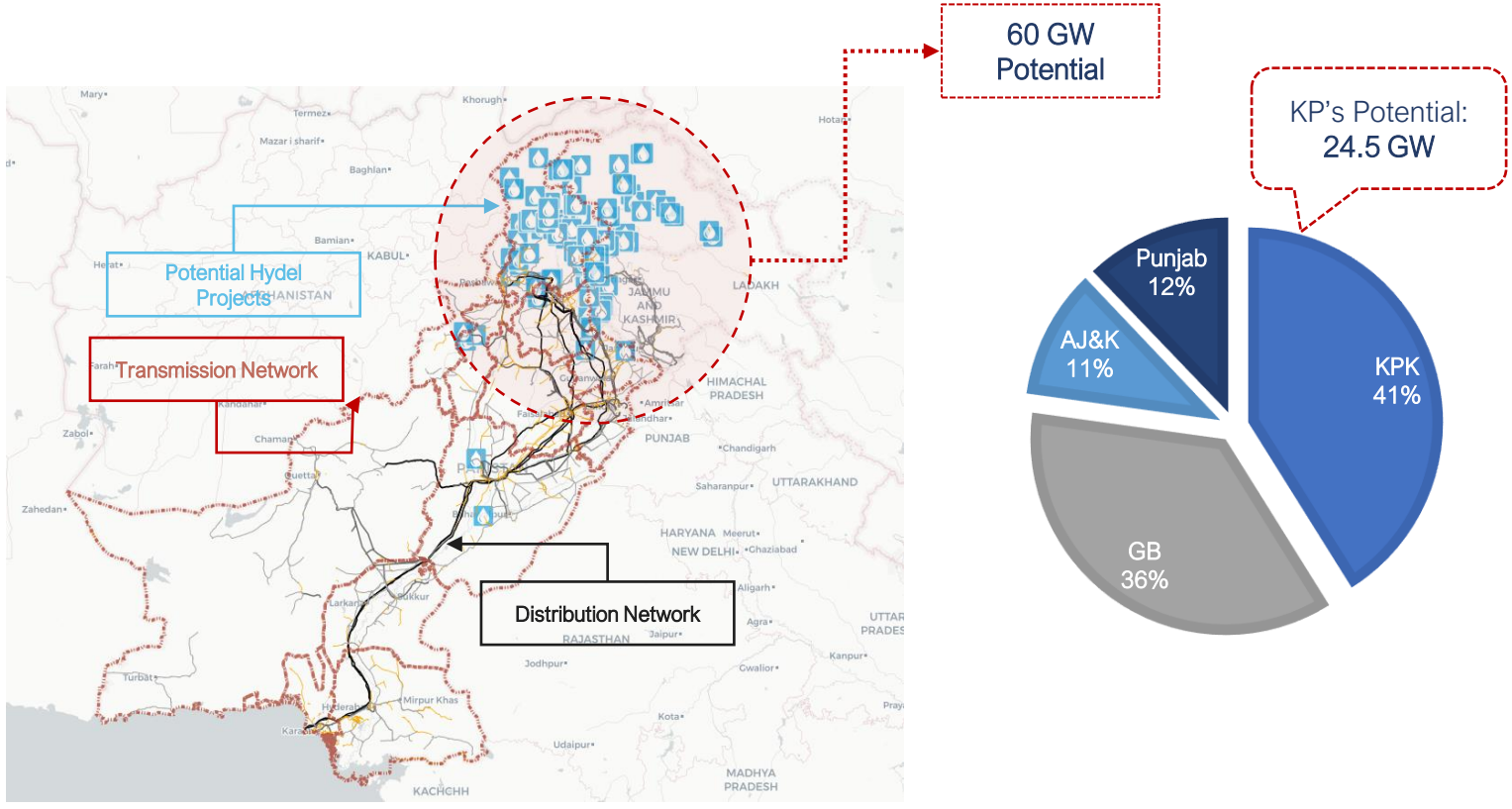
KP Hydro Generation Pipeline

Resource Availability

Pakistan's gross theoretical hydro potential[1] amounts to approximately 475,000 GWh / annum, of which around 204,000 GWh / annum is considered as technically feasible. PPIB estimates this potential to be around 60,000 MW.

Approximately 16.45% of this potential has been harnessed to date with projects of 9,861 MW in operation.

As is evident in the adjacent map[2], most of the potential hydel projects are located in the country's north, areas with sparse transmission and distribution networks. This is one of the major reasons for constrained utilization of Pakistan's hydel potential to date.



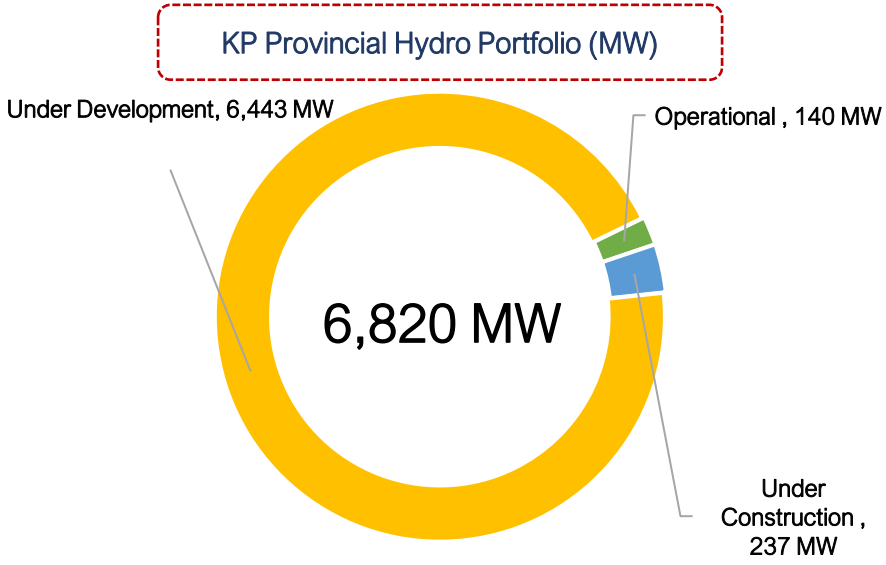
[1] Hydropower & Dams World Atlas.
[2] Sourced from NREL database for Pakistan

KP Hydro Generation Pipeline

Overall Hydro Portfolio

Under the Khyber Pakhtunkhwa Hydro Power Policy – 2016, hydro power generation projects can be developed by:

- Private Sector;
- Public sector under the Independent Power Producer (IPP) model where relevant concessions under Power Policy are applicable
- Public Private Partnership (PPP) where relevant concessions under Power Policy are applicable; and
- Captive Power Plants



The underdevelopment portfolio is divided into two categories:

- Public sector: 3,184 MW
- Private sector: 3,259 MW

Status of these projects and categorization according to their development stage is discussed in Appendix A & Appendix B.

Going forward, GoKP is pursuing a multi-pronged strategy for exploitation of the province's hydro potential based on the following.

1. Using its operational / completed public hydro portfolio to provide cheaper electricity to industries in KP through wheeling arrangements.
2. Developing key hydro projects across hydro corridors in KP under public sector domain to catalyze growth of the sector.
3. Facilitate private sector investment by undertaking projects under PPP mode.
4. Undertake feasibility studies for various regions (Chitral, Swat etc.) to explore power evacuation possibilities for all future projects.

KP Hydro Generation Pipeline

PEDO's Portfolio – The Next Ten Years

PEDO's Project Portfolio
1,858.6 MW

Completed Projects
103.5 MW

- Malakand III – 81 MW
- Pehur – 18 MW
- Machai – 2.6 MW
- Shishi – 1.9 MW

Projects Nearing Completion
116.4 MW

- Daral Khwar – 36.6 MW
- Ranolia – 17 MW
- Jabori – 10.2 MW
- Koto - 40.8 MW
- Karora – 11.8 MW

Under Construction Projects
157.2 MW

- Gorkin Matiltan – 84 MW
- Lawi – 69 MW
- Reshun – 4.2 MW

Future PEDO Projects
551.5 MW

- Gabral Kalam – 88 MW
- Madian – 157 MW
- Balakot – 300 MW
- Mujahidin – 6.5 MW

Share in Projects on PPP basis
930 MW

- Lower Spat Gah – 496 MW
- Batakundi – 96 MW
- Naran – 188 MW
- Private Sector[1] – 150 MW

Other Projects

- Chitral Transmission Corridor FS
- Mini Micro Hydro Projects

[1] Assumed on basis of private sector consent and project development status. May increase subject to interest of private sector LOI holders.

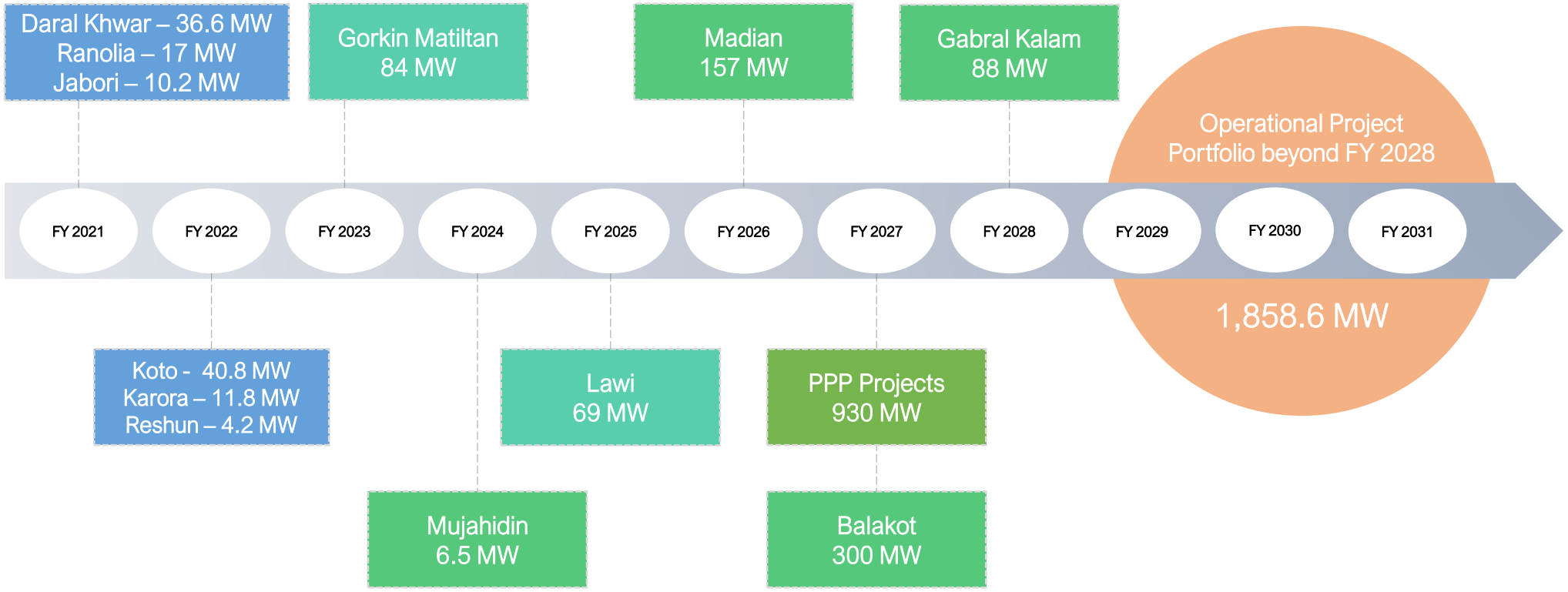
KP Hydro Generation Pipeline

PEDO's Portfolio – Regulatory Status

Cluster	Project Name	Capacity (MW)	PC-1 Approval	Other Regulatory Approvals									
				Approved FS	GIS	GIS Approval	GL	KPK EPA NOC	Benchmark Tariff	CPPA / PESCO Consent	PPA / EPA	COD	COD Stage Tariff
Completed Projects	Malakand III	81.0	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Pehur	18.0	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Machai	2.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
	Shishi	1.9	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No
Nearing Completion	Daral Khwar	36.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
	Ranolia	17.0	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
	Jabori	10.2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
	Koto	40.8	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	No
	Karora	11.8	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Under Construction	Gorkin-Matiltan	84.0	Yes	Yes	No	No	No	Yes	No	No	No	No	No
	Lawi	69.0	Yes	Yes	No	No	Yes	Yes	No	No	No	No	No
	Reshun	4.2	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No
Future PEDO Projects	Gabral Kalam	88.0	Yes	Yes	No	No	No	No	No	No	No	No	No
	Madian	157.0	Yes	Yes	No	No	No	No	No	No	No	No	No
	Balakot	300.0	Yes	Yes	No	No	No	No	No	No	No	No	No
	Mujahidin	6.5	Yes	Yes	No	No	No	No	No	No	No	No	No
Share in Projects on PPP Basis	Lower Spat Gah	496.0	No	Yes	No	No	No	No	No	No	No	No	No
	Batakundi	96.0	No	Yes	No	No	No	No	No	No	No	No	No
	Naran	188.0	No	Yes	No	No	No	No	No	No	No	No	No
	Private Sector	150.0	No	Yes	No	No	No	No	No	No	No	No	No
Other Projects	Chitral Transmission Corridor - FS	-	Yes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	MMHPs	85.6	Yes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

KP Hydro Generation Pipeline

PEDO's Portfolio – Project Completion Timeline



KP Hydro Generation Pipeline

Future Development under PPP Mode

Recognizing the constraints faced by the private sector in development of hydro projects, GoKP shall offer investors the opportunity to undertake project development under a Public Private Partnership (PPP) structure.

The key features of the envisaged structure are discussed below:

- The shareholding of GoKP and the Private Partner in the project shall be 26% and 74% respectively.
- The Private Partner shall "carry" GoKP's interest in the project till achievement of COD and inject required equity on GoKP's behalf.
- Upon achievement of Commercial Operations Date (COD), such equity will be acquired by GoKP from the Private Partner at a price which is equivalent to 26% of the NEPRA approved equity amount along with a return on equity during construction (ROEDC) to be computed at "X" % (i.e. investor cost of funds).
- Share acquisition from Private Partner can be phased out in a defined time frame (e.g. year 1 to year 3 after COD).
- Under this structure, GoKP shall facilitate Private Partner in obtaining regulatory and other approvals for the project.
- Detailed modalities of the PPP arrangement shall be subject to negotiation between Private Partner and GoKP.

Section 05: PEDO's Operational Hydropower Portfolio

PEDO's Current Hydropower Portfolio

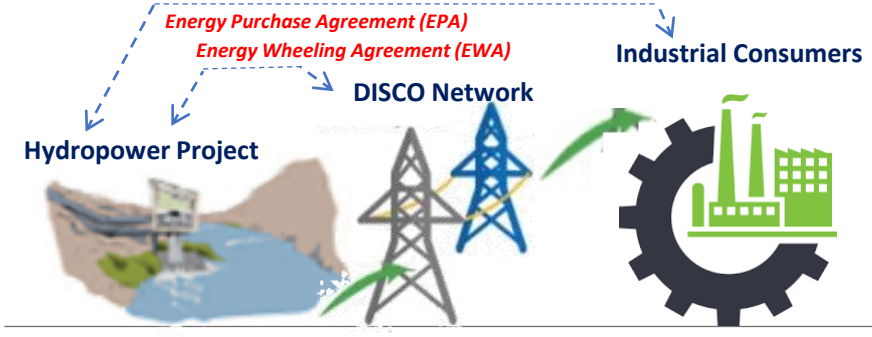
Wheeling Concept & Objective

Conceptual Understanding of Electricity Wheeling

Wheeling of electricity is the process of transmitting electricity from a producer / generator to a user(s) within the same DISCO (balancing area) or from one area to another, using electrical network of the DISCO(s).

In Pakistan, NEPRA's Wheeling of Electric Power Regulation 2016 (regulations), allows generation companies to sell its electricity to Bulk Power Consumer (BPC) at any location in the country. The consumers will be required to pay the cost of transporting of electricity (wheeling) for using NTDC/DISCO system(s), while the cost of generation, is to be mutually agreed between the generator and BPC.

For implantation of wheeling concept in Pakistan, the generation company enters in a long-term Energy Purchase Agreement (EPA) with a buyer and simultaneously enters in a Energy Wheeling Agreement (EWA) with the respective DISCO, under the applicable regulations.



Prerequisites for Electricity Wheeling in Pakistan

NEPRA (Wheeling of Electric Power) Regulations, 2016 (Wheeling Regulations) provides process and procedure for implementing wheeling, under the said regulations

- Electricity can be wheeled to BPCs with sanctioned load of 1 MW and above.
- DISCO is bound to offer non-discriminatory open access to its respective system and inter-connection services to the generation companies for the purpose of wheeling of electricity.
- DISCOs can not reject wheeling application without NEPRA approval.
- DISCOs are allowed to charge wheeling rates as per NEPRA determination.
- If wheeling is not technically feasible through DISCO's exiting network, the generation company may construct a dedicated distribution line for dispatch of electricity to the BPCs.

Objectives & Implementation Plan

To ensure rapid industrial growth in the KP province, the provincial government is providing a comprehensive facilitation process and is creating Special Economic Zones. However for achieving the desired industrial growth level, **it is imperative that cheaper hydropower of KP province is made available to local industry. Accordingly, the KP provincial government is successfully implementing wheeling model on its owned hydro generation sources within the province.**

For implementing above objectives, PEDO conducted Phase-I auction / bidding under which electricity from its Pehur 18 MW hydropower project was offered for sale in March 2019 and electricity wheeling to five Industrial consumers (BPCs) commenced in Dec 2020.

PEDO is currently in process of implementing phase-II of wheeling of electricity to industrial consumers, under which electricity from 5 other hydro generation projects will be offered to industry.

PEDO's Current Hydropower Portfolio

Regulatory Framework of Wheeling

Wheeling Regulations

In order to facilitate the wheeling of power, the Authority has formulated Wheeling Regulations. Key highlights of these regulations includes:

- Open Access: Every Transmission Licensee and DISCO (T&D Provider) shall offer open access to its respective Transmission or Distribution system and inter-connection services for the interested parties.
- Existing and New Connections: Wheeling may be availed by generation companies who are already connected with a T&D Provider /system.
- Wheeling Agreement: Within thirty (30) days of the acceptance of its application, generator shall enter into a Wheeling Agreement with DISCO.
- Wheeling Charges: The T&D provider shall charge generator **Wheeling Charges** as approved by NEPRA in the tariff determination of DISCO.
- Metering Requirement: The Wheeling Meters shall be installed at the Entry and Exit Points of the Transmission or/and Distribution system.
- Excess Energy by Wheeler of Power: Where DISCO fails to transport Energy from entry point to exit point or a BPC is unable to accept delivered energy, settlement of such energy shall be made at the energy charge part (as approved by NEPRA) of the generation company.
- Shortfall: For any shortfall in the Committed Capacity that the generation company is unable to deliver to, the DISCO may opt to continue to supply to the relevant Bulk Power Consumer(s) for such shortfall of power on request and shall invoice the generator at the tariff approved by the Authority.

Wheeling Costs

Besides Wheeling Charges, NEPRA on 11th January 2021 made a decision in the matter of Wheeling Costs to be included in the Tariff Determinations of DISCOs, based on which following costs have been applied:

- Generator to bear **technical losses** as allowed to relevant DISCOs – existing PESCO losses are about 19.93%.
- NTDC UOSC will be applicable if the NTDC network is used.
- Hybrid BPCs, shall pay **fixed charges on connected load** or actual MDI whichever is higher, to be determined by NEPRA on case to case basis. Since it will be applicable on case to case basis a rough estimate is that it will range between Rs 1 to 1.5 /kWh applicable on BPCs

Inter-DISCO Wheeling

PEDO in its 2nd Phase of bidding for wheeling of electricity allowed BPCs in TESCO jurisdiction to participate in the bidding process considering the fact that Federally Administrative Tribal Areas is being merged with KP.

As of date there are no precedents available for inter-DISCO wheeling and also sufficient clarity is not available within Wheeling regulations on the issue, however review of detailed Design and Implementation Roadmap of the Competitive Trading Bilateral Contract Market (CTBCM) approved by NEPRA as on November 12, 2020, it is understood that wheeling regulations are based on "**postage stamp method**" whereby **technical losses and wheeling charges of all concerning DISCOs are expected to be applicable on any wheeling transaction**, while NTDC UoSC and fixed charges will continue as applicable currently.

PEDO's Current Hydropower Portfolio

Commercial Aspects of Wheeling

Grid Price (Existing PESCO charges)

As per the existing applicable consumer tariff, the electricity price charged to customer has four parts

(a) Fixed charges
(b) Peak Tariff
(c) Off-peak tariff
(d) Applicable GST and electricity duty

Competitive Grid Price Jan 2020	B-3 Rs/kWh	B-4 Rs / kWh
Off-peak rate	Rs12.98	Rs12.88
Fuel Price Adjustment	1.1138	1.1138
N.J Surcharge	0.1	0.1
FC Surcharge	0.43	0.43
Total Price	**14.624**	**14.524**

Source: Analysis of PESCO Consumer Tariff and discussions with BPCs based on Dec Electricity Bill

As per the current wheeling structure successfully executed for Pehur hydropower project the electricity supply allowed to be adjusted against wheeled electricity is for off-peak hours. This means the competing grid price for wheeling arrangement is off-grid price along-with related charges. The applicable GST would be similar for industrial consumer.

A recent development in this regard is Industrial Electricity package announced[1] by federal government under which for B-1, B-2 and B-3 consumer categories:

- All industries to be exempted from the higher peak-hours rates and will be charged off-peak rates even during peak hours, however this expected to be revised in April 2020.
- Further approval of 50% discount on use of additional units as compared to their previous year bills is applicable till June 2020.
- 25% discount on additional units post June 2020 (to be approved by NEPRA)

it is highlighted that **electricity prices will continue increasing in line with with devaluation and increasing prices of imported fuel, while price of wheeled electricity will remain almost same except for partial impact of CPI.**

Expected Cost of Wheeled Energy

The technical losses of respective DISCOs will be borne by PEDO. Estimated cost of wheeling to PEDO is Rs 1.59 for BPCs in PESCO, while same is Rs 2.55 for BPCs in TESCO

Wheeling cost to PEDO	BPCs in PESCO	BPCs in TESCO
Technical Losses PESCO	19.93%	19.93%
Technical Losses TESCO	-	11.96%
Total	19.93%	31.89%
Assumed Energy Price (to be established from Auction)	Rs 8.0/kWh	Rs 8.00/kWh
Cost to PEDO	**Rs 1.59/kWh**	**Rs 2.55/kWh**

As per the below table there will be savings to BPCs even if the 25% discount on incremental use of electricity is made applicable, post June 2020.

Wheeled energy Price to BPCs in PESCO	132kVA BPC	11kVA BPC Rs/kWh	MIX BPC
Assumed Energy Price (to be established from Auction)	8.00	8.00	8.00
Wheeling Charges[2]	0.32	0.71	1.09
Expected cost connected load (case to case)	1.5	1.5	1.5
Total Energy Price from Wheeling	**9.82**	**10.21**	**10.59**
Discounted Grid Price (25% on off-peak rate)	**11.38**	**11.38**	**11.38**
Min Saving to Industrial consumers in PESCO	**1.56**	**1.17**	**0.79**
Additional Cost to BPCs in TESCO[3]	0.15	0.28	0.44
Min Saving to Industrial consumers in TESCO	**1.41**	**0.89**	**0.35**

[1] Decision of the Authority in the matter of Motion filed by the MOE(Power Division) with respect to Support Package for Additional Consumption and Abolishment Of Time of Use Tariff Scheme for Industrial Consumers of [illegible] 2020
[2] NEPRA Tariff Determination Dec 11, 2020 with regard to PESCO tariff
[3] NEPRA Tariff Determination Dec 14, 2020 with regard to TESCO tariff

PEDO's Current Hydropower Portfolio

Pehur – A Success Story of Wheeling

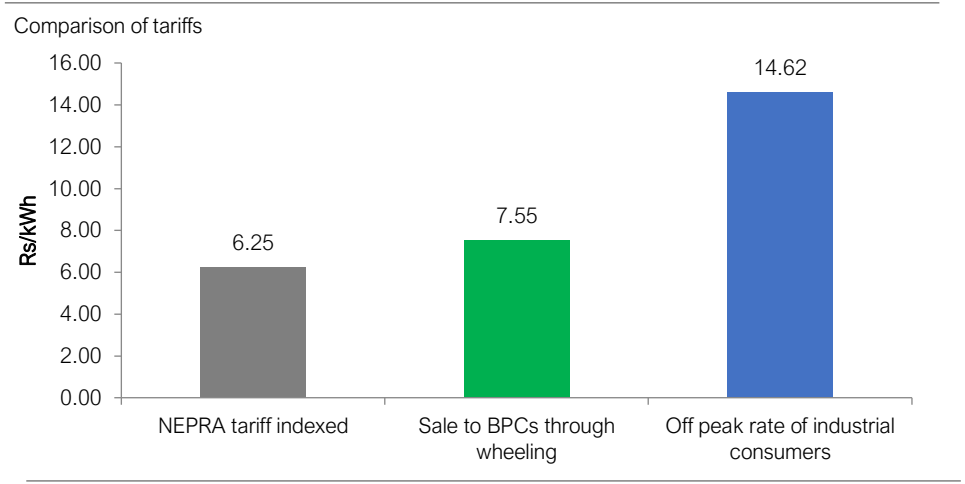
Phase-1 Wheeling of electricity from 18MW Pehur Hydropower Project was the first ever multi-buyer wheeling of electricity in the history of Pakistan. The process involved transparent bidding process for selecting interested industry players from KP, which were then taken forward for execution of EPA and obtaining related approvals from DISCO & NEPRA for execution of EWA.

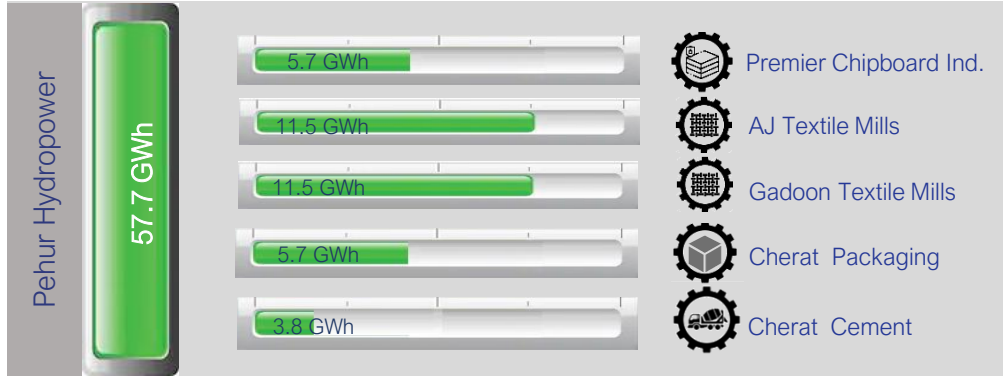
Considering the fact that PEDO was required to maintain uniform electricity price, to manage the risk of fluctuating monthly demand of electricity consumers/ BPCs under wheeling arrangement from Pehur, the concept of price discovery using strike price mechanism was used. Under the said mechanism Financial Bid prices of bidders were stacked against energy demand from each bidders till the cumulative total of the bid quantities reaches 100% of sellable electricity from Pehur hydropower projects. The weighted average price was then calculated for all the bids, that become applicable on all consumers. Bidders below strike price was given option either to opt-out or agree on the strike price.

The Phase-1 process constituted of following steps:

- Advertisement from PEDO for technical and financial proposals – Feb 2019
- Issuance of RFPs to interested industry players
- Receipt of technical & financial proposals from interested BPCs – April 2019.
- Opening of financial proposals - April 2019
- Approval of evaluation results by PEDO Board – Sept 2019
- Option Notices to successful bidders to opt the strike price established under the financial evaluation process.
- EPA execution in Oct 2019 followed by EWA execution on Feb 2020.

Above process is planned to be replicated for Upcoming Phase-II Wheeling





PEDO's Current Hydropower Portfolio

Wheeling of Electricity – Phase II

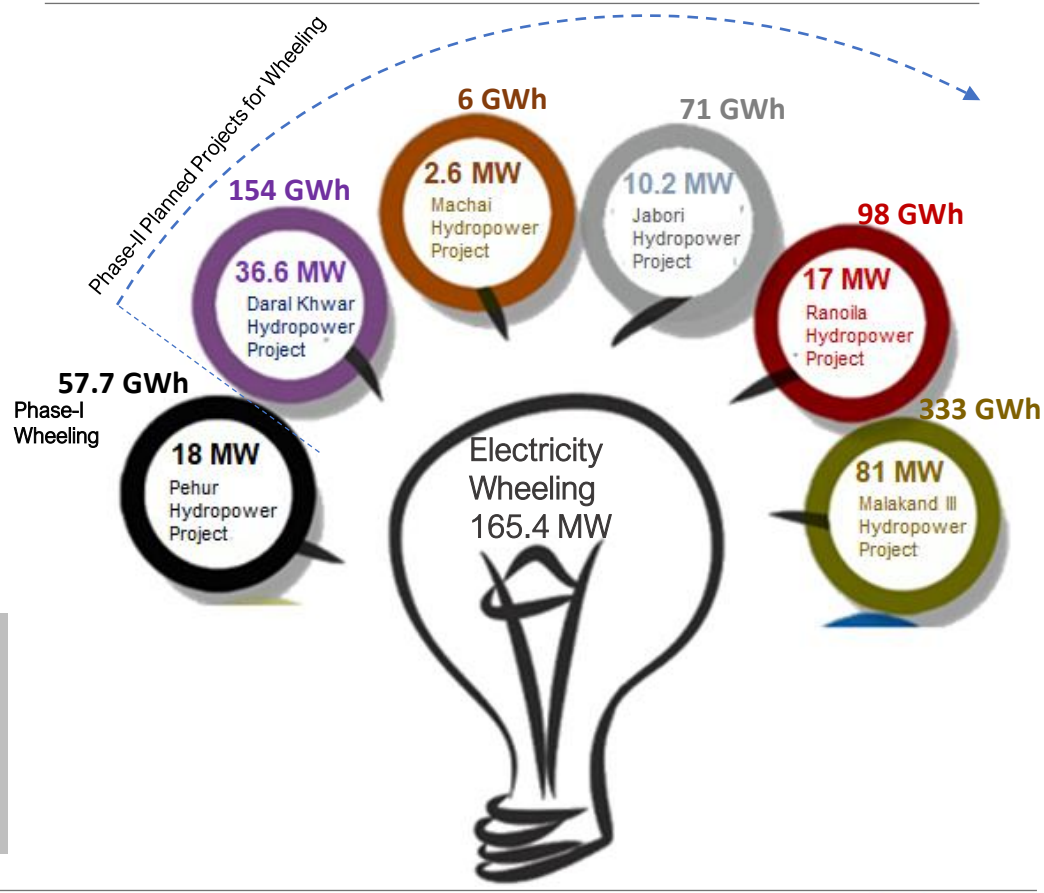
Success of first round of wheeling of electricity has paved way for launch of 2nd round under which electricity from 5 additional projects will be offered to industrial consumers, under wheeling arrangement.

Given below are the salient features of Phase II of wheeling by PEDO:

- In 2nd Phase, a total of 148 MW (887 GWh based on design) will be offered for wheeling to prequalified BPCs.
- An advertisement for EOI has been published for pre-qualification of BPCs in November 2020
- Industrial consumers of TESCO have been included for shortlisting wheeling of electricity
- The 2nd Phase of wheeling got an overwhelming response from BPC, whereby a total of more that 79 BPCs have applied for obtaining prequalification documents, out of which 74 consumers have submitted documents for pre-qualification.
- Bidder shall be prequalified for an initial period of 2 years under which PEDO shall offer projects for wheeling

Prequalification criteria of BPCs:

- Operational or under construction industrial projects in KP province.
- Connected or in the process of connection with PESCO or TESCO through one or more feeders
- Having existing or expected connected load of 1 MW or higher.



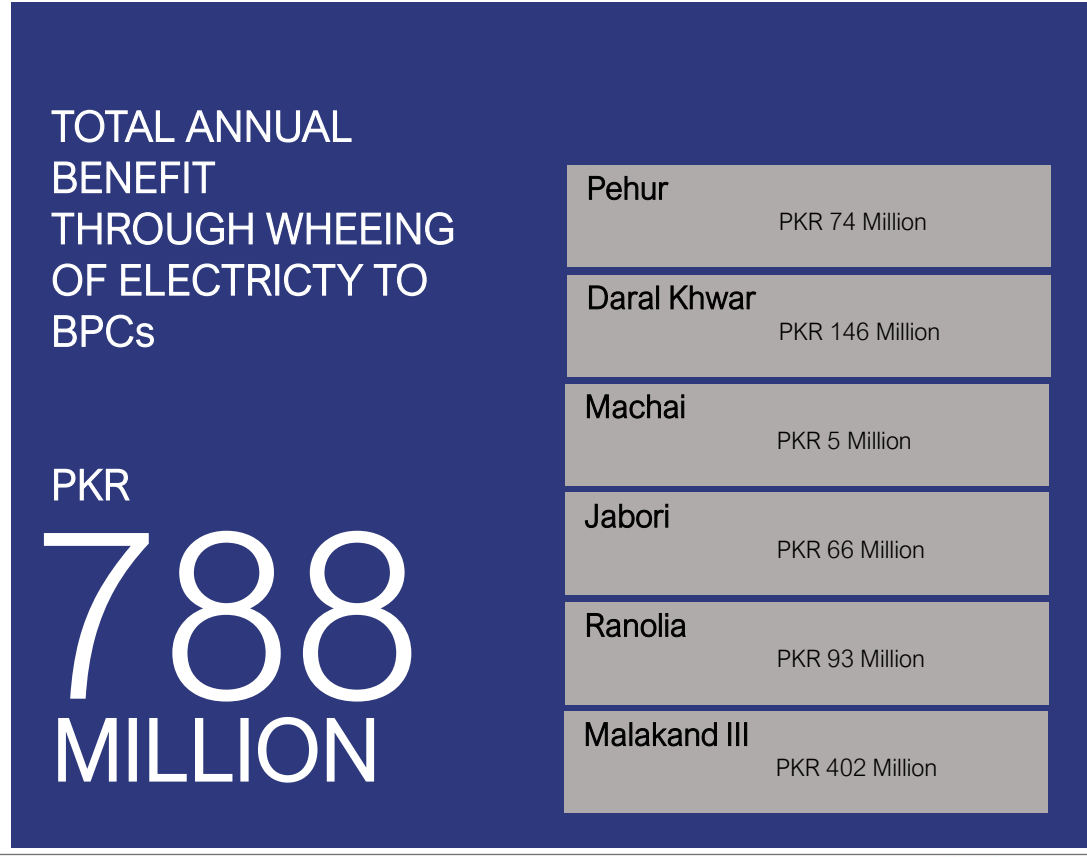
PEDO's Current Hydropower Portfolio

Benefits of Wheeling

Wheeling of electricity shall be a win-win situation for PEDO, BPCs and PESCO. Such models will provide the cheap electricity to industries which will increase the revenue for PEDO, BPCs and the DISCO.

- Through the wheeling arrangement, the profitability of PEDO, BPCs and PESCO will increase.
- PEDO projects were supplying electricity to national grid at a lower price.
- In case of wheeling these projects will be getting electricity at a competitive and higher price, resulting in increased profit for PEDO.
- Total annual benefit occurring out of wheeling to BPCs amounts to approx. PKR 788 Million to the province.

Benefit of wheeling to KP



PEDO's Current Hydropower Portfolio

Contractual Framework

Major Terms of Power Purchase Agreement

- **Power Purchase Agreement:** Power Purchase Agreement is entered into between PEDO and BPC/Industrial consumer for sale/purchase of electricity through wheeling.
- **Commencement Date:** Commencement date/notice shall be served by PEDO on the last to occur of the following conditions – (a) the grant of second-tier supply authorization by NEPRA to the Seller under the NEPRA Licensing Rules, (b) the execution of the Energy Wheeling Agreement between the Seller and PESCO and (c) receipt by the Seller of the Guarantee from the Purchaser
- **Term**: The term of the PPA is a period of 10 years commencing on the first day of the month in which the Commencement Date occurs.
- **Purchaser Allocated Input Energy:** Purchaser shall notify the Purchaser Allocated Input Energy for each Billing Cycle to Seller not later than 10 days prior to commencement of such Billing Cycle, otherwise Purchaser Allocated Input Energy notified by the Purchaser in the last Billing Cycle shall be taken for next Billing Cycle. For calculating saleable energy to consumers Allocated Input Energy is expected to be adjusted for technical losses of concerned DISCOs.
- **Energy Price:** Energy Price shall comprise of (a) Fixed Component (Remain Fix), (b) Variable Component (Quarterly CPI indexations) and (c) Water Use Charge
- **Invoicing and Payment:** Seller shall invoice the Energy Payment and Wheeling Charges for a Billing Cycle to the Purchaser within thirty (30) days after the end of such Billing Cycle. Purchaser shall pay the Seller the amount shown on an invoice on or before the 10th day following the day the invoice is received by the Purchaser

Major Terms of Energy Wheeling Agreement

- **Wheeling Regulations;** The EWA is prepared and executed by the Parties in line with requirements of the National Electric Power Regulatory Authority (Wheeling of Electric Power) Regulations, 2016.
- **Commencement Date:** The wheeling of electricity shall be commenced upon issuance of 2nd tier supply authorization by NEPRA to PHPP under the NEPRA Licensing (Generation) Rules, 2000.
- **Term**: The term of the EWA is 10 years from Commencement Date with an option to extend the same with mutual consent of both the parties.
- **Wheeling Services:** PESCO will wheel the input energy from PHPP to exit points of selected industrial consumers against Wheeling Charges as determined & indexed by NEPRA from time to time.
- **Interconnection;** Existing interconnection will be used for the wheeling arrangement otherwise a separate interconnection is to be negotiated and executed.
- **Metering:** The wheeling meters shall be used to measure Input Energy at entry point and the Actual Output Energy at the Exit Point(s).
- **Wheeling Charges**: Wheeling Charges will be based on actual output energy and NEPRA determined rates & indexations. PEDO will be primary obligor for payment of the wheeling charges.
- **Excess Energy used by PESCO:** Input energy undelivered to industrial consumers which is consumed by PESCO shall be charged by PEDO to PESCO at the tariff determined by NEPRA as indexed from time to time.
- **Electricity Wheeled**: Based on recent amendments Input energy will be reduced by technical losses of concerned DISCOs, for calculation of Output Energy.
- **Shortfall Energy**: Any energy shortfall will be provided by PEDO on applicable consumer tariff. NEPRA will established fixed price for connected load for such hybrid consumers.

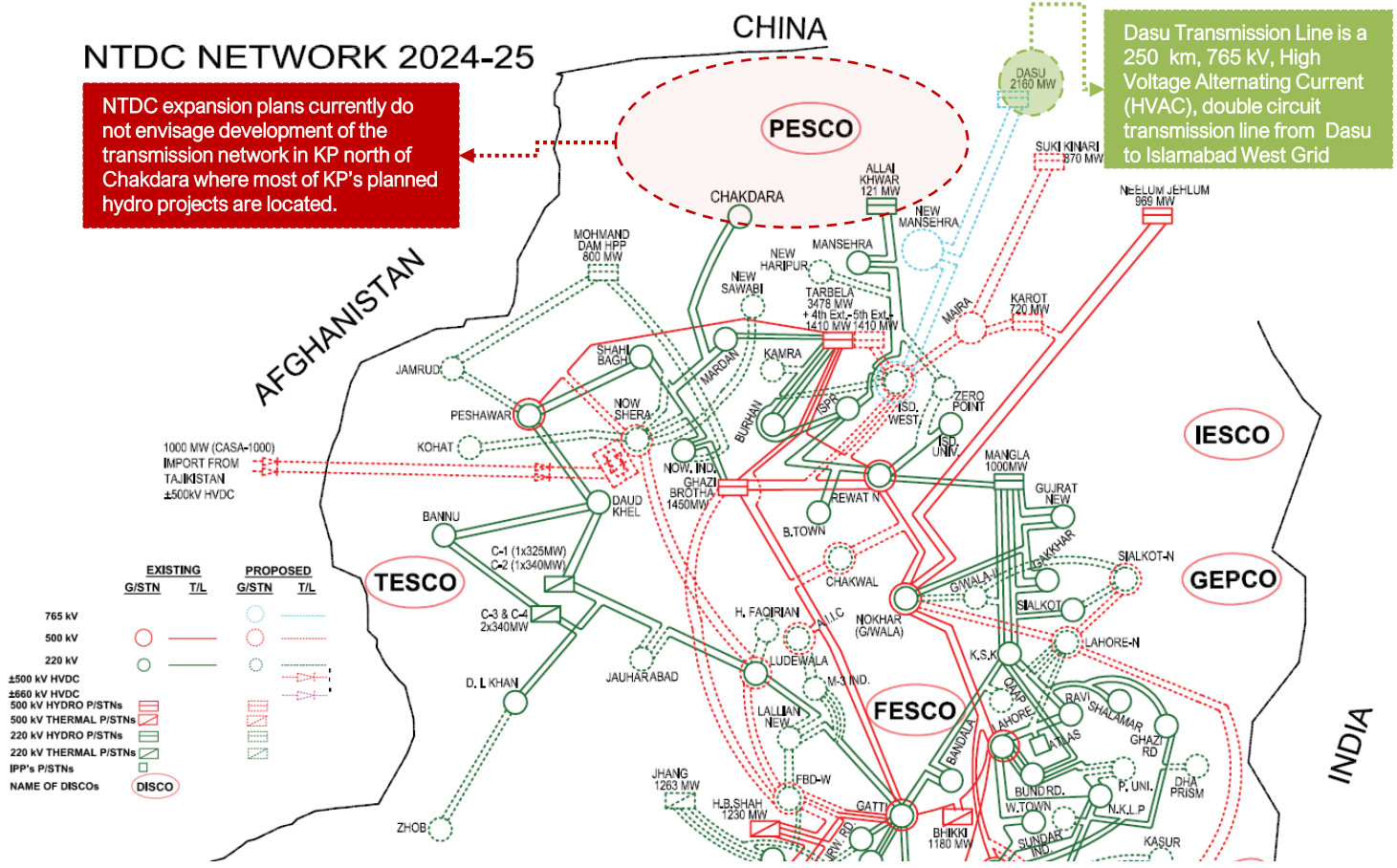
Section 06: KP's Transmission Network

The Transmission Sector in KP

Overview

As elaborated in chapter 3, utilization of KP's hydro potential is hugely constrained owing to insufficient capacity in the transmission and distribution network to evacuate power from envisaged hydro power projects.

On the other hand, National Transmission & Dispatch Company Limited (NTDC)'s network expansion plans till 2025 do not seem to account for a significant number of hydro projects being considered for development in KP under the provincial regime. In addition to the Dasu Line, the proposed additions to the NTDC system in KP include a 500kV line for evacuation of Suki Kinari (870 MW) and a 220kv line for evacuation of Mohmand Dam (800 MW).



Planned NTDC Grid map for 2024 - 25 showing major load and generation centers and transmission zones in the country's north.[1]

[1] Extracted from WB's Variable Renewable Energy Integration and Planning Study—Pakistan Sustainable Energy Series, conducted by Tractebel

The Transmission Sector in KP

Applicable Regulatory Framework

NTDC is acting as National Grid Company (NGC) under license by NEPRA and accordingly is responsible for ensuring evacuation of power from the generation plants to the load centers across the country. The design, construction, operation, and maintenance of the 500/220kV transmission system (and strengthening/ up gradation of the existing one) is a part of the NTDC core functions and if so desired, NTDC can construct the required transmission facilities in KP.

Policy Framework for Private Sector Transmission Line Projects 2015

Since large scale capacity additions in the electrical generation system necessitate corresponding augmentation in the transmission network, and given the encouraging response of the private sector for investment in power generation and the constraints on public sector resources, the Government of Pakistan (GOP) decided to solicit proposals from the private sector for investment in the field of both AC and DC Extra High Voltage (EHV) Power Transmission Lines, Substations, and Converter Stations through the introduction of the Policy Framework for Private Sector Transmission Line Projects 2015.

Special Purpose Transmission Licences

A private party / PEDO to apply for a special purpose transmission license pursuant to Section 19 of the NEPRA Act. There have been a few instances where private sector entities and provincial governments have applied for and procured a special purpose transmission license (i.e., Fatima Transmission Company Limited, the Pak Matiari Transmission Company Pvt Limited and the ST&DCPL for the owning, construction, operation and management of a 132 kV Nooriabad-KDA-33 Transmission line).

Provincial Grid Company (PGC)

The NEPRA (Amendment) Act, 2018 provides that the Government of a Province may construct powerhouses and grid stations and lay transmission lines for use within the Province and determine the tariff for distribution of electricity within the Province. Further, the NEPRA Act also allows the Provincial Governments to establish a PGC. The PGCs are allowed to engage in the transmission of electric power within the territorial limits of such Province.

The Transmission Sector in KP

Rationalizing role of Khyber Pakhtunkhwa Transmission and Grid System Company Limited (KPTGCL)

KPTGCL has been incorporated by GoKP to develop a transmission corridor between Chitral, Dir and Swat for evacuation of power from proposed HPPs in GoKP's portfolio. The company has accordingly filed an application for grant of a PGC license to NEPRA.

The KPTGCL proposed corridor includes evacuation for HPPs upstream of Chakdara Grid Station, for which no plans have been identified by NTDC to date. An overview of the complete plan is provided on the next page.

Phase 1

Phase 1 of the plan envisions transmission of bulk power through 500 KV and 220 KV transmission lines network with the major transmitting and receiving stations located at Chitral (500/220/132 KV GS),Chakdara (500/220/132 KV GS), Swat 220/132 KV GS, Kohistan 220/132 KV GS and Mansehra 220/132 KV GS.

These major Stations will be inter-connected in such a way as to establish 500 KV and 220 KV network rings. In parallel, 132 KV network ring will be added looping various HPPs.

Way Forward and Recommendations

Given the inherent centralized nature of the transmission network, any expansion plans need to be made in harmonization with NTDC's plans.

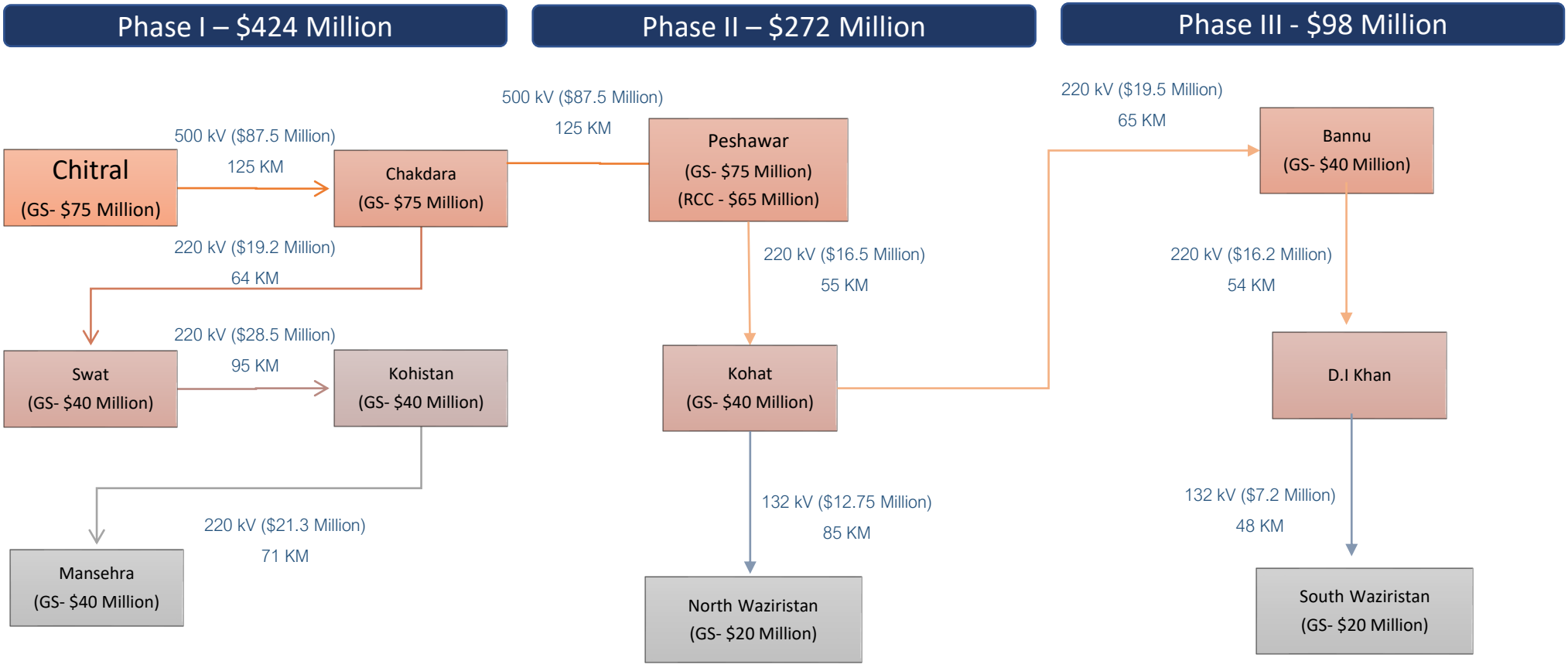
A case in point is that of Gorkin Matiltan HPP. While PEDO intends to connect the project to Daral Khwar HPP through a 40 km transmission line, NTDC does not approve and wants to evacuate the project through an already planned 500KV line double circuit line from Bhasha to Mardan through Swat Corridor. If the aforementioned line materializes, the swat corridor transmission line may not need to be developed by KPTGCL.

Accordingly, it is recommended that GoKP / PEDO focus on development of Chitral transmission corridor given that no NTDC plans exist for the region. The funding strategy incorporates PKR 200 Million for feasibility study of the Chitral corridor. If found viable, the development of the line is envisioned under a PPP structure. However, the current business plan does not incorporate the cost of Chitral transmission line, as feasibility is yet not completed for the same.

It is further recommended to setup a separate unit inside PEDO to oversee matters related to power evacuation and grid interconnection for PEDO's project portfolio along side establishing liaison with project directors and NTDC / PESCO. This shall go a long way in mitigating the apparent disconnect between provincial and federal project development

The Transmission Sector in KP

KPTGCL's Proposed Overhead Transmission Line and Grid Station Network Plan 2021 – 2030



Section 07: Mini & Micro Hydel Portfolio

Mini & Micro Hydel Portfolio

Support to Community Based Organizations & Off Grid Promotion

As per the requirements of PEDO Act, PEDO is mandated to promote and execute community based and local bodies-centered off-grid power projects based on locally available renewable sources.

For this purpose, PEDO institutionalizes these CBOs by supporting them in development of SOPs and related processes and procedures.

PEDO can also enter into contracts with these CBOs for cost sharing, access to land, issue of licenses and determine tariffs and their mode of collection, accounting and usage, handing-over, vesting and post handing over, transfer of operation and management of such off-grid power projects based on locally available renewable sources to the local bodies or rural communities.

PEDO is required to provide post-completion support and monitoring system to ensure that the completed schemes are efficiently operated and maintained and get timely technical backstopping in case of emergency.

All such schemes aimed at a local body or a community-based organization should cover all aspects of development, generation, transmission, distribution, operation and maintenance, regulation and tariffs and PEDO may entre into agreements for such purposes.

This section of Business Plan focuses on following areas:

1. Phase-1 constituting 356 MHPs (34.7 MWs)
2. Phase-2 constituting 672 MHPs (53.13 MW)
3. Business Model for MMHPs and proposal for debt recovery
4. Projected cash flows to analyze shortfall/excess in funding and debt servicing.

Source: PEDO, Annual Review 1000 MHPs. 2020-21

Mini & Micro Hydel Portfolio

Program Overview

Khyber Pakhtunkhwa is currently developing 1,028 micro-hydels (87.8MW) across 21 rural districts with the aim to provide cheap renewable electricity to off-grid areas. The Micro hydel Project (MHP) has been divided into two phases; 365 MHPs (34.7MW) in Phase I and 672 MHPs (53.1MW) in Phase II.

Development contractor/mobilizers such as SRSP and AKRSP were hired for construction of Phase I MHPs and the consequent training of community members for O&M services. Phase I commenced on March 2015, with the initial target of developing 356 micro-hydels (34.7MW) across Malakand and Hazara Region. Till date, 307 MHPs (25.2MW) have been completed while 25 MHPs (7.3MW) are currently under construction. 24 of the projects are yet to be initiated.

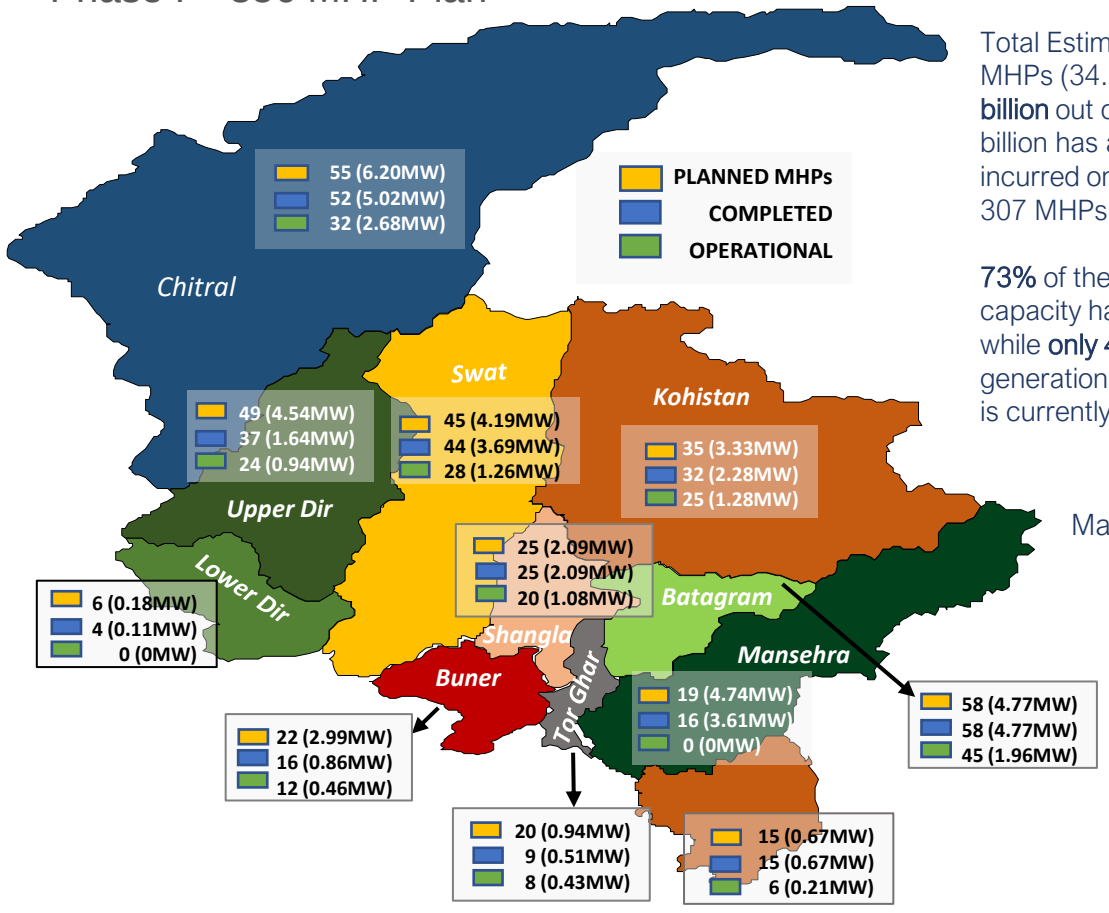
Phase II; construction of 672 MHPs (53.1MW) will begin in June 2021 and is expected to be completed by December 2023.

District	Phase I -356 Projects	Planned Projects	Completed Projects	Under Construction
Battagram	58	58	58	0
Abbottabad	15	15	15	0
Mansehra	26	19	16	3
Torghar	20	9	8	1
Buner	22	18	16	2
Swat	45	45	44	1
Shangla	25	25	25	0
Kohistan	35	35	32	3
Chitral	55	55	52	3
Dir Upper	44	49	37	12
Dir lower	11	4	4	0
Total	**356**	**332**	**307**	**25**

Source: PEDO, Annual Review 1000 MHPs. 2020-21

Mini & Micro Hydel Portfolio

Phase I – 356 MHP Plan



Total Estimated Cost of 356 MHPs (34.7MW) is **PKR 5.25 billion** out of which PKR 4.37 billion has already been incurred on the construction of 307 MHPs (25.2MW).

73% of the planned generation capacity has been installed while **only 41%** of installed generation capacity (Phase I) is currently operational.

34.740MW (356 MHPs) - Planned Generation Capacity

73% Of planned generational capacity has been installed

25.205MW (307 MHPs) - Installed Generation Capacity

41% Of installed generational capacity is currently operational

10.320MW (200 MHPs)- Current Operational Capacity

14.885MW (107 MHPs) - Non-Operational Capacity

Major Issues In Current Non-operational Projects

107 MHPs are currently non-operational

51 Completed MHPs are awaiting approval for Social Enterprise Model

56 Completed MHPs are non-operational due to following issues

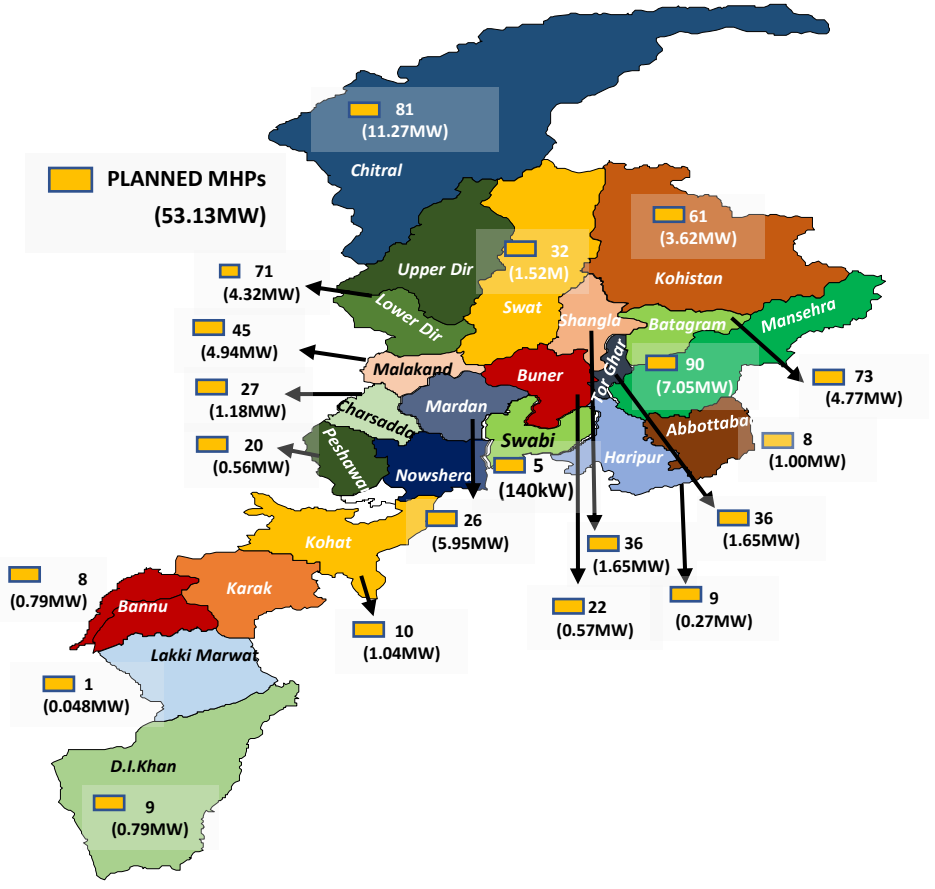
- **19** Technical issues
- **13** Damaged by floods/ disaster
- **9** T&D issues
- **6** E&M issues
- **8** Miscellaneous issues

PEDO is currently resolving these issues

Source: PEDO, Annual Review 1000 MHPs. 2020-21

Mini & Micro Hydel Portfolio

Phase II – 672 MHP Plan



As of November 2020, hiring of contractors for Phase II is in progress. The program includes construction of 672 MHPs (53.13 MW) across 20 different KP districts. 160 Phase II MHPs (15.7MW) will be constructed on canals while 512 MHPs (37.4MW) will be built on rivers/ tributaries. Phase II is expected to cost a total of **PKR 11,796.75 million** and is set to be completed by December 2023 leading to a total generation capacity of **53.13 MW.**

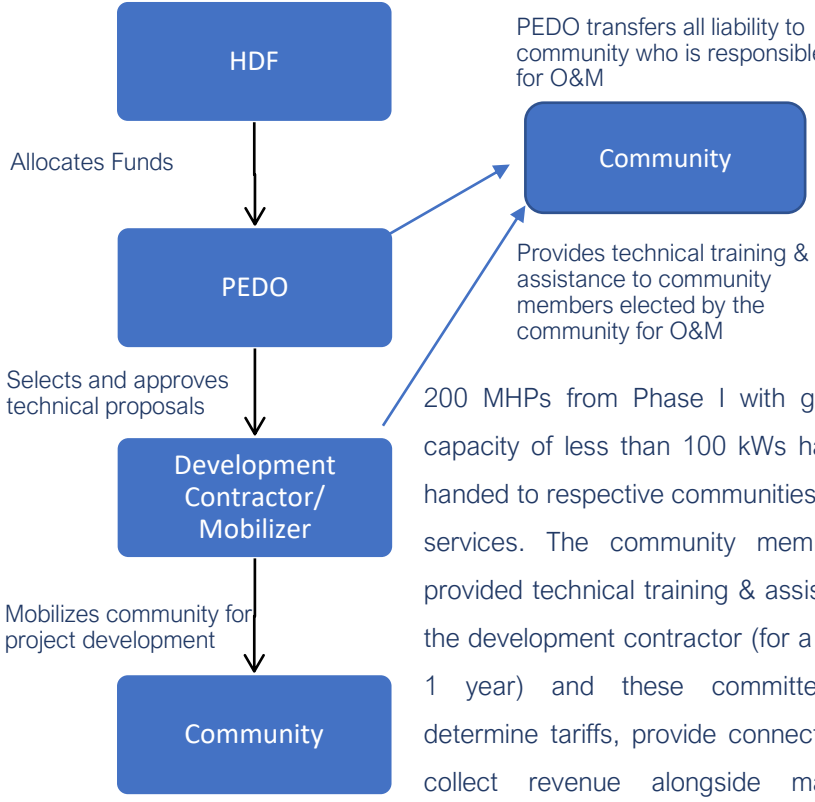
MHPs on Canals		
District	Total No of Projects	Total Capacity (MW)
Mardan	26	5.95
Swabi	5	0.14
Haripur	9	0.27
Peshawar	20	0.56
Kohat	10	1.04
Charsadda	27	1.18
Malakand	45	4.94
Lakki Marwat	1	0.05
Bannu	8	0.79
D.I. Khan	9	0.79
Total	**160**	**15.72**

MHPs on Stream/Tributaries		
District	Total No of Projects	Total Capacity (MW)
Chitral	81	11.27
Kohistan	61	3.62
Shangla	36	1.65
Swat	32	1.52
Abbottabad	8	1.00
Battagram	73	4.77
Upper, Lower Dir	71	4.32
Buner	22	0.57
Mansehra	90	7.05
Torghar	38	1.62
Total	**512**	**37.41**

Source: PEDO, Annual Review 1000 MHPs. 2020-21

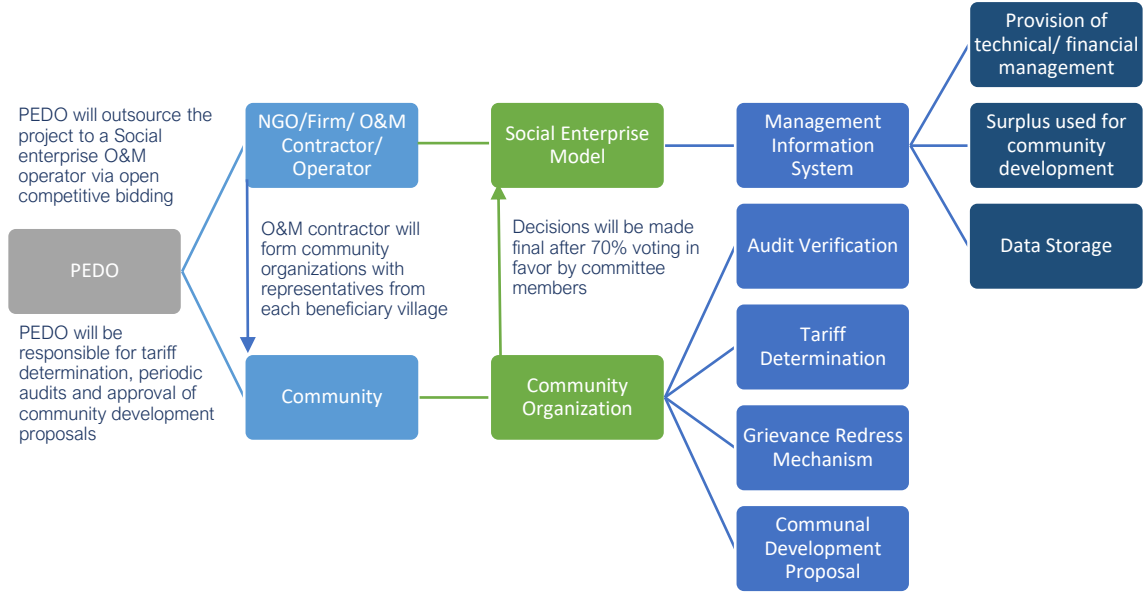
Mini & Micro Hydel Portfolio

Business Model Being Followed for 229 MHPs of less than100kW



200 MHPs from Phase I with generation capacity of less than 100 kWs have been handed to respective communities for O&M services. The community members are provided technical training & assistance by the development contractor (for a period of 1 year) and these committees then determine tariffs, provide connections and collect revenue alongside maintaining O&M.

Social Enterprise Model Under Approval for 799 MHPs of 100kW and above



51 MHPs developed under Phase I remain un-operational due to lack of communal capacity and increased complexity of electromechanical equipment, making community-level O&M non-feasible.

Currently, the Social Enterprise model submitted by PEDO works through outsourcing of O&M to a private service provider who will then be in-charge of technical and financial management alongside community development via re-investment of surplus.

Mini & Micro Hydel Portfolio

Project Sustainability

As per PEDO's current plan, the MHP program will operate on two different models based on their generation capacity and electromechanical complexity. For projects with less than 100kW capacity [799 MHPs], the liability will be transferred to community members who will be provided technical training & assistance by the development contractor (for a period of 1 year) and these committees will then determine tariffs, provide connections and collect revenue to fund O&M activities.

PEDO has proposed a social enterprise model for MHPs with a generation capacity of 100kW and greater [229 MHPs], whereby the O&M of the installed MHPs will be outsourced to O&M operators through competitive bidding. The O&M operator will then form a village community consisting of representatives from each village responsible for tariff determination, audit verification, grievance redress mechanism and community development proposals. The tariff will comprise of the costs of O&M operator to ensure continuity of MHPs. The O&M operator will create a Management Information System (MIS), provide technical and financial management, store data and invest surplus into community development while PEDO will oversee tariff determination, conduct periodic audits and approval of community development proposals. To undertake this, PEDO will require a share of revenue to fund the oversight function and also to fund any future rehabilitation or development activities.

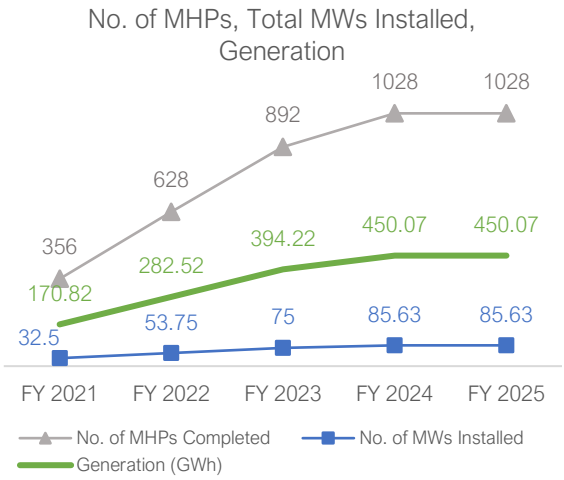
Despite this, the proposed model does not account for recoupment of CAPEX or debt servicing of the ADB loan. Although, the ADB loan agreement has been signed with GoP and it is GoP that makes the debt servicing payments, the amount so paid on behalf of the provinces will be recovered by GoP in provincial share releases in future. The ultimate financial burden of the loan and interest thereon will be transferred to GoKP[1]. **It is recommended that the said financial burden is recovered from the beneficiaries of the project**.

Source: PEDO, Environment, Social Development & Gender Empowerment Department.

[1] Reference: Email from Manager Finance/Admin, MMHPPs, PEDO (dated 13th of January, 2021) and meeting held with the same in PEDO head office, Peshawar (on 12th of January, 2021).

Mini & Micro Hydel Portfolio

Operational Cost of 1028 MHPs



The number of MHPs completed and MWs installed have been assumed to grow proportionately under the assumption that the 356 MHPs under Phase I will be completed by the end of FY 2021 whereas 672 Phase II MHPs will be completed over the FY 2022–FY 2024 (till December 2023) – evenly spread over this period. Generation is based on 60% capacity (assumption by consultant).

Operational Costs	PKR per kWh[1]
O&M Costs	2.03[3]
Insurance Costs	0.38[3]
Provision for Rehabilitation	1.13[3]
Sub Total	**3.53**
Debt Servicing Component[2]	2.56[4]
Total	**6.09**

O&M Cost: Using 1.875 MW Shishi Micro Hydropower project as reference (which has a total annual O&M cost of PKR 20 million), a per MW rate of O&M cost is calculated that is PKR 10.67 million per MW per Annum.

Insurance Cost: It is assumed that KP will be able to achieve insurance cost of 1% of cumulative Capital Expenditure.

Provision for Rehabilitation: It is estimated that a provision for rehabilitation and CSR initiatives for the 1028 MHPs program will be required at the rate of 3% of accumulated CAPEX, annually.

Proposal for ADB Debt Servicing

It is proposed the community pays a tariff of PKR 6.00 per kWh to PEDO who can hire O&M operators through reverse bidding to undertake O&M activities at an estimated cost of Rs 3.53/kWh. Additionally, the tariff will fund insurance costs and rehabilitation provision. Remaining PKR 2.47 / kWh (Rs 6 – 3.54) can be used to partially service the debt. A tariff of PKR 6.0 /kWh, is expected to be acceptable to communities, based on the analysis of their paying capacity presented ahead. However, this will not service the ADB debt fully and negative cash flows will need to be funded. An additional PKR 0.10 to 0.30 per kWh will need to be funded by the Government.

With additional PKR 0.10 to 0.30 per kWh Government support, break-even will be achieved to sustain the MHPs and service the related debt. However, the Government will have to bear risks related to currency & LIBOR fluctuations, and inflation on foreign debt .

Funding of Costs	PKR / kWh[1]
Tariff Charged to Users	6.00
Government Support	0.10
Total	**6.10**

If debt servicing component related to 200 MHPs handed over to community is spread only over the remaining 828 MHPs and operational cost of only remaining MHPs is considered, the total cost (including debt servicing component) will be up to PKR 6.96/kWh.

Source: Analysis presented above has been undertaken by the consultant and assumptions have been taken based on consultant's experience in the sector.

[1] Average for 22 years from FY 2021 to FY 2042 (till end of ADB debt period)

[2] Required to o fully service the ADB debt.

[3] Detailed calculation of operational cost can be found in Appendix C.

4 at the rate of exchange of PKR 165/USD and n the absence of any further PKR devaluation.

Mini & Micro Hydel Portfolio

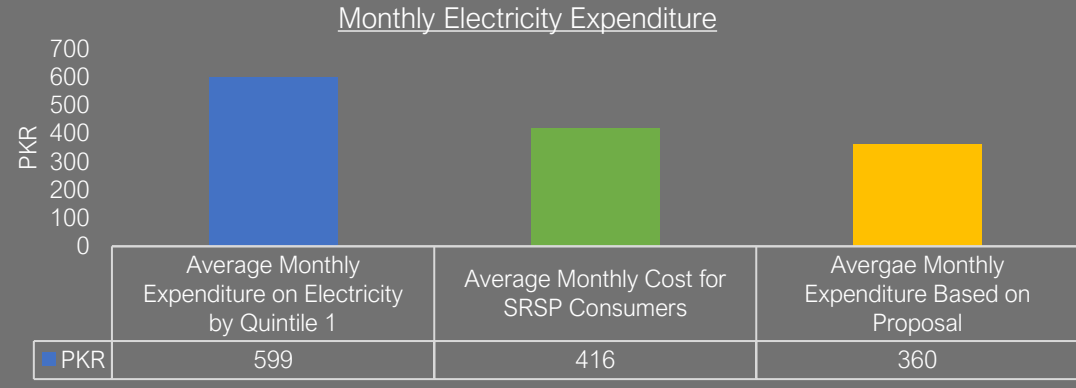
Justification for PKR 6.0 per kWh Tariff - Paying Capacity

The Household Integrated Economic Survey 2018-19 uses the five quintiles to classify population into groups based on their standard of living and income levels. The poorest households are grouped together in Quintile 1 while those with higher consumption are grouped in Quintile 2 and so on, with Quintile 5 representing the population group with the highest consumption.

For Quintile 1 of rural KP, average monthly household income is PKR 28,086 and average monthly expenditure on fuel and lighting is PKR 2,991, with the average electricity expenditure being PKR 599.

Rural KP	Quintile 1
Average Monthly Household Income (PKR)	28,086
Monthly Household Expenditure on Fuel & Lighting (PKR)	2,991
Average Monthly expenditure on electricity (PKR)	599

UNIDO's World Small Hydropower Development Report 2019, includes a case study on the MHPs installed by SRSP, where the typical domestic rate is around EUR 0.035 per kWh or PKR 6.94 with an allocation of around 60 kWh per Household per month, bringing the average monthly electricity bill at PKR 416.4. The average paying capacity for the lowest rural KP quintile is at PKR 599 based on average monthly household expenditure on electricity in HIES 2018-19. The proposed total tariff of PKR 6.0 (refer to previous page) will result in a monthly household electricity cost of PKR 360 (consumption 60 kWh). This is lower than the cost borne by SRSP consumers and should be acceptable to the community.



Source: UNIDO, World Small Hydropower Development Report 2019
Source: Analysis undertaken by the consultant using information from credible sources such as UNIDO, World Small Hydropower Development Report 2019.

Section 08: PEDO's Solar Generation Pipeline

Solar Generation Pipeline

Solar Resource Potential & PEDO's Mandate

Solar Resource Potential

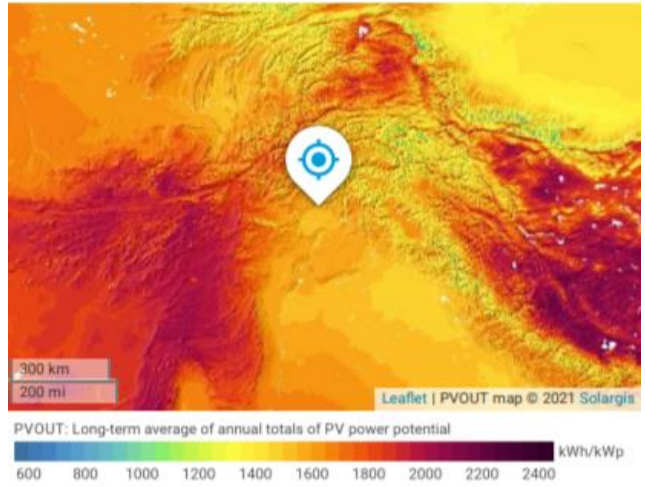
Pakistan has enormous solar potential which makes a perfect case for installation of solar based applications for generation of electric energy in the country. National Renewable Energy Laboratory of the USA, estimated the solar energy potential around 351,970 MW in KP Province.

As per the report on "Solar Resource and Photovoltaic Power Potential of Pakistan" under Global ESMAP Initiative, throughout the province of KP, yearly sum of global horizontal irradiation is around 1,775 kWh/m2. This translates to a specific yearly PV electricity output of **1,561 kWh / kWp**.

PEDO Mandate for development and utilization of energy resources (that includes Solar)

As per the Pakhtunkhwa Energy Development Organization Act 2020, "Notwithstanding anything contained in any other law for the time being in force, the PEDO shall have exclusive functions and powers for the development and utilization of the power and energy resources of the Province through public sector, private sector or through public private partnership mode.

Solar Resource Map of KP



DISCO	Cities	GHI (kWh/m2)	PVOUT (kWh/kWp)
PESCO	Peshawar	1704	1492
	Haripur/Hattar	1793	1576
	Kohat	1779	1574
	DI Khan	1783	1544
TESCO	Khyber	1697	1629
	Orakzai	1830	1706
	Mohmand	1823	1610

Resource in Major Load Centers of KP

Solar Generation Pipeline

Existing activities & schemes implemented by PEDO

Current Solar portfolio of the organization is broadly categories into following segments:

Projects	Sector	Funding	Completed	Ongoing	Total
Facilitation to Solar IPPs	Private IPPs	N/A	-	249.5 MWp	249.5 MWp
Electrification of Villages	Energy & power	ADP & HDF	2.0 MWp	-	2.0 MWp
Installation of Mini Grids	Energy & power	ADP	-	1.30 MWp	1.3 MWp
Solarization Program			-	-	
• Solarization of Schools and Primary Health Facilities	Energy & power	ADB, ADP	-	12.00 MWp	12.0 MWp
• Solarization of 4,000 Masajid	Energy & power	ADP	-	7.08 MWp	7.1 MWp
• Solarization of Government Buildings	Energy & power	ADP	0.9 MWp	-	0.9 MWp
• Solarization of 300 Masajid (Merged Districts)	Energy & power	ADP	0.5 MWp	-	0.5 MWp
• Solarization of Masajid and worship places	Accelerated Implementation Program (AIP - merged area)	ADP	-	0.5 MWp	0.5 MWp
• Solarization of Masajid in Swat and Peshawar	Multi-Sector Development (MSD)	ADP	-	2.6 MWp	2.6 MWp
Total			**3.4 MWp**	**273.0 MWp**	**276.4 MWp**

Solar Generation Pipeline

Facilitation to Solar IPPs

PEDO's LOIs for Solar IPPs

PEDO has issued 5 LOIs for Solar Independent Power Producers with cumulative capacity of 250 MW. Three out of these five projects are located in Kolachi, Dera Ismail Khan; while one is in Nowshera and one in Kohat.

Three of these solar projects i.e. FAS Energy, Kolachi Solar and Javed Solar, all located in Dera Ismail Khan, were issued Generation Licenses and benchmark tariffs from NEPRA which was around 3.95 cents/kwh (levelized). However these tariffs are yet to be notified by Ministry of Energy. Remaining two projects of Siddiqsons (located in Kohat and Lachi, 50 MW each) do not have tariffs but hold Generation Licenses.

Project Name	Size	Location	GL	Tariff
Kulachi Solar Power	50 MWp	D.I. Khan	✔	✔
FAS Energy	50 MWp	D.I. Khan	✔	✔
Javed Solar	49.5 MWp	D.I. Khan	✔	✔
Siddiqsons Kohat Solar	50 MWp	Kohat	✔	✘
Siddiqsons Nowshera Solar	50 MWp	Nowshera	✔	✘

Current Status of the Projects

The five solar LOIs by PEDO were issued under 'Development of Renewable Energy for Power Generation Policy, 2006' (RE Policy 2006). However as per the Cabinet Committee on Energy's (CCoE) Decision notified by the Government of Pakistan on 4 April 2019, certain renewable projects were allowed to proceed with development process in spite of the expiry of the RE Policy 2006, and restricted other projects, not holding GL and Tariff at the date of decision, from proceeding under RE Policy 2006. Since the three projects, Kolachi, FAS and Javed Solar, were issued the tariffs on 21 Feb. 2020, they were not allowed to proceed under CCoE Decision.

Presently, other than the projects named in the CCOE Decision (that include five PEDO LOIs), will be allowed to proceed under 'Alternate and Renewable Energy Policy 2019' (ARE 2019). However, LOI holders of the solar projects in KP has challenged the arbitrary division of projects under CCoE decision and have requested federal government to consider the projects under RE Policy 2006.

Solar Generation Pipeline

Facilitation to Solar IPPs - New Regulatory Framework of Competitive bidding

Alternative & Renewable Energy Policy, 2019 - Province's role in Federal Procurement under Competitive Bidding

All new renewable energy projects (other than hydro projects) of public utility procurement are now under the purview of the federal Alternative and Renewable Energy Policy, 2019. Procurement of Renewable Energy by Federal Public Utilities will be done primarily through competitive bidding. For the purposes of competitive bidding, **AEDB will announce the auction volumes annually based on the 'Indicative Generation Capacity Expansion Plan'** outputs, with the purchase and interconnection commitments from federally owned public power utilities in place before bidding.

As per ARE Policy 2019, locations are to be geographically spread based on multiple considerations, including resource mapping, load centers, interconnection availability at affordable cost, technical reasons and distribution. To **support balanced development footprint across the country, a minimum share for each province would be ensured by a 'Steering Committee'** (with Provincial Energy Secretaries are to be voting members of the Steering Committee) established under AEDB. The Steering Committee will also liaise with the **Provinces to identify land parcels and other facilities (such as access roads) the provinces are willing to offer to the renewable energy projects**.

The RFP and the associated contract package will be prepared by the Steering Committee and approved by the Board of AEDB. Requisite approvals of NEPRA and other competent forums will be obtained. The **Provincial Energy Departments will then conduct the bidding using the approved RFP and the contract package** with a representative of AEDB associated during the bidding process.

The **outcome of the bidding will be processed by the Provincial Energy Departments with NEPRA** for approval and award of tariff to the successful bidders. Thereafter, the GOP acting through AEDB will award the concessions to the successful bidders.

If the national grid company is not able to evacuate power from approved projects due to technical or financial limitations, then the Provincial grid company and/or project sponsors shall be allowed the option of undertaking such interconnection/evacuation subject to conformity to the Grid Code. NEPRA will determine tariff for such interconnection investment on cost plus basis, if such interconnection component is not part of the project auction, with the same return on equity/IRR as it grants to the national grid company for such interconnection. The contractual and financial obligations associated with the interconnection and evacuation of power shall be assumed exclusively by the Provincial grid company and/or project sponsor against indemnity to the national grid company and the relevant DISCO

Solar Generation Pipeline

PEDO Solar Projects – Completed

Completed Projects

PEDO has recently completed 5 solar projects under its domain. Summary of these projects are as follows:

PKR Millions

	PEDO Solar Projects - Completed	ADP # Code	Funding Source		
			ADP	HDF	Total
1	Solarization of Civil Secretariat (for Remaining Department)	554 - (A) PDWP - 29/11/18	190.13	-	190.13
2	Electrification of 100 Villages through Solar/AE, Phase I	555 - (A) PDWP - 11/11/19	233.45	6.54	239.99
3	Electrification of Un Electrified Villages through Solar/AE, Phase II	558 - (A) PDWP - 17/01/20	109.19	221.98	331.17
4	Solarization of CM's Secretariat/ CM House	560 - (A) PDWP - 16/04/18	109.50	-	109.50
5	Sub-component Solarization of 300 Masajid in Merged Districts[1]	601 - (A) PDWP - 05/04/19	182.63	-	182.63
			824.90	228.52	1,053.42

For two solar electrification projects in 100 villages and 98 villages, PEDO has utilized PKR 228.52 Million from the Hydel Development Fund apart from the Provincial share of ADP.

*It was revealed that the HDF was changed to Energy Development Fund (EDF) through an ordinance which allowed use of fund for projects other than Hydel. Under the said ordinance EDF was used for solar electrification project. However, subsequently EDF was reverted to HDF as the Ordinance repealed after 90 days of its promulgation.

Solar Generation Pipeline

PEDO Solar Projects – Ongoing

Ongoing Projects

PEDO has 5 ongoing projects under its Solar portfolio. Four of these projects are completely funded from provincial ADP.

PKR Millions

PEDO Solar Projects – Ongoing		ADP # Code	Project Cost
1	Solar Electrification of 4000 Masajid in KP	565 - (A) PDWP 5/04/19	2,414.97
2	Installation of 13 Mini-grids in FATA	601 - (A) PDWP 5/04/19	757.0
3	Solarization of Masajid and Worship Places in Merged Districts	615 - (B) PDWP 0/0/0	450
4	Solarization of Masajid in Swat and 440 Masajid in Peshawar	1306 -190601 (B) PDWP 0/0/0	870
	Total		4,491.97

ADB Funded – Ongoing Project

PKR Millions

PEDO Solar Projects – Ongoing		ADP # Code	Project Cost
1	Access to Energy - Solarization of Schools and BHUs	564 - (A) PDWP 27/01/17	4,347.06

Solar Generation Pipeline

Ongoing Projects

Based on the above discussion regarding the ongoing solar projects of PEDO, the table below highlights the funding requirement of PEDO to complete its solar portfolio projects, however since these projects are constructed for related provincial governments departments, the related funding requirement does not affect this business plan.

PKR Millions

PEDO Solar Projects – Ongoing		ADP # Code	2020-2021		2021-2022		2022-2023		Total Funding Requirement	
			ADP	ADB	ADP	ADB	ADP	ADB	ADP	ADB
1	Access to Energy - Solarization of Schools and BHUs	564 - (A) PDWP 27/01/17	-	1,907.66	-	1,907.66	-	-	-	3,815.32
2	Solar Electrification of 4000 Masajid in KP	565 - (A) PDWP 5/04/19	71.70	-	851.63	-	851.63	-	1,774.96	0.00
3	Installation of 13 Mini-grids in FATA	601 - (A) PDWP 5/04/19	140.40	-	563.56	-	-	-	703.96	0.00
4	Solarization of Masajid and Worship Places in Merged Districts	615 - (B) PDWP 0/0/0	340.0	-	110.0	-	-	-	450.00	0.00
5	Solarization of Masajid in Swat and 440 Masajid in Peshawar	1306 -190601 (B) PDWP 0/0/0	190.0	-	680.0	-	-	-	870.00	0.00
	Total		**742.1**	**1,907.66**	**2,205.19**	**1,907.66**	**851.63**		**3,798.92**	**3,815.32**

- Funding requirement for current year 2021 is estimated as the difference between current year allocation as per the ADP 2020-2021 and current year releases for the projects.
- Allocation for subsequent years is based in their proposed completion plan and where it is more than one year, through forward is evenly distributed in remaining financial years.

Solar Generation Pipeline

ADB Loan - Solarization of Schools and Primary Health Facilities (including BHUs)

Project Cost and ADB Loan

In December 2017, Khyber Pakhtunkhwa commenced installation of solar plants at 8,000 schools and 187 Primary Health Facilities. As per the Administrative Approval and PC1 of the project, break up of project cost is show in the table here. The program is expected to complete in December 2021. Based on the firm EPC and consultancy contracts of the project, it is estimated that the project has saving of PKR 165.75 Million

Particulars	PKR Million
Foreign/ Donor Component	3,864.50
Provincial Share	352.14
Community Share (in kind)	130.422
Total,	4,347.06

As mentioned earlier, in the Loan Agreement between GOP and ADB, KP share was USD 223.33 Million out which solar component is estimated as USD 41.97 Million against the following DLIs.`

		Total	15% Advance (USD million)[2]	Pending loan against DLIs (USD million)
DL1	Household Connection=240,000, students=2600,000	8.93	1.34	7.59
DL2	Capacity Generation = 153 MW	8.46	1.27	7.19
DL3	MHPs= 1000 Number, Solar Plants= 8,187	8.93	1.34	7.59
DL4	Solarization of 30% of girls schools	15.65	2.35	13.30
	Interest During Grace Period	-	0.39	-
	Total	**41.97**	6.69	**35.67**

USD 6.690 Million (equivalent to PKR 711.60 Million) has been disbursed from ADB loan for this project as 15% advance till date. Based on discussion with PEDO, it is expected that the project will be completed by December 2021 and will meet all solar related DLIs of ADB loan. As of today PKR 345.75 Million has been paid for the project from ADB share. Thus USD 35.67 Million will be available for drawdown against all DLIs.

Section 09: New Avenues for PEDO & GoKP

New Avenues for PEDO & GoKP

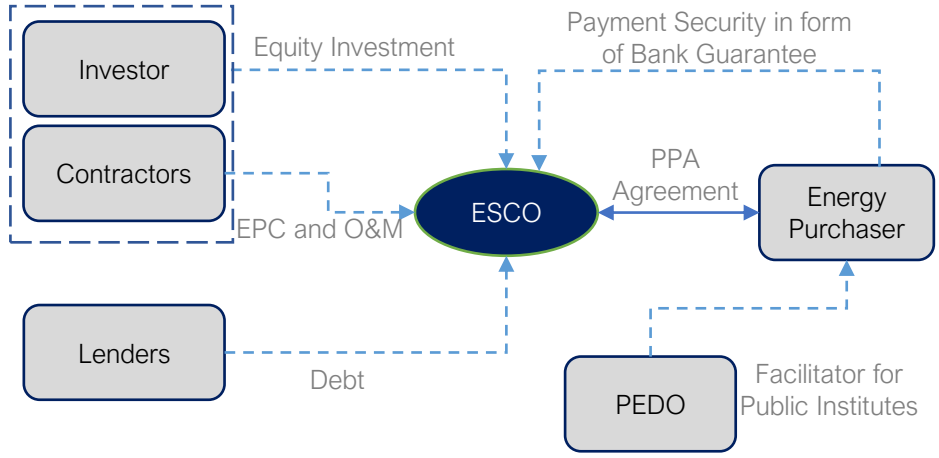
ESCO Model - Introduction

PEDO has carried out the Solarization of CM House, CM Secretariat and Civil Secretariat in the past and also implemented Net-Metering at these solarized sites. It is one of the modes of energy efficiency and conservation at public level.

Similarly, PEDO can play a role for optimizing the solar potential of the province by introducing Energy Service Companies' (ESCOs) model for large industrial & commercial units as well as general services consumers (including universities and hospitals).

For this PEDO can facilitate interested public sector hospitals and universities in design of a transaction structure where upfront outlay for construction for roof-top solar solutions is differed and avoid performance risk and maintenance issue of the solar power plant. Usually these objectives are achieved by engaging Energy Supply Companies (ESCOs).

ESCO Transaction Structure



Hiring of ESCOs through a transparent completive process will help in reducing electricity costs as well as operations and maintenance costs for the industrial, commercial and power intensive government/semi-government facilities as under the ESCO's performance-based contracting, ESCO's compensation is directly linked to the amount of energy that is actually sold/saved.

In the ESCO transaction structure, PEDO can act as a registrar of energy and maintain Energy Ledger, containing debit and credit entries in respect of the Energy Generation (Guaranteed and Actual) to be sold and bought by the parties under ESCO arrangement, and can charge its consultancy fee.

New Avenues for PEDO & GoKP

ESCO Model - Introduction

What is ESCO? An Energy Service Company is a commercial business providing a broad range of comprehensive energy solutions including designs and implementation of energy savings projects, energy conservation, energy infrastructure outsourcing, power generation and energy supply, and risk management.

How it Works? The ESCO performs an in-depth analysis of the property, designs an energy efficient solution, installs the required system and maintains it to ensure energy savings during the payback period. The savings in energy costs is often used to pay back the capital investment of the project over a period spanning from 5 to 25 years.

Viability: A comparison with the current applicable tariff of Off-peak gird electricity under General Services (A3-c) is made with the unit cost of electricity for 1 MW Solar Power Plant (under ESCO model) with a project life of 15 years. It appears that even during the debt period Energy Purchaser can save up to 41% of electricity cost in case of general services users (i.e. Govt Offices, Universities, Hospitals) for electricity unit cost in off-peak consumption. See adjacent table for details.

Off-peak Grid Electricity Cost – FY 2019-20	
	A3(c) General Rs.
Tariff (kWh)	17.56
NJ Surcharge	0.10
FC Surcharge	0.43
E.D @ 1.5%	0.26
GST @ 17%	3.12
Total rate-Rs./kWh	**21.47**

Tariff under Solar ESCO*		
During debt	Tariff Rs/kWh	10.82
	GST @17%	1.84
	Total Rs/kWh	**12.66**
After debt	Tariff Rs/kWh	4.47
	GST @17%	0.76
	Total Rs/kWh	**5.24**

**Key assumptions: Loan period 10 years, SBP RE Financing Facility, Investor's ROE 16%, O&M PKR900/watt, Average Energy Yield 1600 MWh/annum of Pakistan as per https://globalsolaratlas.info/map?c=34.03946,71.53613,11&s=34.03946,71.53613&m=bookmark

New Avenues for PEDO & GoKP

ESCO Model – Debt financing under SBP concessionary finance

State Bank of Pakistan issued Revised* SBP Financing Scheme for Renewable Energy on June 20, 2016 with a view to promote renewable energy projects in the country. Under the concessionary financing scheme of RE Projects by SBP, ESCOs shall not be required to be certified under AEDB Certification Regulations. However, following considerations apply:

- ESCO's consumers has to enter in Tripartite agreement creating lien of bank on the RE equipment installed.
- Cash deposit equivalent to expected average three (3) months' electricity bill is required, while no letter of credit or bank guarantee as security is allowed. However, as per current practice ESCOs usually require a minimum 6 months security deposit, or 3 months deposit plus 3 months payment guarantee.
- The vendors/suppliers/EPC contractors of an energy sale company are certified under AEDB Certification Regulations.
- Contracts/agreements of such energy sale company with vendors/suppliers as well as ultimate owners/users are made at an arm's length basis in order to avoid any conflict of interest.
- Disbursements by banks/DFIs are not made to the energy sale company directly; instead, payments are made to the manufacturers/suppliers/contractors in line with underlying contracts and construction milestones.

New Avenues for PEDO & GoKP

Floating Solar Photovoltaic (PV) Systems

Floating Solar Photovoltaic (PV) System is an alternate form of PV system that is directly sited on water as opposed to land or rooftops, saving valuable land for farming and other commercial activities. As of 2019, **2.4GW** of floating solar capacity has been installed globally.

2.5x Covering the surface area of all reservoirs across the world would generate 2.5 times the electricity produced by all the underlying hydropower reservoirs

31% Annual market growth rate projected between 2018-22

10% More efficient than land mounted PVs due to the cooling effect of water on solar cells translating into significant cost-saving over time

60% Of covering Tarbela's reservoir area with FPV, would yield 7,000 MW electricity equivalent to Tarbela's total installed capacity after T4HP and T5HP

Advantages

- ✓ Boosts energy yield of reservoirs
- ✓ Reduces evaporation from reservoirs
- ✓ Improves water quality by preventing algae growth
- ✓ Eliminates need for site preparation
- ✓ Improved efficiency due to cooling effect of water

Disadvantages

- x Technical complexities of design and building
- x Uncertainty regarding costs
- x Risk of corrosion/degradation due to moisture/ friction
- x 20-25% increase in system cost compared to land mounted PVs

Floating Solar Pilot Project in KP by The World Bank

Under the Khyber Pakhtunkhwa Hydropower and Renewable Energy Development (KHRE) program, 10-15 MW of Solar PVs will be installed on PEDO's hydropower assets, which is expected to cost **US$12 million** with an **annual generation capacity of 19 GWh.**

Source: "IFC Energy Insights, Floating Solar Photovoltaic on the Rise 2020
Source: The World Bank. Where Sun Meets Water-Floating Solar Marker Report 2018
Source: Tarbela 5th Extension Hydropower Project: Environmental and Social Assessment

New Avenues for PEDO & GoKP

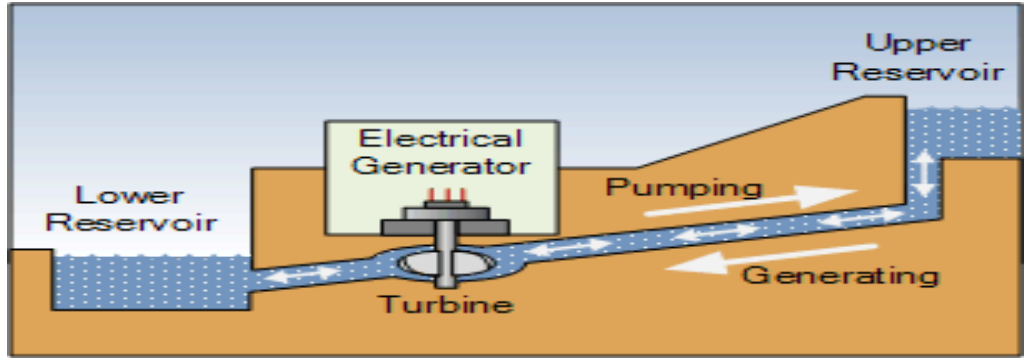
Pumped Hydro Storage (PHS)

Pumped hydro storage (PHS) utilizes hydroelectric power to store electricity; during low demand and during excess energy generation by pumping water to a higher altitude, and releasing the water to flow back down through turbines during peak times. The plant can be installed at interconnected power system, on rivers, canals and lakes and existing hydropower stations to secure large-scale transmission stabilization.

95% Of global storage electricity

140 GW Current global installed capacity

Advantages	Disadvantages
✓ Energy Balancing & Stabilizing	x Requires large land resource
✓ Flood Control	x High initial capital costs
✓ Improves Storage Capacity	x Site specific negative environment and ecological impact
✓ Ancillary Grid Services such as network frequency control	



Regional Example: Pumped Hydro Storage in India

2.6GW of pumped hydro storage is already operational in India with another 3.1GW under construction.

Proposals for another 8.9GW have been made, including:

- 500MW Kundah PHS at a total cost of US$ 265 million
- 600MW PHS in Odisha with a total estimated investment of US$ 430 million
- 1 GW of PHS on Turga dam in West Bengal.

Way Forward: A province wide scoping study to be commissioned for identification of pumped hydro potential in KP and to ascertain the most viable sites that may be explored for development.

Source: Energy Storage Association. Pumped Hydropower
Source: "Pumped Hydro Storage in India", Institute for Energy Economics and Financial Analysis

Section 10: Sustainable Utilization of KP's Resources

Sustainable Utilization of KP's Resources

Environmental Safeguards

Overview

The Government of Khyber Pakhtunkhwa (GoKP) remains committed to ensuring all energy projects developed in the province fulfill the applicable national environment and social safeguard requirements, along with any specific requirements from any financing agency, in case international financing is being sought for a specific project intervention.

Applicable Regulatory Framework

The Khyber Pakhtunkhwa (KP) Environmental Protection Act of 2014 is the main legislative framework related to environmental protection in the Province. In accordance with this Act, the GoKP will ensure that the development of all projects is cleared by the KP Environmental Protection Agency (KP EPA), following the procedures given in the Pakistan Environmental Protection Agency (PEPA), Review of (IEE) and (EIA) Regulations, 2010 and the National Environmental Quality Standards, 2012 are implemented in letter and spirit. These regulations classify the projects into two categories for environmental clearances as follows:

1. Energy projects requiring an IEE Study (Schedule I)
   - Hydroelectric power generation less than 50 MW
   - Thermal power generation less than 200 KW
   - Transmission lines less than 11 KV, and large distribution projects
   - Oil and gas transmission systems
   - Oil and gas extraction projects including exploration, production, gathering systems, separation and storage
   - Waste-to-energy generation projects

2. Energy projects requiring an EIA Study (Schedule II)
   - Hydroelectric power generation over 50 MW
   - Thermal power generation over 200 MW
   - Transmission lines (11 KV and above) and grid stations
   - Nuclear power plans
   - Petroleum refineries

Sustainable Utilization of KP's Resources

Social Safeguards

Overview

The GoKP intends to ensure that all energy projects to be developed in KP will meet all social safeguard requirements. Similar to environmental safeguards, the requirements consist of fulfilling the national requirements along with any financing agency specific guidelines/policies.

Applicable Legal / Regulatory Framework

The Land Acquisition Act, 1894 and the KP Amendment to this Act in 2020 will be fully implemented to ensure compliance. Both these Acts complement the Constitution of Pakistan, 1973, which is focused on ensuring, "*No person shall be deprived of his property save in accordance with law*" (Article 24(1)), and "*No property shall be compulsorily acquired or taken possession of save for a public purpose, and save by the authority of law which provides for compensation therefor and either fixes the amount of compensation or specifies the principles on and the manner in which compensation is to be determined and given*" (Article 24(2)).

Furthermore, Article 4(2a) reiterates the right of the people by stating that: "*No action detrimental to the life, liberty, body, reputation or property of any person shall be taken except in accordance with law*".

All international financing agencies continue to lay special emphasis and focus on ensuring that no unprecedented impacts due to Involuntary Resettlement (IR) and/or on Indigenous Peoples (IP) take place during development of any projects being financed by them. Detailed assessments on the land acquisition process, identified of Affected Persons (APs), compensation on market-based rates, poverty assessments and assessment of alternate livelihoods for the displaced persons are just some of the assessments routinely required to be prepared as part of the project preparatory process prior to commencement of physical works to fulfill the requirements of different financing agencies.

The GoKP will make all efforts to ensure that the Emergency Clause is not imposed as far as possible for acquisition of land for development of energy projects.

Sustainable Utilization of KP's Resources

GoKP's Approach to Future Project Development

The GoKP will ensure that high quality environmental assessments are prepared with the key/critical types of potential impacts expected to arise during the development of different types of projects adequately addressed with required mitigation measures also provided to ensure no long term, irreversible impacts take place that may damage the environment permanently.

In particular, the development of large-scale interventions such as large hydropower projects, long distance high voltage transmission lines and similar large-scale infrastructure projects in KP will require careful planning to ensure all potential environmental impacts are identified and adequately addressed at the project design phase.

The GoKP will also ensure that as far as possible, any potential impacts on biodiversity, consisting of both terrestrial and aquatic ecology including avifauna along with any activities in any sensitive areas, such as protected/reserve forests, game reserves and/or wildlife sanctuaries will be prevented altogether or minimized as far as possible with necessary mitigation measures implemented, as felt necessary. The GoKP also intends to ensure that any project activities in culturally and religiously sensitive areas will also be minimized as far as possible.

The most critical issues routinely observed for large scale infrastructure projects in the past in KP are land acquisition and resettlement with considerable complexities arising during this process, resulting in considerable delays in certain instances in the project development schedule.

The GoKP intends to plan and use foresight in identifying potential projects with a higher level of sensitivity placed on social safeguards in order to proactively address any such issues on priority basis and thus minimize the possibility of delays due to lack of resolution of any outstanding issues due to IR and/or IP.

Appendices

Appendix A

KP Under Development Hydro Portfolio – Public Sector

Project Name	Capacity (MW)	Location	Status
Lower Palas HPP	665	Kohistan	Yet to be awarded
Lower Spat Gah HPP	496	Kohistan	NTP
Kari-Mushkur HPP	495	Chitral	Feasibility Study completed
Ghrait- Swir Lasht HPP	370	Chitral	Feasibility Study completed
Balakot HPP	300	Mansehra	Feasibility Study completed
Naran HPP	188	Mansehra	Feasibility Study completed
Madian	157	Swat	Feasibility Study completed by private party (Cherat) on PPIB LOI
Batakundi HPP	96	Mansehra	Feasibility Study completed
Gabral-Kalam HPP	88	Swat	Detailed design in progress
Istaru Booni HPP	72	Chitral	Feasibility Study completed
Mujigram-Shoghor HPP	64	Chitral	Feasibility Study completed
Barikot Patrak HPP	47	Dir	Negotiations for funding ongoing with WB
Birti HPP	26	Kohistan	Feasibility Study completed
Patrak Shringel HPP	22	Dir	Negotiations for funding ongoing with WB
Ghorband Khwar HPP	21	Swat	Feasibility Study completed

Appendix A

KP Under Development Hydro Portfolio – Public Sector

Project Name	Capacity (MW)	Location	Comment
Kedam Khwar HPP	17	Swat	Pre FS completed
Ayun Gol HPP	15	Chitral	Pre FS completed
Ndihar Khwar	12	Mansehra	Feasibility Study completed
Utror HPP	8	Swat	Pre FS completed
Saiful Maluk Katha HPP	8	Mansehra	Pre FS completed
Rosh Gol HPP	7	Chitral	Pre FS completed
Total	**3,173**		

Appendix B

KP Under Development Hydro Portfolio – Private Sector

Project Name	Capacity (MW)	Location	Status
Turen Mori Kari HPP	350	Chitral	Feasibility Study completed
Jamshill Turen More HPP	260	Chitral	Feasibility Study completed
Karrang HPP	260	Kohistan	Pre FS completed, LOI to be awarded
Kalam Asrit HPP	238	Swat	LOI issued, FS in progress
Laspur-Murigram HPP	232	Chitral	Feasibility Study completed
Asrit Kedam	215	Swat	NTP issued
Sharmai HPP	150	Dir	Feasibility Study completed
Shushgai Zhendoli HPP	144	Chitral	Feasibility Study completed
Shogo Sin HPP	132	Chitral	Feasibility Study completed
Shigo Kas HPP	102	Dir	Feasibility Study completed
Arkari Gol HPP	99	Chitral	Feasibility Study completed
Ban khwar HPP	84	Swat	LOI to be issued
Gabral Utror HPP	73	Swat	LOI to be issued
Meragram HPP	70	Chitral	Feasibility Study ongoing
Torkhow River HPP	70	Chitral	Feasibility Study ongoing

Appendix B

KP Under Development Hydro Portfolio – Private Sector

Project Name	Capacity (MW)	Location	Status
Mastuj-1 HPP	65	Chitral	Feasibility Study ongoing
Sahibabad HPP	63	Dir	LOI to be issued
Shalfalam HPP	60	Dir	Feasibility Study ongoing
Ushu River HPP	55	Swat	Feasibility Study ongoing
Charun-Shachar HPP	50	Chitral	Feasibility Study ongoing
Mastuj River HPP	48	Chitral	Feasibility Study completed
Ushu River	48	Swat	Feasibility Study ongoing
Wari HPP	37	Dir	LOI to be issued
Tarappi HPP	32	Mansehra	Feasibility Study ongoing
Sammar Gah HPP	28	Kohistan	Feasibility Study completed
Tangar HPP	25	Mansehra	Feasibility Study completed
Kund	25	Mansehra	Pre FS completed
Barum Gol HPP	25	Chitral	Feasibility Study ongoing
Kaigah-II HPP	24	Kohistan	Feasibility Study ongoing
Gwaldai Sin HPP	21	Dir	Feasibility Study ongoing

Appendix B

KP Under Development Hydro Portfolio – Private Sector

Project Name	Capacity (MW)	Location	Status
Ushu River HPP	20	Swat	Feasibility Study ongoing
Dhadar HPP	18	Mansehra	Feasibility Study completed
Chowkel Khwar HPP	12	Swat	LOI issued, FS in progress
Oshghor HPP Raw site	11	Chitral	Feasibility Study ongoing
Kaigah-III HPP	10	Kohistan	Feasibility Study ongoing
Mahandri	10	Mansehra	Feasibility Study completed
Gabral village HPP	10	Swat	LOI to be issued
Daral Khwar-2 HPP	10	Swat	Feasibility Study ongoing
Sarral-Dhartian	10	Mansehra	Feasibility Study ongoing
Shishiko HPP	9	Chitral	Feasibility Study ongoing
Bhimbal Katha HPP	8	Mansehra	Feasibility Study ongoing
Bilkani HPP	7	Swat	Feasibility Study completed
Serai Sin HPP	7	Dir	Feasibility Study ongoing
Olai Khwar-1 HPP	7	Swat	NTP issued
Olai Khwar-2 HPP	6	Swat	NTP issued

Appendix B

KP Under Development Hydro Portfolio – Private Sector

Project Name	Capacity (MW)	Location	Status
Samkot Osheri HPP	5	Dir	Feasibility Study ongoing
Gwaldai Sin-2 HPP	5	Dir	Feasibility Study ongoing
Jabri Bedar HPP	4	Mansehra	Feasibility Study completed
Gandigar HPP	3	Dir	Feasibility Study ongoing
Nila Da Katha HPP	2	Mansehra	Feasibility Study ongoing
Total	**3,259**		