
Chapter 14

Energy

Energy and Economy

Energy sector plays a vital role in the economic development of a country. The recent decades witnessed a manifold increase in the demand for energy. The three principal drivers of increase in energy demand are the surge in economic activities, population growth and rapid technological transformation in the world.

The surge in commodity prices in 2021 and during the initial months of 2022 mainly lifted by the global economic rebound, improved growth prospects and conflict between Russia and Ukraine. According to the International Energy Agency (IEA), the economic recovery from the COVID-19 pandemic, combined with unusual weather conditions led to a sudden jump in electricity demand by more than 6 percent in 2021. The cost of fuel and electricity has enhanced cost of overall production, consequently higher prices have substantially increased cost of living which further eroded the purchasing power of households across the world.

Currently, global economy faces higher energy prices which may remain intact due to the Russian-Ukraine war. The war has led to significant disruptions to the production and trade of commodities for which Russia and Ukraine are key exporters. World Bank's (WB) latest forecasts indicated that war in Ukraine is set to trigger the largest commodity shock. This would contribute to huge price surge for energy related goods including oil and natural gas. The WB report further revealed that energy prices are set to increase more than 50 percent, pushing up cost for households and businesses. This situation has raised concerns at global level, particularly for the developing economies where provision of energy subsidy has become a major challenge due to weak fiscal position.

Pakistan Energy Profile

Government of Pakistan (GoP) has announced different policies to ensure the smooth supply of energy to the general public and to boost economic growth. These policies include "The National Power Policy 2013", "The Power Generation Policy 2015" and "Alternative and Renewable Energy Policy 2019". The National Power Policy 2013 aimed to develop an efficient and consumer-centric power generation, transmission and distribution system that could meet the needs of the people and boost the economy of the country in a sustainable and affordable manner. The main targets included complete elimination of load shedding, decreasing the average cost of electricity generation,

decrease in the transmission & distribution losses, increase in the revenue collection and a reduction in the time required for decision making at the ministry level or other related departments.

In 2015, Government introduced “Power Generation Policy 2015” to facilitate private investment in the power sector. The policy offered incentives to the private sector to set up new power generation projects as well as invest in public sector power generation projects in a different phases of development. The main focus of power generation policy 2015 was to have sufficient least cost power generation capacity in the country, prioritizing utilization of indigenous resources, facilitating all stakeholders involved in the transaction and safeguarding the environment.

In 2019, the Alternative and Renewable Energy Policy was introduced to assist and promote the development of renewable resources in the country. The main objective of the policy was to provide supportive environment for renewable power projects, increase the share of green energy capacity to 20 percent by 2025 and 30 percent by 2030 through attracting private capital in the area of green energy.

Energy sector is prone to certain challenges. For instance, the problem of circular debt in the energy sector is a long awaited issue. Successive governments have strived hard to bring circular debt down but the issue largely remained uncontrolled. In FY2013, circular debt was around Rs 450 billion which reached to Rs 1148 billion in 2018. According to the data of the Central Power Purchasing Authority (CPPA), circular debt stood at Rs 2467 billion by March 2022. This implies that circular debt is equivalent to 3.8 percent of Pakistan's GDP and represents 5.6 percent of Pakistan's government debt. Growing at the current pace and if it is allowed to grow unaddressed, it is estimated to reach Rs 4 trillion by 2025, demanding the urgency of reforms in the power sector.

Pakistan's dependence on liquefied natural gas (LNG) has increased in recent years due to depleting indigenous natural gas deposits. Over the past three years, the stock of circular debt in the gas sector has nearly doubled to Rs 650 billion increased from Rs 350 billion in 2018. The inappropriate response of the government created problems in the import of LNG by the private sector which led to gas crisis in the country, especially in winter. This led to a suspension of gas supply to the captive power plants industries and compressed natural gas (CNG) stations.

Pakistan Energy Mix

Pakistan is producing very limited percentage of oil to meet the overall demand of the country. The indigenous oil production is constrained by technological, technical and financial constraints. This necessitates import of crude oil and other oil products in large quantities to meet significant share of the total demand. Latest data indicates that import bill of oil increased by 95.9 per cent to US\$17.03 billion during July-April FY2022 compared to US\$8.69 billion during the same period last year. Higher oil prices in the global market and massive depreciation of the Pakistani rupee is making oil more expensive, triggering external sector pressure and widening trade deficit of the country. The surge in oil import bill is attributed to increases in value as well as increase in demand as the import of petroleum products went up by 121.15 percent in value and

24.18 percent in quantity. The Crude oil imports rose by 75.34 percent in value and 1.4 per cent in quantity during the period under review. Similarly, liquefied natural gas witnessed an increase of 82.90 percent in value, while liquefied petroleum gas (LPG) imports also jumped by 39.86 percent during July-April FY2022.

The scarce natural gas reserves of the country are quickly depleting due to substantial increase in the demand for gas, putting huge pressure on the limited natural gas reserves of the country. Government is looking for both short as well as long-term alternatives solutions to respond effectively to the substantial energy requirements. Keeping in view the rising demand for energy, Government is focusing to develop new exploratory wells to increase the supply of national gas. In addition to that, LNG and piped gas are being imported. In the FY2021, around 373 million MMBTU of LNG gas worth around US\$3.4 billion was imported. This corresponds to around 30 percent of the total natural gas consumption in the country. During July-Feb FY2022, 75.64 percent gas is domestically produced, while 24.36 percent of gas is being imported.

Coal is also used for electricity generation in Pakistan. Thar has the largest coal reserves in the country which has been actively developed in recent years. The first Thar plant, having capacity of 660 MW, became operational in the first quarter of FY2020. Currently, the overall electricity generation from coal has reached to 5280 MW. Thar coal is contributing 1,320 MW, while imported coal contribution in electricity generation is 3,960 MW which is around 75 percent of the total electricity generation from coal in the country. Electricity generation configuration is relying heavily on the imported coal and this trend is likely to change as units based on the Thar field are added to the electricity generation mix.

Pakistan is very rich in hydropower and has the enormous potential to generate electricity from water. The estimated total hydropower potential of Pakistan is around 60,000 MW. The country is not utilizing full potential and using nearly 16 percent of the total hydropower potential. The high investment cost for the installation of hydroplants, development of electricity transmission network and resettlement of the affected population are few reasons for hydropower not being exploited to its full capacity. Currently, the Hydro installed capacity is 10,251 MW which is around 25 percent of the total installed capacity.

Pakistan has wind corridors as well and there is huge potential to generate electricity from wind. It is estimated that Pakistan can generate 50,000 MW from wind. The contribution of Wind in the total installed capacity is 4.8 percent and currently stood at 1,985 MW. The potential for solar power in Pakistan is also high. The sunlight is available abundantly almost throughout the country. Currently, the capacity share of these renewable resources is small, but it is expected to increase sharply, as reflected in the Alternative and Renewable Energy Policy 2019. The installed capacity of solar is 600 MW which is around 1.4 percent of the total installed capacity.

Pakistan is also producing energy from the nuclear technology whose contribution is increasing gradually. The gross capacity of the nuclear power plants was 2,530 MW that supplied about 7,076 million units of electricity to the national grid during July-March FY2021. The gross capacity of nuclear power plants has increased by 39 percent and it

stood at 3,530 MW that supplied 12,885 million units of electricity to the national grid during July-March FY2022.

Pakistan's Electricity Generation Capacity

The total electricity generation capacity during July-April 2022 has increased by 11.5 percent and it reached 41,557 MW from 37,261 MW during the same period last fiscal year.

	FY2020-21 (July-April)	FY2021-22 (July-April)
Installed Capacity (MW)	37,261	41,557
Source: Ministry of Energy, (Power Division)		

Fuel-wise Installed Capacity

The percentage share of Hydel in total installed fuel-wise capacity has marginally reduced to 24.7 percent during July-April FY2022 as compared to its share in FY2021. The contribution of RLNG in the installed capacity has increased to 23.8 percent in July-April 2022 from 19.66 percent. The percentage share of coal remained the same, although there is an increase in the installed MW from 4,770 MW during July-April 2021 to 5,332 during July-April 2022. The percentage contribution of gas has declined from 12.15 percent during July-April 2021 to 8.5 percent in July-April 2022.

There is an increase in the percentage share of renewable energy which is a good sign for the economy as well as for the environment. The percentage contribution of Nuclear has increased to 8.8 percent during July-April FY2022 from 6.68 percent during July-April FY2021. The share of wind has increased from 3.31 percent to 4.8 percent while the percentage share of solar has increased from 1.07 percent in July-April FY2021 to 1.4 percent during July-April FY2022.

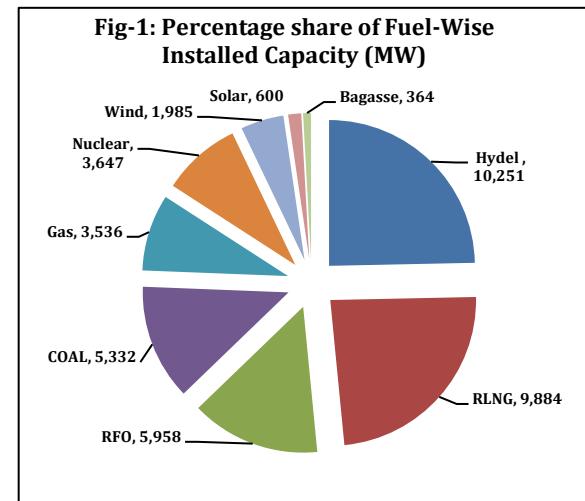


Table 14.2: Fuel-wise Installed Capacity Breakup JULY-April FY2022

	Installed (MW)	Percentage (%) Share
Hydel *	10,251	24.7
RLNG**	9,884	23.8
RFO	5,958	14.3
COAL	5,332	12.8
Gas	3,536	8.5
Nuclear***	3,647	8.8
Wind****	1,985	4.8
Solar	600	1.4
Bagasse	364	0.9
Total	41,557	100.0%

*Karot Hydel Power 2 Units of 360 MW Capacity are running on Commissioning test and are included in Installed Capacity.

**All KE power plants are operated on Indigenous gas and RLNG as the same is supplied by SSGC on co-mingled basis.

***Supply from KANUPP was discontinued from August 2021

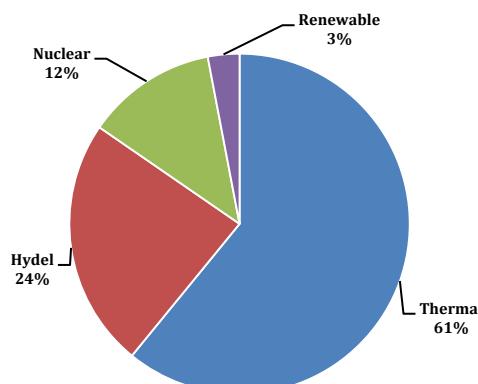
****Two Wind Power Plants 100 MW Capacity are running on Commissioning test and are included in Installed Capacity.

Source: Ministry of Energy, (Power Division)

Share in Electricity Generation

There is a slight shift in the percentage share of different sources in electricity generation. Thermal has still the largest share in electricity generation in the country, although its percentage contribution has declined from 62.5 percent during Jul-April FY2021 to 60.9 percent during Jul-April FY2022. Similarly, the percentage contribution of Hydel in electricity generation has also reduced from 27.8 percent in Jul-April FY2021 to 23.7 percent during Jul-April FY2022. The percentage share of Nuclear has increased from 7.2 percent during Jul-April FY2021 to 12.35 percent during Jul-April FY2022. The contribution of renewable in the electricity generation has increased from 2.4 percent during Jul-April FY2021 to 3.02 percent in the first ten months of FY2022.

Fig-2: Share in Electricity Generation



Source: Ministry of Energy, (Power Division)

Table 14.3 Share in Electricity Generation in (GWh)

	FY2020 (Jul-Apr) (GWH)	FY2021 (Jul-Apr) (GWH)	FY2022 (Jul-Apr) (GWH)	FY2020 (Jul-Apr) (%)	FY2021 (Jul-Apr) (%)	FY2022 (July-April) (%)
Thermal	65,317	71,178	74,862	61.43	62.52	60.9
Hydel	30,136	31,730	29,181	28.34	27.87	23.7
Nuclear	8,101	8,218	15,182	7.62	7.22	12.4
Renewable	2,768	2,715	3,709	2.60	2.38	3.0
Total	106,322	113,842	122,934	100	100	100

The Electricity Generation is inclusive of K-Electric System.

Source: Ministry of Energy, (Power Division)

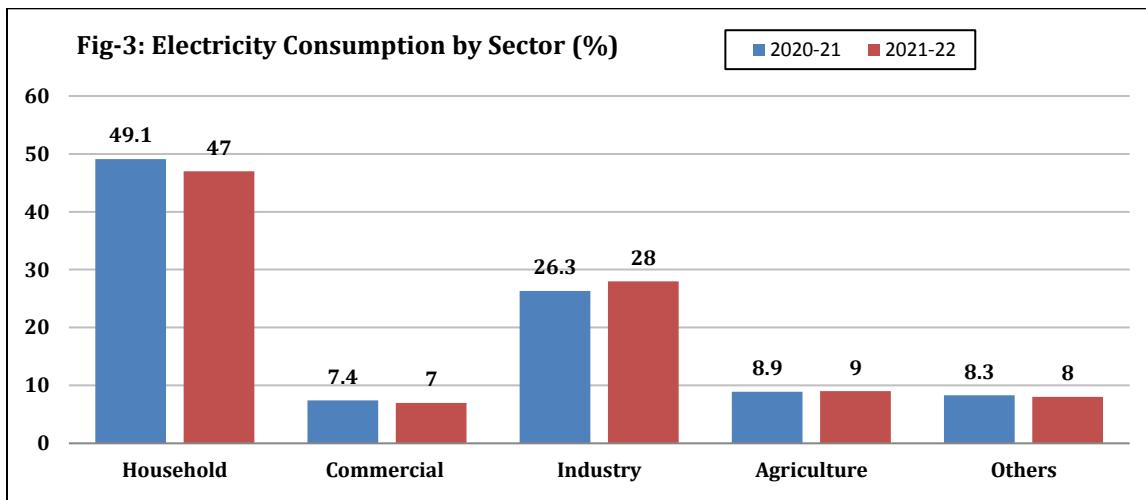
Electricity Consumption

The first ten months of the current fiscal year has not seen any major shift in the consumption pattern of electricity. The share of household in electricity consumption has slightly declined from 49.1 percent in FY2021 to 47.0 percent in FY2022. Electricity consumption in the commercial sector has also witnessed a decline and stood at 7 percent in FY2022, down from 7.4 percent in FY2021. However, the share of Industry in electricity consumption has increased to 28 percent during July-April FY2022 from 26.3 percent during July-April FY2021. The use of electricity in agriculture sector has slightly increased to 9 percent from 8.9 percent. The share of electricity consumption in other sectors, including public lighting, general services and other government traction has decreased to 8 percent from 8.3 percent.

Table 14.4: Share in Electricity Consumption

Sector	Units sold (GWh)		Percentage share	
	FY2020-21 (Jul-Mar)	FY2021-22 (Jul-Mar)	FY2020-21 (Jul-Mar)	FY2021-22 (Jul-Mar)
Household	41,508	42,055	49.1	47
Commercial	6,246	6,648	7.4	7
Industry	22,280	25,160	26.3	28
Agriculture	7,558	8,151	8.9	9
Others	7,008	7,347	8.3	8
Grand Total	84,600	89,361	100	100

Source: HDIP



Oil Sector

Pakistan generates its power from an energy mix that includes oil, gas including natural gas and LNG, coal, renewable sources including solar, wind and hydro energy, nuclear, and biomass. The energy sector is heavily dependent on imported fuel including oil and LNG and will continue to rely on its imports because of the low domestic capacity. Higher oil prices in the global market and massive depreciation of the Pakistani rupee making oil imports more expensive, triggering external sector pressure and is widening trade deficit of the country. The surge in oil import bill is attributed to increases in value as well as increase in quantity demanded. Oil import bill increased by 95.9 percent to US\$17.03 billion July-April FY2022 compare to US\$8.69 billion during the corresponding period last year. Further breakup showed that the import of petroleum products went up by 121.15 percent in value and 24.18 percent in quantity. During July-April FY2022, the import of petroleum products increased to US\$8.55 billion in July-April FY2022 compared to US\$3.87 billion during July-April 2021. The crude oil imports rose by 75.1 percent in value and 1.4 per cent in quantity during the period under review. Petroleum crude reached to US\$4.22 billion July-April FY2022 against US\$2.41 billion in the same period in FY2021. During July-March FY2022, the total processed imported crude stood at million metric tons while processed local crude recorded at 2.31 million metric tons. Similarly, the import of LNG has increased by 39.86 percent during

July-April FY2022. It is important to note that increase in LPG is largely triggered by increase in value which stood at 82.90 percent.

Gas Sector

The indigenous supply of natural gas witnessed a decline of around 5 percent and its contribution recorded at 33.1 percent in the total primary energy supply mix of the country. The available statistics for July-March FY2022 indicate that Pakistan has an extensive gas network of over 13,513 KM transmission, 155,679KM distribution and 41,231KM services gas pipelines to cater the requirement of millions of consumers. The number of consumer has increased from 10.3 million to more than 10.7 million across the country. Government's policies to enhance indigenous gas production to meet increasing demand of energy in the country proved effective. At present, the capacity of two Floating Re-gasification Storage Units (FRSU) to Re-gasified Liquefied Natural Gas (RLNG) is 1200 MMCFD. RLNG is being imported to bridge the widening gap between demand and supply of gas in the country. The average natural gas consumption has declined from 3,723 MMCFD to about 3,565 MMCFD during July-March FY2022. This also includes 863 MMCFD volume of RLNG during July 2021 to March 2022. During July 2021 to March 2022, the two Gas utility companies (SNGPL & SSGCL) have laid 67 km Gas Transmission network, 3,244 Km Mains and 829 Km Services lines and connected 108 villages/towns to gas network. During July-March FY2022, 259,212 additional gas connections including 257,644 domestic, 1473 commercial and 95 industrial were provided across the country compared to 304,573 additional gas connections provided during the same period in last fiscal year.

It is expected that gas will be supplied to approximately 736,060 new consumers (this target is subject to approval/revision by OGRA) during FY2023. Gas utility companies have planned to invest Rs 27,669 million on Transmission projects, Rs 77,484 million on distribution projects and Rs 8,746 million on other projects bringing the total investment of Rs 113,899 million during the fiscal year 2022-23.

Table 14.5: Sector Wise Natural Gas Consumption in million Cubic Feet Per Day (Mmcfd)

Sector	Gas Consumption	RLNG	Total
Power	560	555	1,115
Domestic	907	1	908
Commercial	62	8	70
Transport(CNG)	49	23	72
Cement	1	0	1
Fertilizer	684	51	735
General Industry	439	225	664
Total	2,702	863	3,565

Sources: Ministry of Energy (Petroleum Division)

The consumption of natural gas in power sector has reduced from 610 MMCFD to 560 MMCFD. The use of gas in domestic sector has also decreased to 907 MMCFD during July-March FY2022 from 915 MMCFD in the same period last year. Commercial sector

witnessed a decline in the use of gas and its consumption registered at 62 MMCFD during July-March FY2021-22. Earlier it was 65 MMCFD during the first nine months of FY2021-22. The use of gas (CNG) in the transport sector has declined to 49 MMCFD from 63 MMCFD. The consumption of gas in fertilizer sector has reduced from 687 MMCFD to 684 MMCFD while the consumption in general industry has increased to 439 MMCFD from 433 MMCFD. However, total consumption of gas has reduced to 2,702 MMCFD during July-March FY2022 from 2,773 MMCFD during the same period in FY2021.

Nuclear Energy

Government has formulated several policies for the development of the power sector in the past. The aims of these policies were elimination of inefficiencies in existing generation, transmission and distribution systems, as well as diversification of the energy generation mix with maximum utilization of indigenous energy resources to supply reliable, affordable and clean electricity.

Development of nuclear power remained the responsibility of the Pakistan Atomic Energy Commission (PAEC). PAEC is generating electricity through nuclear power in the country.

PAEC started operation of its first nuclear power plant, Karachi Nuclear Power Plant (KANUPP) on August 01, 1971. KANUPP completed 50 years of safe operation on August 01, 2021 and was shut down permanently for decommissioning. It is a true symbol of success and pride for Pakistan by generating and providing cheap electricity to the general public.

At present, there are six nuclear power plants (NPPs) operating on two sites in the country. Among these six NPPs, two units of Karachi Nuclear Power Plant (K-2, K-3) at Karachi and four units of Chashma Nuclear Power Plants (C-1, C-2, C-3 & C-4) at Chashma, Mianwali Punjab. Last year, the gross capacity of these nuclear power plants was 2,530 MW that supplied about 7,076 million units of electricity to the national grid during July-March 2020-21. The capacity of these nuclear power plants has increased this year and the gross capacity of NPPs stood at 3530 MW that supplied 12,885 million of electricity to the National grid during 1st July 2021 to 31st March 2022. This shows an increase of 39 percent in terms of MW and 82 percent increase in terms of units supplied.

Despite COVID-19 difficulties, NPPs performed effectively in these difficult times by supplying uninterrupted and continuous power at highest capacity factors. One of these plants, K-2 has made a new record in Pakistan's history by operating for 100 days continuously since its commercial operation date, becoming the first nuclear power generation plant to achieve this milestone. K-3 was connected to the national grid on 4th March 2022. The provincial acceptance of K-3 is expected on 15th April 2022.

PAEC is planning for the construction of another nuclear power plant at Chashma near Mianwali. The site is already home to four operating nuclear plants. This unit, named as C-5, will replicate the design characteristics of K-2 and K-3.

Table 14.5: Performance of Nuclear Power Plants

Plant	Capacity (MW)		Electricity sent to Grid (million kWh)	
	Gross	Net	FY2021-2022 July-March	Lifetime up to March 2022
KANUPP*	100	90	45	14,972
C-1	325	300	1,861	43,919
C-2	325	300	1,779	24,709
C-3	340	315	1,681	12,716
C-4	340	315	1,500	10,539
K-2	1,100	1,017	5,874	6,887
K-3	1,100	1,017	145	145

* KANUPP permanently shut down for decommissioning on August 01, 2021

Source: Pakistan Atomic Energy Commission

Mineral Sector

Coal is an important source of energy and power sector uses significant share of coal for the generation of electricity. Generally, indigenous coal is consumed in brick kilns and cement factories while imported coal is used for power generation, cement manufacturing and other industries like steel making, etc. During FY2021, domestic coal production figured around 9.3 million tonnes, and about 18.9 million tonnes of coal were imported. During July-Feb FY2022, the import of coal stood at 12.21 million metric tons. The consumption of coal in cement and other industry has significantly declined from 37.6 percent July-March FY2021 to 24.1 percent during July-March FY2022. The consumption of coal has increased from 19.7 percent in July-March FY2021 to 31.4 percent during July-March FY2022. Power sector uses most of the coal and the share has increased to 44.5 percent during July-March FY2022 from 42.7 percent during the corresponding period last year.

Private Power and Infrastructure Board (PPIB)

PPIB is struggling to embrace the profound economic changes and associated goals of access to affordable energy for sustainable economy. PPIB is well aware of the existed challenges of the energy sector and its transformation needed for the energy system. As a long term vision, PPIB strives hard to respond effectively to successfully meet the growing and changing energy paradigm. Since its inception in 1994, PPIB has a track record of attracting around US\$23

billion of investment with the establishment of forty IPPs totalling 18,211 MW and a mega High-Voltage Direct Current (HVDC) transmission line project in the country. This constitutes around 50 percent of installed power generation capacity in the country.

Table 14.6: Consumption of Coal by Sector

(000 metric ton)

Sectors	2020-21	2021-22
Cement/Other Industry	7,875.0 (37.6%)	5,300.0 (24.1%)
Brick kiln Industry	4,125.0 (19.7%)	6,900.0 (31.4%)
Power (WAPDA &IPPs)	8,925.0 (42.7%)	9,800.0 (44.5%)
Total	20,925.0 (100%)	22,000.0 (100%)

Source: Petroleum Division, Ministry of Energy

Table 14.7: Installed power generation capacity

Completed Projects: Fuel/Technologies

Total 18,211 MW	Hydro	Thar Coal	Natural/Low BTU Gas	RLNG	Imported Coal	Oil
	333 MW	1,320 MW	5,372 MW	3,633 MW	3,960 MW	3,593 MW

Source: Private Power and Infrastructure Board

At present, PPIB is implementing two robust policy frameworks having market competitive incentives and simplified procedures for the investors. The “Power Generation Policy 2015” and the “Policy Framework for Private Sector Transmission Line Projects 2015” were launched to attract new investments for development of new power generation projects and augmentation of transmission network in the country. These policy frameworks have so far received overwhelming market response, by attracting many renowned local and international investors and lenders.

Portfolio of the Upcoming Projects

Government of Pakistan and subsequently PPIB are fully cognizant of the climate change agenda. Therefore, maximum attention has been paid to all projects including coal to ensure that these projects are strictly complying with international environmental standards of WB/IFC. PPIB is also working on 21 different projects ranging from Hydro, Thar coal, RLNG to imported coal. Details of these projects are given in table 14.8.

Table 14.8: Portfolio of the Upcoming 21 Projects of 11,386 MW

	FC achieved/Under Construction	LOS Issued	Candidate Projects in the IGCEP portfolio	To be processed as per the requirement of new capacity in the IGCEP
Hydro	2 IPPs of 1604 MW	4 IPPs of 1839 MW	4 IPPs of 1,472 MW	4 IPPs of 1,260 MW
Thar Coal	3 IPPs of 1,980 MW	1 IPPs of 330 MW	1 IPP of 1,320 MW	—
RLNG	1 IPP of 1,263 MW	—	—	—
Imported Coal	—	1 IPPs of 300 MW	—	—
Total	6 IPPs of 4,847 MW	6 IPPs of 2,469 MW	5 IPPs of 2,792 MW	4 IPPs of 1,260 MW

Source: Private Power and Infrastructure Board

Commissioning of 660 MW Thar Coal based Lucky Electric Power Project

Recently, PPIB declared successful completion of the commissioning of a 660 MW Lucky Electric Power Plant at Bin Qasim. This critical power plant was earlier synchronized with the national grid towards the end of 2021 and after its extensive testing and relevant inspections since then led to its commercial operation on 21st March ,2022.

China-Pakistan Economic Corridor (CPEC)

CPEC benefits Pakistan through development of multi-sector infrastructure projects including various projects in the energy sector. Overall, thirteen power generation projects of 11,648 MW are being facilitated by PPIB under CPEC. These include four hydropower projects of 3,428 MW, five Thar-coal based projects of 3,960 MW, four imported coal-based projects of 4,260 MW and a 660 kV High-Voltage Direct Current (HVDC) Transmission Line Project. Out of these, three imported coal-based power projects of 3,960 MW and one Thar coal-based power project of 660 MW have been commissioned, while ±660 kV Matiari-Lahore HVDC Transmission Line Project has also started operations on commercial basis with effect from 1st September 2021. This is not only the first transmission line project developed by the private sector but the first ever HVDC transmission line in Pakistan as well. Furthermore, another nine IPPs of 7,028 MW which include four hydro IPPs of 3,428 MW, four Thar coal based IPPs of 3,300 MW and one imported coal based IPP of 300 MW are at different stages of processing.

Fig-4: CPEC Energy Projects-PPIB (11,648 MW)

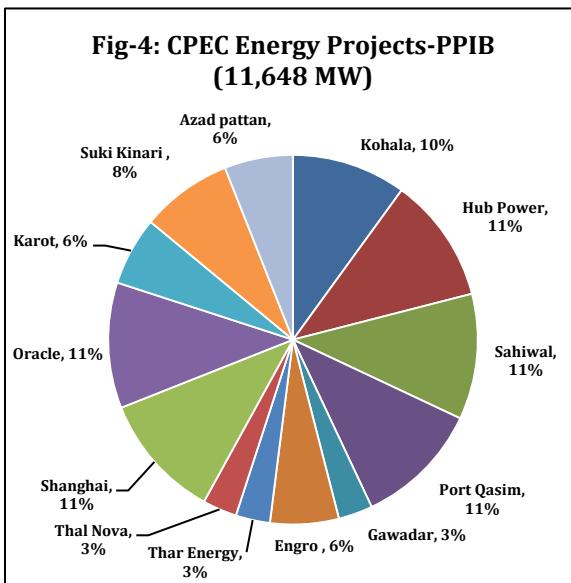


Fig-5: Commissioned Projects PPIB-CPEC (4,620 MW-40%)

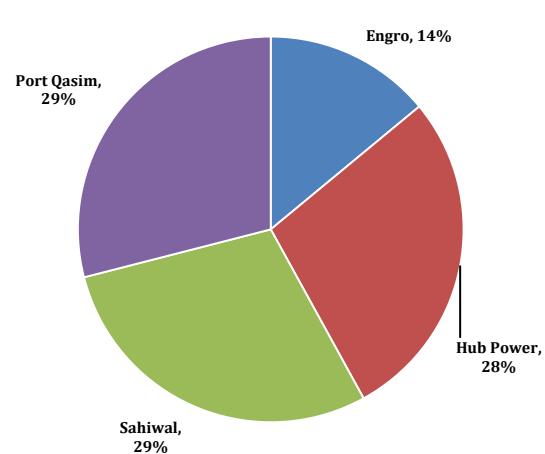
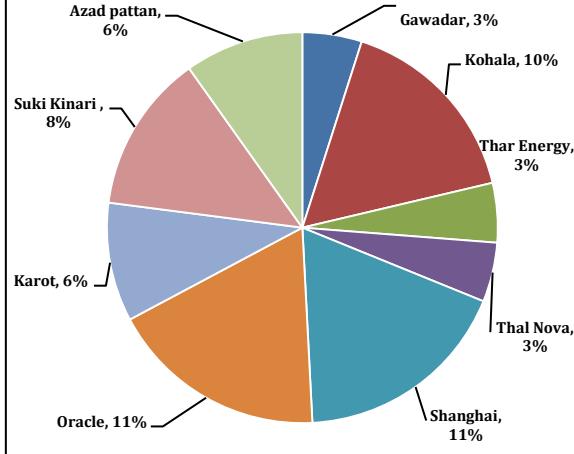


Fig-6: Under Implementation Projects PPIB-CPEC (7,028 MW-60%)



Besides the paramount advantage of generating much needed electricity, these projects would play instrumental role in promoting economic development, creating employment opportunities and improving livelihoods through social and development works at their respective locations.

PPIB Amendment Bill 2022: Merger of AEDB into PPIB

Originally, the Alternative and Renewable Energy (ARE) project development was within the mandate of PPIB. However, in order to build more focus on ARE in line with the government's international commitments for environment friendly energy development the Alternative Energy Development Board (AEDB) was established in 2003. From the administrative perspective, the AEDB was essentially tasked with the similar functions as that of PPIB's, except that its scope is limited to development of ARE projects, resulting in duplication of functions, resources and efforts. Therefore, it has been decided by the Government that the mandate of AEDB may be brought back to the fold of the PPIB by merging AEDB with PPIB. This will also dovetail with the Competitive Trading Bilateral Contract Market (CTBCM) which envisions an Independent Auction Agent (IAA) that will be assigned the task of conducting the auctions/biddings on behalf of DISCOs; where PPIB as single entity will act as IAA. In this regard, after due process, the Private Power Infrastructure Board (Amendment) Bill 2022 has been introduced in the National Assembly on 21st January 2022.

Short Term Targets

In line with the Government priorities, PPIB is targeting to continue prioritizing indigenous and renewable-resource based generation of power and is processing a portfolio which is largely dominated by hydro and Thar-coal based generation. Since majority of pipeline power generation projects are at advance stages, they require attention for accomplishing critical milestones. Accordingly, PPIB's is focusing on handling upcoming IPPs efficiently. The central focus of PPIB is the timely completion of these projects. In this regard, PPIB is targeting to complete eleven IPPs of around 6,000 MW mostly based on hydro and Thar coal based electric power plants during 2022-24. Summary is given in table 14.9.

Table 14.9: PPIBs Upcoming IPP Electricity Generation Projects (MW)

Year	Hydro	Thar Coal	Imported Coal	RLNG	Total
2022	720	2,640*	-	1,263	4,623
2023	7.08	-	-	-	7.08
2024	892	330	-	-	1,222
Grand Total	1,619	2,970	-	1,263	5,852

* includes 660 MW Lucky Electric Project which has achieved COD with effect from 21st March 2022

Note: Due to the COVID-19 Pandemic, the scheduled dates of the commissioning of some projects may be slightly revised.

Source: Private Power and Infrastructure Board

Other Future Plans of PPIB

- In the backdrop of AEDB-PPIB merger, the mandate of PPIB is going to be expanded in the near future, as a result, power generation projects based on all fuels/technologies (except nuclear) would be processed by a single entity i.e. PPIB. In this regard, the gigantic target would be to add 37,339 MW of renewable energy projects (Wind, Solar, Bagasse and Hydro) by 2030.
- In near future, PPIB would be playing a critical role as Independent Auction Administrator (IAA) under Competitive Trading Bilateral Contract Market (CTBCM)

of the Government for turning the existing market from single buyer model to a Competitive Wholesale Power Market.

- ◉ PPIB is aiming to undertake small hydropower projects under Tripartite Letter of Support (TLOS) regime so that share of clean and green electricity is increased in the overall energy-mix of country.
- ◉ For overcoming transmission constraints, PPIB is planning to undertake additional transmission line projects in the private sector to make this segment reliable and efficient.

For the first time, comprehensive planning has been carried out in Pakistan in the form of the Indicative Generation Capacity Expansion Plan (IGCEP), which includes expansion planning studies which is updated annually in order to retain accuracy in the wake of changing dynamics. PPIB is planning to process new hydro-based IPPs under International Competitive Bidding (ICB) mode in accordance with the findings of IGCEP study so that there is no situation of deficit or excess generation in the country.

Renewable Sector

The GoP is striving hard to embrace the transformational changes in power system. AEDB is taking steps to ensure affordability, sustainability, energy security and energy access for all. Government is taking initiatives for the promotion of alternative and renewable technologies and emphasizing on utilization of indigenous and environmentally clean energy generation resources.

Development of IPP Based Projects

In compliance of the Cabinet Committee on Energy (CCoE), decision, Alternative Energy Development Board has actively been facilitating different projects. The development of large scale grid connected ARE based power generation project is being pursued through private investors. The objective of projects under the umbrella of ARE is to exploit clean energy resources and increase the share of ARE in the energy mix. In compliance of the CCoE's decisions, AEDB has actively been facilitating these projects. These projects are placed under different categories.

Category- I: Projects under this category are in the pipeline and significant work has been done on these projects. 19 projects of 531 MW that have already been issued LOS subject to revision of tariff in case tariff determination has been done since more than one year or if the tariff validity period has lapsed

Category- II: Four solar PV projects of 250 MW capacities, listed under Category-II of the CCoE decisions, achieved Financial Closing in 2021 and were facilitated to carry out the construction of the projects. Six wind power projects of 300 MW capacity achieved Commercial Operation Date and started supplying electricity to the national grid. Another six wind power projects of 310 MW capacity were under construction and expected to achieve COD by April, 2022.

Category- III: AEDB prepared the Request For Proposal (RFP) package for carrying out competitive bidding for wind and solar projects falling under category-III and carried

out the revisions in the RFP documents as per the determination of NEPRA. RFP Packages are ready to be floated upon receipt of information pertaining to Interconnection Ready Zones (IRZs) by NTDC/DISCOs. The competitive bidding is planned to be initiated by June/July 2022.

Distributed Generation (Net Metering)

Apart from large scale renewable projects, Government is also encouraging utilization of renewable energy technology at consumer ends across domestic, commercial, industrial sectors. AEDB has been promoting the renewable energy based net-metering deployments under the NEPRA (Alternative & Renewable Energy) Distributed Generation and Net Metering Regulations, 2015.

AEDB has also been carrying certification of service providers, vendors and installers of solar systems under AEDB (Certification) Regulations, 2018 in order to facilitate the consumers and DISCOs. The regulations were revised in August, 2021 with the aim of simplification under Government's vision of 'Ease of Doing Business'. AEDB issued certificates to one hundred one installers during July-Mar FY2022. As of March, 2022, the total number of active AEDB certified installers reached up to one hundred sixty two compare to 104 last year which shows an increase of 55 percent.

During July-Mar FY2022, a total of 10,783 net metering based systems of 196.77 MW capacity were installed by different segments of consumers. As of 31st December, 2021, the number of net-metering based solar installations had reached up to 17,950 with a cumulative capacity of 305.79 MW.

Major Activities to be Undertaken in Short-term

- i. Facilitating remaining projects under Cat-I and Cat-II of the CCoE's decision in achievement of their Financial Closing.
- ii. Carry out competitive bidding for wind and solar power projects falling under Category-III of the CCoE decision, planned to be initiated by June/July 2022.
- iii. Preparation of Annual ARE Procurement Plan by the AEDB Board's Steering Committee on the basis of approved IGCEP.
- iv. Development of RFP package for carrying out competitive bidding in accordance with the approved Annual ARE Procurement Plan.
- v. Initiation of competitive bidding process for procurement of new ARE capacity under the ARE Policy 2019 by end of 2022.

Other Initiatives in FY2022

Additional measures to promote ARE technologies and to attract private sector investments are taken. The supportive measures taken by AEDB are as follows:

- i. AEDB proactively engaged with WB for carrying out the Pakistan Renewable Energy Competitive Bidding Study that will provide strategic analysis and advice to the AEDB and other relevant sector agencies on the implementation of competitive

- bidding for the contracting of renewable energy capacity to achieve the 2025 and 2030 targets in line with the ARE Policy 2019.
- ii. Carried out revision of AEDB (Certification) Regulations aimed to simplify the procedures laid therein in order to ensure the implement the present Government's policy of Ease of Doing Business.
 - iii. AEDB promoted the net metering concept and facilitated the concerned stakeholders in implementation Net Metering systems under NEPRA's regulations. For mass deployment of net metering-based systems, several supportive steps have been taken including simplifying the process of acquiring generation license and other approvals/ permissions and shortening the time period required for the same.
 - iv. Developed the Request for Proposal (RFP) package after stakeholder consultation for carrying out competitive bidding amongst pipeline wind and solar projects are per the decisions of the CCoE.
 - v. AEDB assisted State Bank of Pakistan in revision of SBP's Financing Scheme for Renewable Energy in order to make financing available for broader consumer categories and swift implementation.
 - vi. Assisted NTDC in carrying out the feasibility study of solar water pumping in Balochistan.
 - vii. Supported Government of Balochistan in preparation of PC-IIIs for renewable energy based off-grid electrification projects in districts of southern Balochistan.

Concluding Remarks

Historically, Pakistan's economic growth is constrained by bottlenecks in the energy sector. Pakistan's energy requirements are increasing and demand for energy in the coming decades will rise substantially. Energy demand on this scale will put increasing pressure on energy resources and distribution networks. This is unsustainable without a fundamental transformation of the energy system. Dependency on the dominant fossil energy resources, especially oil is risky. Energy security is essential because the kind of disruption we have seen is a potential threat to our economic well-being. Exploration of the more indigenous and renewable resources is key to have energy security.

The Government has been endeavoring to bring in transformational changes in power system by exploring alternate sources of energy in the country. Government is also focusing on the renewable sources of energy to make access to energy affordable. The exploration of alternate and renewable sources of energy will also help to ensure energy security and sustainability. In this connection, Pakistan is actively following the policy of a shift from conventional sources of energy to the utilization of indigenous renewable and environment friendly clean energy generation resources. There is a significant transformation and the contribution of alternate and renewable sources of energy is increasing.