ADB TA 8727 REG

CAREC: Study for Power Sector Financing Road Map

Mobilizing Financing for Priority Projects

Pakistan

September 2016

pwc

CAREC

List of Abbreviations

ADB	Asian Development Bank
ADO	Asian Development Outlook
CAREC	Central Asia Regional Economic Cooperation
CASA	Central Asia South Asia
CHP	Combined Heat and Power
CPEC	China Pakistan Economic Corridor
CPPA	Central Power Purchasing Agency
EWP	Energy Work Plan
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GWh	Gigawatt Hour
HPP	Hydro Power Plant
IEA	International Energy Agency
IEP	Integrated Energy Plan
IFC	International Finance Corporation
IPA	Investment Promotion Agency
IPO	Initial Public Offering
KESC	Karachi Electric Supply Corporation
kWh	Kilowatt-hour
MMCFD	Million standard cubic feet per day
MTDS	Medium Term Debt Strategy
MW	Mega Watt
NEPRA	National Electric Power Regulatory Authority
NTDC	National Transmission & Dispatch Company
OGDCL	Oil and Gas Development Company Limited
PEPCO	Pakistan Electric Power Company
PPPs	Public Private Partnerships
T&D	Transmission & Distribution
TA	Technical Assistance
TAPI	Turkmenistan-Afghanistan-Pakistan-India
TPP	Thermal Power Plant
TWh	Terawatt-hours
UHV	Ultra-High voltage
USAID	United States Agency for International Development
USD	United States Dollar
WAPDA	Water & Power Development Authority

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1. National power sector overview

The Electricity sector in Pakistan has witnessed several reforms post-independence and the regulatory landscape has since been evolving over the years. The major changes in the sector started after creation of WAPDA and KESC in 1950s. In this section, we have provided a brief description of the companies/ agencies involved in the sector, including their roles and ownership structure. Further, we have discussed the historical electricity supply and demand situation in the country along with a description of the regulatory landscape and institutions involved in regulating the sector.

1.1. Industry structure and institutional arrangements

Before it's restructuring in 1998, the power industry of Pakistan consisted of two vertically state owned power utilities. The Water & Power Development Authority (WAPDA) controlled all electricity related functions in entire Pakistan except Karachi, which was under Karachi Electric Supply Corporation (KESC).

Subsequent to the approval of the Strategic Plan for Pakistan Power Sector Reform by the Government of Pakistan (GoP), there was unbundling of WAPDA's power wing into separate companies for power generation, transmission and distribution of power across Pakistan. The unbundling of WAPDA into separate G, T & D functions led to the creation of:

- Four Thermal Generation Companies (GENCOs),
- One Transmission (& Dispatch) Company, and
- Ten Distribution Companies (DISCOMs) all under State control.

In order to co-ordinate the functions of the unbundled entities & strengthen the organisational set-up, Pakistan Electric Power Company (PEPCO) was formed in 1998. The responsibility of thermal power management of the four GENCOs & the DISCOMs was given to PEPCO. The National Electric Power Regulatory Authority (NEPRA) was created as the energy regulator. Subsequently in 2007, WAPDA was made responsible for hydro power generation & development in the country.

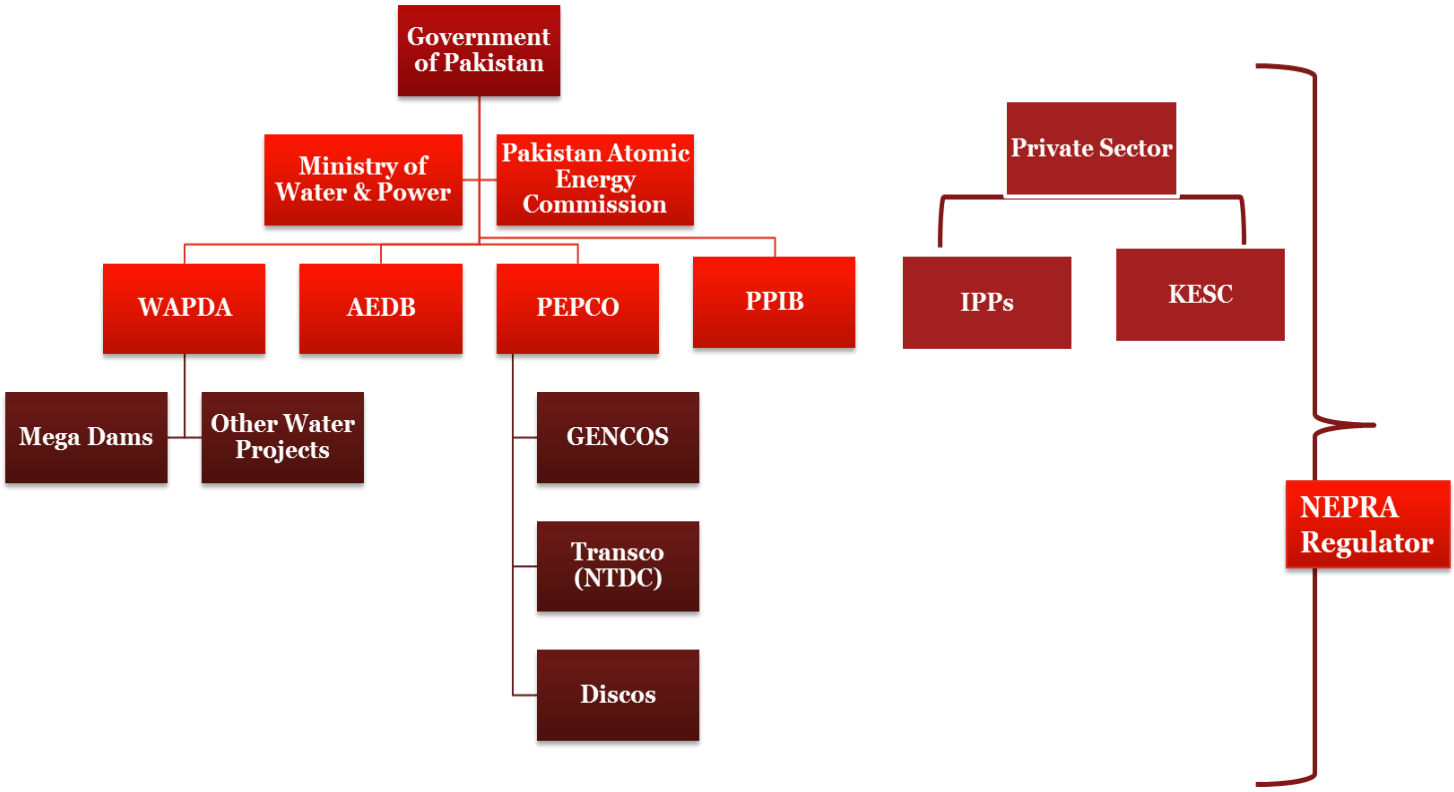
The National Transmission & Dispatch Company (NTDC) is a public limited company with majority government ownership and is tasked with the duties of transmission, dispatch & system operator (SO) functions. Prior to April 2015, the NTDC also used to play the role of Central Power Purchasing Agency (CPPA) for procurement of power from GENCOS, Hydel & Independent Power Producers (IPPs) on behalf of DISCOMs.

Recently, the Ministry of Water & Power separated CPPA from NTDC and formed an independent agency called CPPA-G (also market operator) where G stands for guarantee. The Board of Directors of the CPPA (G) consists of representatives from open market, GENCOs, DISCOMS and Finance and Water and Power Ministries.

In May 2008, Abraaj Capital acquired a 50% stake with management control in KESC. This marked the beginning of privatisation of the government-owned power utilities in Pakistan. Other government-owned GENCOs had also been opened for the private sector but mostly remained unattractive for investments because of operational inefficiencies.

The Private Power & Infrastructure Board (PPIB) was established in 1994 to provide a one-window facility for implementation of projects above 50 MW capacity while the respective provinces would be responsible for projects below 50 MW.

The figure below shows the existing structure of the power sector in Pakistan:



1.2. *Power supply and demand*

Pakistan faces a severe power supply and demand gap that has continuously grown since 2006-07. Pakistan has been unsuccessful in meeting the ever increasing demand for energy due to overreliance on fossil fuels for power generation which has in turn been exacerbated by inefficient use of indigenous resources like coal and hydro due to insufficient technological advancement, leading to a skewed power generation mix.

The fallout of this enormous demand supply gap has led to load-shedding for almost 14 hours[1] a day across some parts of the country. Moreover, capacity additions have also not been able to keep pace with the burgeoning energy demand in the country. The shortage of energy and its related problems have continued to impede Pakistan's economic growth prospects severely given the country's underdeveloped, inefficient and poorly managed power sector infrastructure.

1.2.1. *Power supply*

Power Generation Mix: Power sector of Pakistan is mainly governed by PEPCO, a governing body looking after WAPDA, GENCOs and DISCOMs. Currently there are four GENCOs apart from KESC, which are privately owned entities responsible for power generation in Karachi. The four GENCOs are:

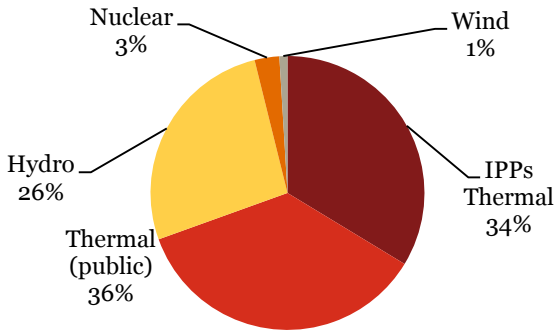
- Jamshoro Power Company Limited,
- Central Power Generation Company Limited,

[1] Dawn News Article (http://www.dawn.com/news/1118183)

- Northern Power Generation Company Limited, and
- Lakhra Power Generation Company Limited.

The total installed capacity of Pakistan in FY 14-15 (year ended June'15) was 24,962 MW. Between FY 2012 and 2015, around 1,739 MW of capacity was added with significant increase in capacity of IPPs and also increase of around 250 MW of wind power capacity.[2]

Power Generation by Fuel-Type (2014-15)
Source:NTDC Statistics



Power generation mix of Pakistan for FY 2014-15 shows that the generation is highly dependent on thermal (70%) followed by hydro (26%), nuclear (3%) and wind (1%). Approximately, USD 14.5 Billion worth of oil is imported each year, most of which is used for electricity generation. Higher dependency on fuel oil for electricity generation has resulted in fuel crisis and increased power supply cost. Due to inefficient utilisation of domestic resources and the focus on reducing energy imports, the need for leveraging the indigenous cheaper hydro power has gained more importance. Pakistan has hydropower potential of more than 60,000 MW[3] but less than 13% of the total hydropower potential has been harnessed till now.

Pakistan's power generation includes significant participation from IPPs which account for almost 9,298 MW of Thermal and Hydro power capacity of the total installed capacity of 24,906 MW during 2014-15. The table below captures the installed power capacity over the years for public players vis-à-vis IPPs. A list of power plants for Pakistan is provided in the **Appendix A** of this report.

Installed Capacity in Pakistan over the years (MW)

Fiscal Year ended June,30	2010	2011	2012	2013	2014	2015
WAPDA Hydro	6,444	6,516	6,516	6,733	6,902	6,902
Thermal (Public)	6,784	6,650	7,222	7,182	7,880	7,663
IPP Hydro	111	111	111	195	195	213
IPP (Thermal)	7,456	9,103	8,666	8,670	9,021	9,085
Nuclear (PAEC)	462	787	787	787	787	787
Wind	0	0	0	50	106	256
Total	21,257	23,167	23,302	23,617	24,891	24,906

Source: NTDC Power Statistics report 2014-15 (all figures for year ended June 30)

[2] NTDC Power Statistics report 2014-15
[3] PPIB Report (http://www.ppib.gov.pk/HYDRO.pdf)

Ineffective utilisation of resources for power generation and shift in generation mix

Pakistan's power generation has seen a significant shift since the 1980s when hydropower accounted for almost 70% of the total power generation to a dominant thermal based generation mix with (~70%) as of 2014-15[4].

Pakistan's electricity generation is highly dependent on imported oil as almost USD 14.5 Billion (as of FY 13)[5] worth of oil is imported annually; the major portion of which is used for electricity generation. The shift from hydro to thermal based generation, and more recently from natural gas to fuel oil as the primary fuel for electricity generation have caused fuel crisis in Pakistan's power sector. Further, these trends have contributed to an increase in power supply costs.

Shift in Power Generation Mix in Pakistan

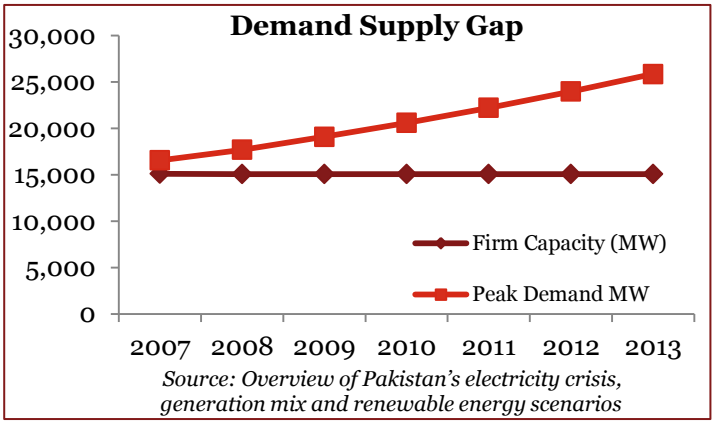
Oil's share in electricity generation has grown since the 1990s, while the share of hydroelectric sources has largely remained stagnant; HPPs generate electricity at around 20-25% of the cost of generation from other fuels but entail significant upfront capital costs compared to oil or coal; While hydropower is the cheapest source of electricity for Pakistan, mobilising the finacing for such projects is a major challenge.	While Pakistan has a hydro potential of about 60,000 MW (approx.), only 7,185 MW has been harnessed so far; The share of hydro power is 26% of total generation in 2014-15 as compared to nearly 70% in the 1980s.	Thermal power was relied upon for power generation since natural gas was abundant and also cheaper than oil; Depletion of indigenous gas (since 2005, gas production has remained stagnanat at 4,000 MMFCD) has resulted in increased usage of expensive furnace oil and high speed diesel in electricity generation. This has adversely impacted affordability of power in due course; Overreliance on imported oil is exerting a strain on the balance of payments besides making the energy mix unfavorable.

Power Imports: Currently, Pakistan is importing about 74-100 MW of power from Iran for its border areas that face severe power shortages. Iran and Pakistan are considering another two projects which involve import of 1,000 MW and 100 MW of power respectively to Pakistan.

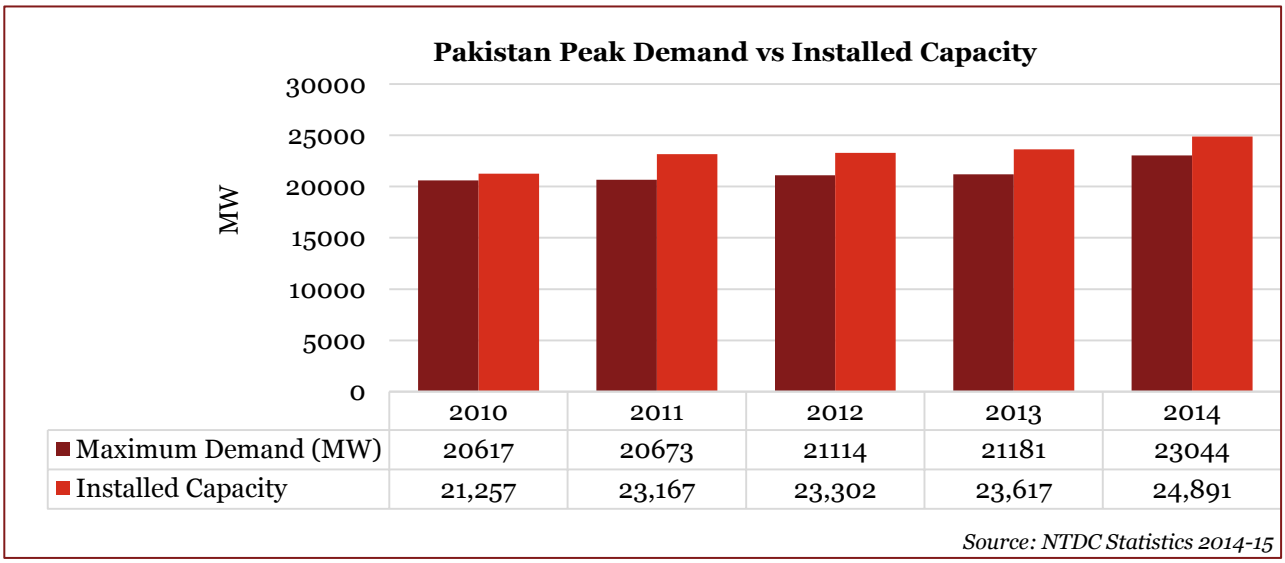
[4] "The share of hydel power in total power generation of Pakistan was nearly 70% in 1970s which has now been reduced to 32%"~Dunyanews article
[5] Period when oil prices stayed in the upper $90 levels per barrel

1.2.2. *Power demand*

Electricity peak demand in Pakistan has grown at the rate of 7.8% from 2007-2013. Although the demand has experienced a very high growth rate, energy consumption has reduced since 2007-08 due to supply constraints. Pakistan is experiencing an acute energy crisis at this moment due to lingering losses and underinvestment in power generation which is exacerbated by inefficient management of indigenous coal and hydro based resources. The deficit has exceeded 7,000 MW or about one-third of peak demand during July 2015. The country also faces a growing shortage of natural gas.



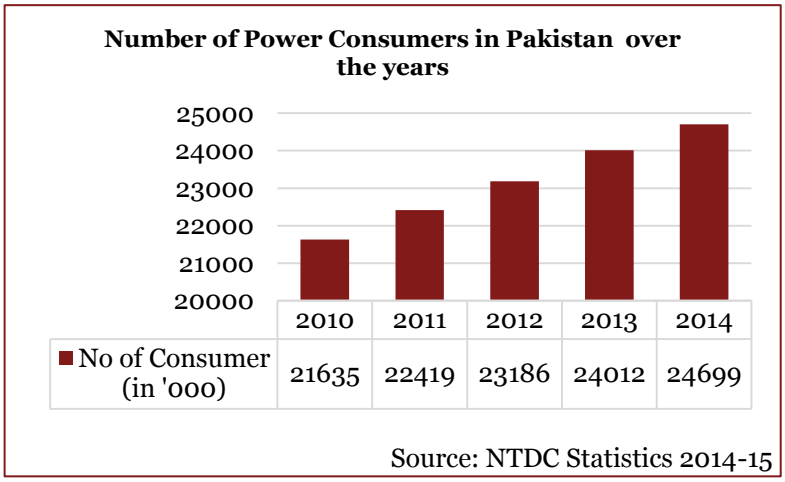
Source: Overview of Pakistan's electricity crisis, generation mix and renewable energy scenarios



	2010	2011	2012	2013	2014
Maximum Demand (MW)	20617	20673	21114	21181	23044
Installed Capacity	21,257	23,167	23,302	23,617	24,891

Source: NTDC Statistics 2014-15

While the chart above shows that the installed capacity in Pakistan is slightly higher than the demand, it is to be noted that the available capacity is much lower than the installed capacity. A major disconnect remains between the current installed capacity and actual generation. Fuel and financing shortages, physical plant maintenance needs, and other problems with generation constrained the supply availability and peak availability was only around 14,000 MW, or roughly 60% of installed capacity.



	2010	2011	2012	2013	2014
No of Consumer (in '000)	21635	22419	23186	24012	24699

Source: NTDC Statistics 2014-15

In 2005, Pakistan's economy started growing at a healthy rate, as GDP and per capita income rose by 8–9% annually from 2005 to 2008. During the same period, commercial energy consumption increased by about 8.4% annually with the highest

annual rates of increase in energy usage in the industrial and commercial sectors at 12.5% and 11.3% respectively.

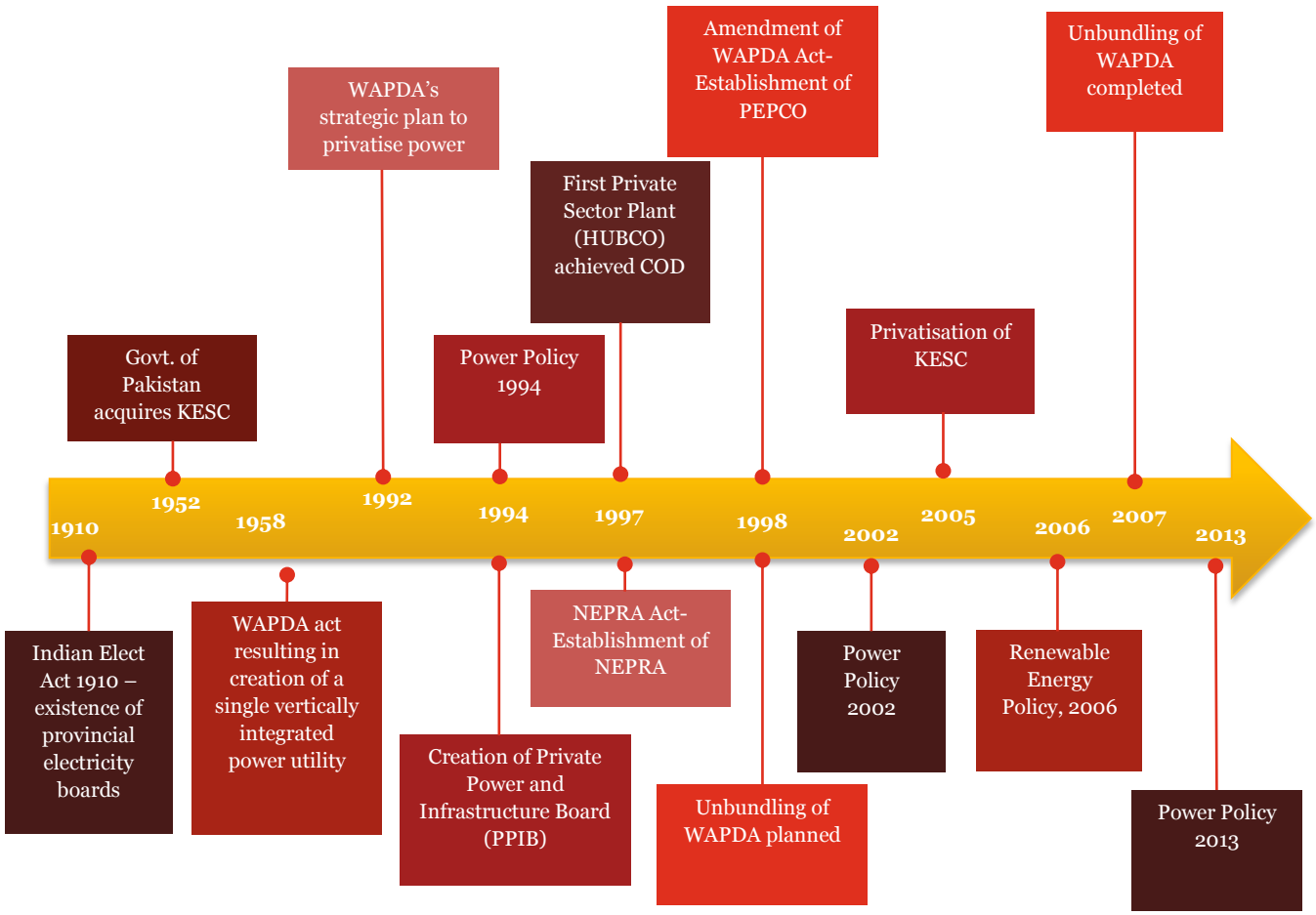
Between 2010 and 2014, annual energy consumption expanded by 2.3%. This slowdown was primarily due to supply constraints. Total annual energy use in the industrial and agricultural sectors declined by 3.2% and 3.9% respectively during 2007-2011 and these sectors have not experienced any significant increase in consumption between 2011 and 2014.

- It is noted that the demand for electricity far outstrips the current generation capacity leading to gaps of up to 4,500 – 5,500 MW. The demand-supply gap has continuously grown since 2008, and has led to load-shedding of 12-16 hours across some parts of the country.
- On an average, supply deficit of around 5,000 MW was experienced in 2014-15 and it touched the peak of over 7,000 MW in July 2015. (Overview of Pakistan's Energy Sector by World Bank-2015).

1.3. Sector regulation

Evolution of legal and regulatory landscape

The key regulatory milestones in the power sector have been represented in the schematic diagram below:



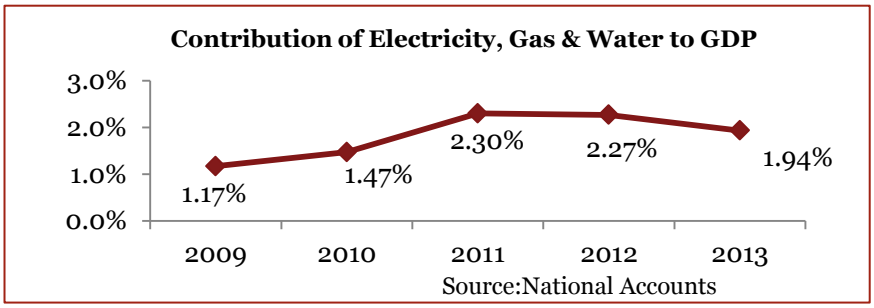
Post 1958, the electricity sector in Pakistan was dominated by two vertically integrated publicly owned utilities, WAPDA and KESC. As such, the sector was being owned, operated and regulated by the government only. Over a period of time, this structure resulted in inadequate generation capacity and poor transmission and distribution infrastructure. Due to heavy losses being faced by both WAPDA and KESC, the need for privatisation was felt and thus the government prepared the strategic plan for the privatisation of the power sector in the year 1992. It also approved the creation of an autonomous regulatory agency to introduce transparent and judicious economic regulation in the sector. Subsequently, NEPRA came into existence in December 1997. Till the year 1998, WAPDA controlled all electricity related technical functions and transactions in Pakistan except in Karachi which was under KESC. In the year 1998, WAPDA was further unbundled into nine distribution companies, four generating companies and one transmission company, all of them functioning under PEPCO.

2. Power sector development and investment plan

Macroeconomic imbalances, structural weaknesses, and concerns regarding security have negatively impacted Pakistan's economy and kept the country's growth below the threshold level needed to reduce poverty and absorb the unemployed labour force. Serious issues with electricity supply has been one of the key factors contributing to slow growth of the economy. The economy of Pakistan has also faced numerous challenges during last few years on account of BOP crises, energy shortfall, high fiscal deficit and high inflationary pressures.

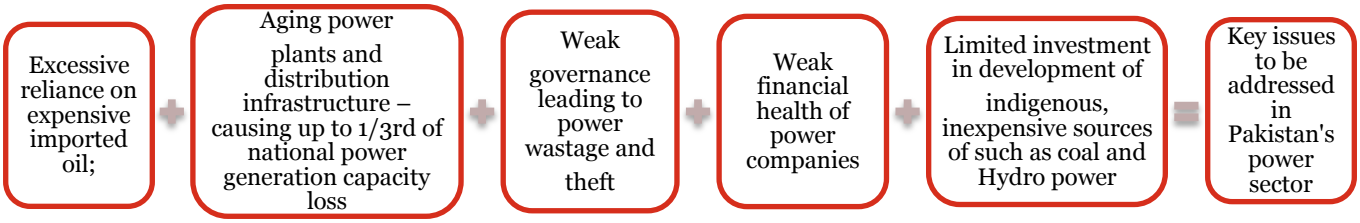
GDP growth (%) by sector (Source: ADB Asian Development Outlook)				
Year	GDP	Agriculture	Industry	Services
2009	0.4	3.5	-5.2	1.3
2010	2.6	0.2	3.4	3.2
2011	3.6	2.0	4.5	3.9
2012	3.8	3.6	2.5	4.4
2013	3.7	2.9	1.4	4.9
2014	4.0	2.7	4.5	4.4
2015	4.2	2.9	3.6	5.0

The contribution of electricity, gas and water to the overall GDP of Pakistan has varied from 1%-2%. The weak energy sector in Pakistan has been a major concern for development of economic activities. There have been several problems such as unreliable electricity supply, price distortions, insufficient collections, costly and poorly targeted subsidies, inadequate governance etc. which have impeded the development activities.



2.1. Objectives driving sector development

Pakistan faces significant shortfall in supply of energy. This shortfall has caused a massive negative impact both on societal as well as economic wellbeing with an estimated 4-7% loss to the country's GDP. The schematic below captures the key challenges that Pakistan's power sector currently faces:

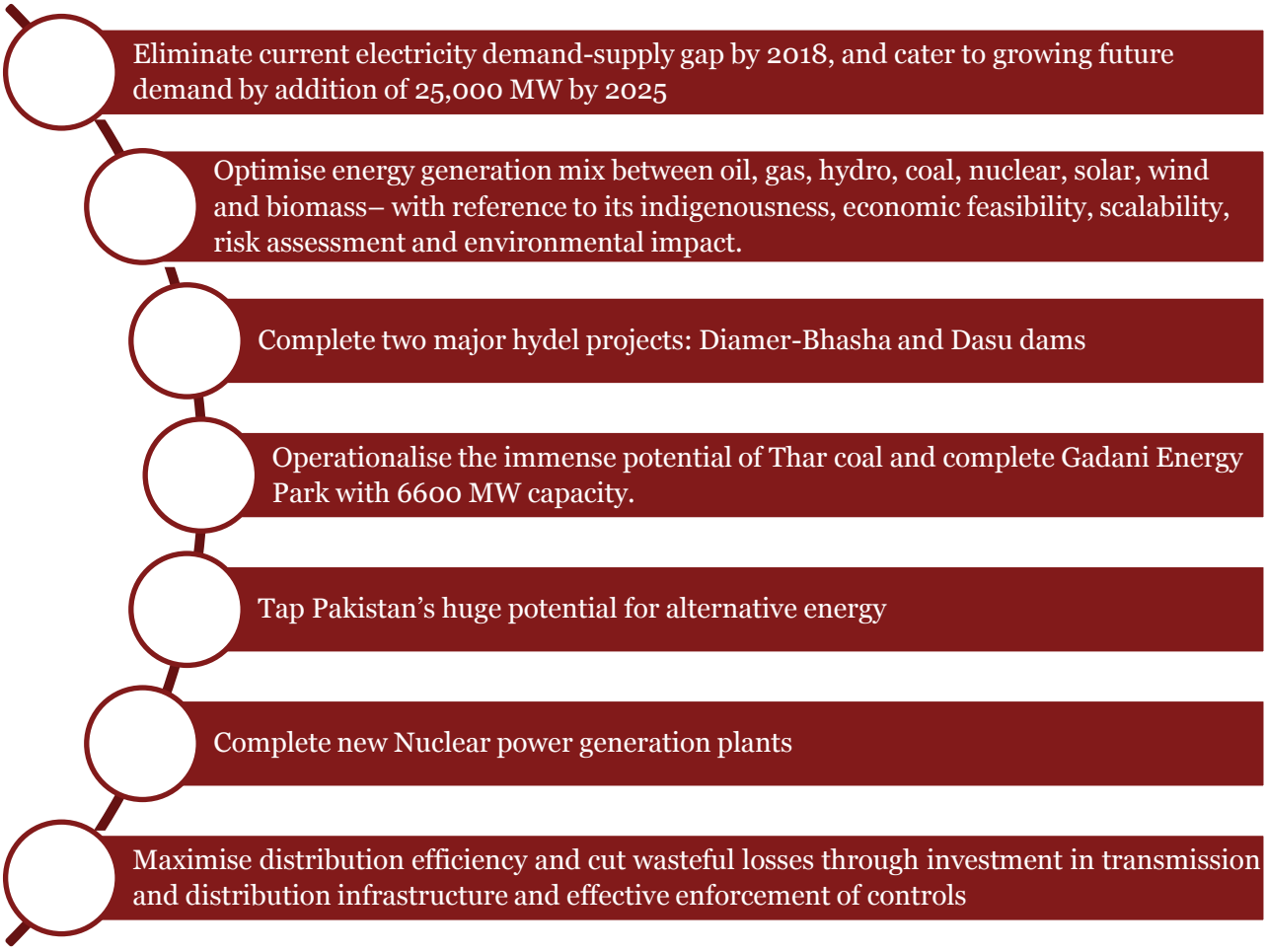


In view of the above challenges, the Government of Pakistan has outlined the Vision 2025 that aims to address the key issues being faced by the different sectors of the country including the energy sector. Pakistan Vision 2025 is designed to serve as a critical guide-post for the development of an effective strategy and road-map to

reach national goals and aspirations. The Vision is expected to be realised through strategies and programmes defined in associated five-year and annual plans.

Pakistan Vision 2025

Pakistan Vision 2025[6] lays down the foundation to meet the national objective of emerging as one of the top ten economies in the world by 2047. The action plan to implement Vision 2025 considers food and energy security amongst the key enablers to achieve this objective. The Vision 2025 aims at ensuring uninterrupted power supply for all sections of the population. It identifies the following goals:



Pakistan's Integrated Energy Plan (IEP), 2009-2022[7]

The key objectives for the power sector as envisaged in the IEP are as follows:

Power generation

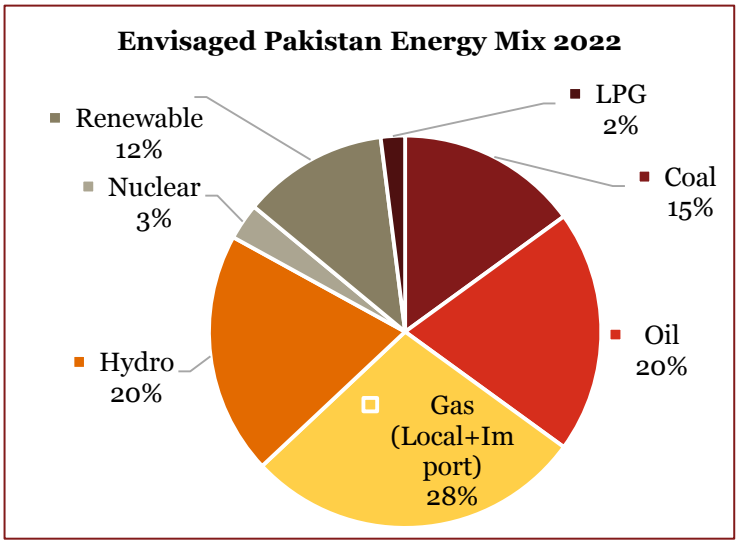
Coal based generation: Generate a minimum of 10,000 MW power from domestic coal by 2020 for base load plants through public & private partnerships.

[6] Pakistan Vision 2025 Document
[7] Source: Integrated Energy Plan 2009-2022-Report of the Energy Expert Group

Pakistan has added around 4,590 MW of new power generation capacity between 2010 and 2014. The table below captures the yearly new power generation capacity addition since 2010.

Installed Capacity Addition in Pakistan over the year (MW)					
Fiscal Year ended June,30	**2010**	**2011**	**2012**	**2013**	**2014**
New capacity addition	956	1,910	135	315	1274
Source: NTDC Power Statistics report 2014-15 (all figures for year ended June 30)					

The objective of this proposed plan is to aim for greater self-sufficiency and reduce dependence on imports by increasing the share of coal and renewable energy. The graph alongside represents the proposed energy mix if the plan is implemented by 2022.



Co-generation: Encourage and incentivise to sugar mills to install high pressure boilers to extract a potential of about 1,000 MW from bagasse during season.

LNG based power generation: Addition of 3,000 – 3,500 MW of generation based on imported gas/LNG in load centres for total capacity addition of about 9,000 MW until 2020.

Hydro: To achieve total hydropower installed capacity of 18,000 MW by 2022.

Alternative and Renewable Energy:

- Install 17,400 MW through wind/solar by 2022.
- Create an enabling environment for fast track power generation by improving the regulatory regime.

Power transmission

There is an urgent need to bring significant reduction in the high conversion and transmission losses of the power sector along with enforcement of energy conservation and efficiency measures in the transmission space. The power transmission and distribution system is crippled with losses of 23-25% due to poor infrastructure, mismanagement and theft of electricity.

The plan envisages to develop a transmission system which will facilitate power transmission efficiently from the new generating stations to the load centres in the middle of the country. The main outlay will be on the transmission system for transferring the power from large hydro power stations in the upper Indus and from coal-based & renewable energy stations in the south. This transmission system will be an integral component of the generation projects. Total capital outlay expected is USD 5-6 Bn.

2013 Power policy

In 2013, with the change in government, the Ministry of Water and Power of the Government of Pakistan developed an ambitious power policy to support the current and future energy needs of the country. Some of the key goals of the National Power Policy are outlined below:

- Seeks to eliminate the demand-supply gap by investing in new power generation capacity; It announced a plethora of ambitious projects to add more than 16,000 MW of new generation capacity by 2018.
- Reduce the cost of generation from the current US$0.12/kWh to below US$0.10;
- The policy also calls to improve the efficiency of the utilities and reduce the cost of power, in part by privatising the distribution .

Alignment of the power sector objective of Pakistan with the CAREC Energy Work Plan, 2016 – 2020

The table below provides a brief overview of alignment of Pakistan's power sectors goals and objectives with the CAREC EWP 2016-20.

No	Element of EWP	Objectives of Pakistan's IEP and Vision 2025 (Energy & Power sector)
1.	**Developing the East-Central Asia-South Asia Corridor**	• The IEP, 2009-2022 outlines the possible options that the Govt. of Pakistan may explore to improve the power supply situations through import from countries like Tajikistan and Iran. • The IEP envisages that approx. 1,000MW of power can be imported from Tajikistan to Pakistan in the first stage (from under construction Rogun & Sangtuda Projects). • The IEP stressed importance on the CASA project that will help Pakistan obtain additional power during the summer season from Tajikistan. • The Vision 2025 envisages energy sector cooperation in the region through Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipeline. The proposed 1,800 kilometre pipeline which will pass over from Turkmenistan to Afghanistan, Pakistan and India is expected to export up to 33 billion cubic meters of natural gas per year.
2.	**Promoting Regional Electricity Trade and Harmonization**	• The vision 2025 aims to leverage Pakistan's strategic location to serve as gateway to Central Asia and attain energy security by connecting to Central Asia. • The CASA project and the TAPI pipeline is expected to have a

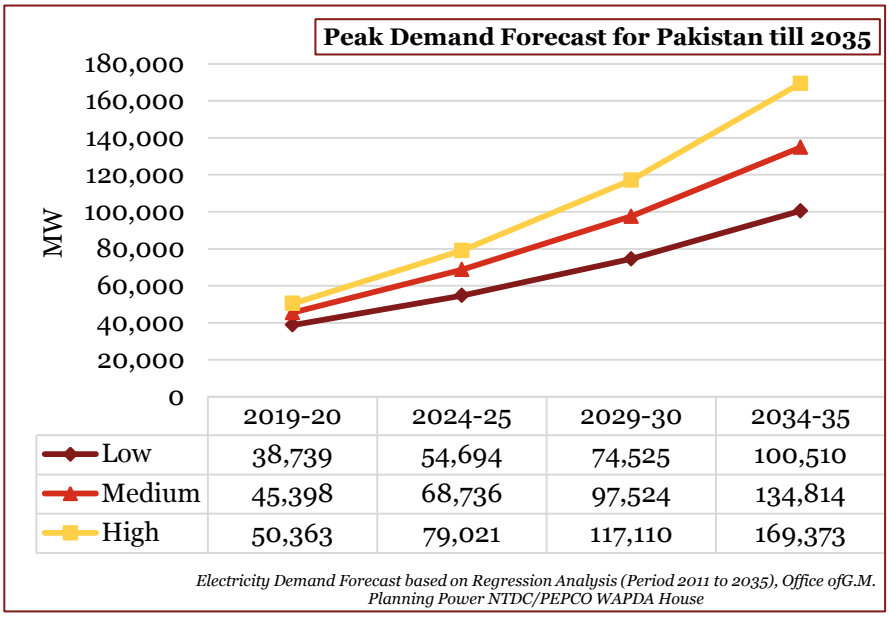
No	Element of EWP	Objectives of Pakistan's IEP and Vision 2025 (Energy & Power sector)
		cascading effect in promoting trade and improving relations in the region.
3.	**Managing Energy-Water Linkages**	-
4.	**Mobilising Financing for Priority Projects**	• The IEP and recommendations from various government agencies clearly recommend that the GOP should encourage the set-up of private/public partnership projects in the IPP sector, thereby speeding up funding. • Support from Multilateral funding agencies is also indicated to establish a Long Term Capital Fund for Fast Track power projects.
5.	**Implementation of Energy Sector Priority Projects.**	• The IEP lays out key power generation projects (thermal and hydro) that need to be implemented by 2022 to achieve the proposed targets.
6.	**Capacity Building and Knowledge Management**	• The IEP acknowledges that capacity building in all institutions is required in order to enhance national energy security. • The IEP acknowledges the need for organisational and human resource development for all government institutions followed by Policy formulation capability & strategic planning. Moreover, this also envisages enhancement of management of relationships between the different organisations and sectors (public, private and community). • It specifies that the Ministry of Petroleum & Natural Resources and Ministry of Water and Power should be part of a major capacity building programme.
7.	**Promoting and Prioritizing Clean Energy Technologies**	• The Vision 2025 plan envisages and plans to promote private sector investments in hydro and other renewable sources. • The IEP envisions that wind and solar will play an important role in Pakistan's power generation mix with approximately 12 percent of the total energy mix expected to come from Renewable Energy by 2022.

2.2. Projected supply and demand

Demand-supply gap shows an increasing trend till 2017 but is expected to reduce from 2018 due to planned construction of new power capacities. It is expected that in the short term, the available generation will usually be low due to unavailability of fuel and lower efficiency of plants. Hence to reduce demand supply gap, Pakistan will have to depend on power import from neighboring countries.The table below shows the Peak Demand vis à vis installed capacity from 2015 to 2018 while the chart captures the Peak demand forecast until 2035.

Peak demand vis-a-vis installed capacity (MW)				
Year	**2015**	**2016**	**2017**	**2018**
Peak Demand	32,130	35,485	38,360	41,747
Installed Capacity	25,034	26,256	28,866	39,420

Source: Pakistan economic survey 2013-14 & NTDC report on electricity demand forecast



	2019-20	2024-25	2029-30	2034-35
Low	38,739	54,694	74,525	100,510
Medium	45,398	68,736	97,524	134,814
High	50,363	79,021	117,110	169,373

Electricity Demand Forecast based on Regression Analysis (Period 2011 to 2035), Office ofG.M. Planning Power NTDC/PEPCO WAPDA House

It is envisaged that the annual growth rate for power demand will range between a minimum of 7.8% to a maximum of 9.6%. It is also envisaged that considering the future energy demands, the Government of Pakistan will work towards leveraging its own coal reserves for electricity production.

Currently, Pakistan is focussing on diversifying its power generation mix. According to estimates of the Oil and Gas Development Company Limited (OGDCL), Pakistan's indigenous oil reserves will be exhausted by 2025, and that Pakistan will run out of domestic sources of natural gas by 2030.This necessitates the need for diversification of the current fuel mix.Moreover, diversification of the generation mix also provides an important channel to reduce the power generation cost per unit.

Pakistan has a coal-based generation potential of 100,000 MW. However, the utilization of indigineous coal is quite low due to lack of modern technology and it is dependent on imported coal to meet its energy requirement. It is envisaged that the China-Pakistan Economic Corridor energy projects will serve as a backbone of the energy strategy to overcome power crisis in Pakistan by leveraging the indigenous resources such as coal and hydro.

Capacity additions under the 2013 Power Policy:

- The government's implementation of the power policy has been most visible in its plans to add new generating capacity through new projects. These include the construction of the 6,600 MW coal-fired Gad-ani Power Park, undertaken with financing from China and investors from the Middle East and due to be completed by 2018;
- A 1,000 MW solar power complex in southern Punjab and another 1,410 MW of new generation capacity at Tarbela;

- The government has also announced plans to add up to 8,000 MW of additional nuclear generating capacity by 2030, again with China's support. But it has released few public details of that programme. [8]

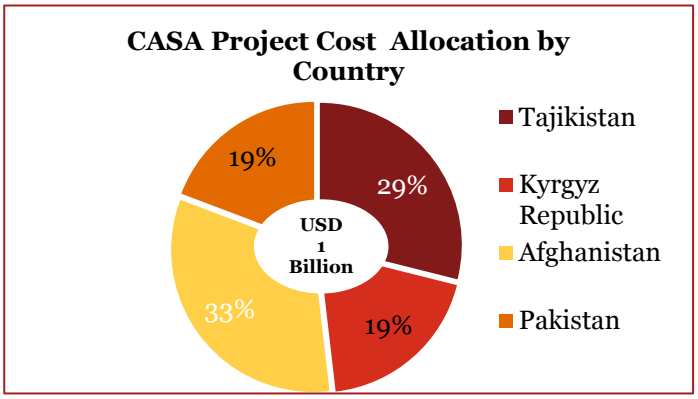
If realised in full potential, the government's slate of new generation projects will boost Pakistan's total installed capacity by nearly two-thirds above its existing levels. A major portion of this new capacity addition will be in the form of coal based power plants.

This diversity can reduce the sector's vulnerability due to unforeseen events, though the final selection of projects must include rigorous analysis to confirm that the projects are cost-effective investments for Pakistan. Ultimately however, the government's supply-side measures are unlikely to completely eliminate power shortages by 2018.

Central Asia-South Asia (CASA) Agreement[9]

The CASA-1000 electric power line project will supply electricity from Kyrgyz republic and Tajikistan to Afghanistan and Pakistan. The CASA-1000 agreement had been formalised in December 2014.

The CASA transmission line is expected to be routed from Datka, Kyrgyz Republic and through Tajikistan and Afghanistan before terminating in Peshawar, Pakistan[10]. The line will allow Tajikistan to sell surplus electricity in the summer to Afghanistan and Pakistan. The chart provided below shows the proposed cost allocation for the CASA project across the four countries.



The CASA-1000 project with total estimated cost of USD 1 Billion will facilitate supply of 1,300 MW of existing summertime hydropower surplus from Kyrgyz Republic and Tajikistan in Central Asia to Afghanistan and Pakistan in South Asia. Tajikistan along with Kyrgyz republic possesses hydropower which is environment friendly and at the same time less expensive. Afghanistan and Pakistan have demand for electricity in the summer for industrial production so as to avoid the closure of small businesses and consequent job cuts. When complete, the full CASA-1000 transmission lines will transmit electricity at high voltages between the Kyrgyz Republic and Tajikistan for the first 477 kilometres and from Tajikistan towards Afghanistan and Pakistan for the next 750 kilometres).

Tajikistan plans to sell power to Pakistan from its Roghun Hydropower project. An estimated 1,000 million USD is still required to fund the CASA-1000 project. This project will provide cheapest power of around 5 cents / unit

Currently, Pakistan has a number of electricity agreements with countries like India, China, Iran and Tajikistan. But in this context, CASA-1000 project will be of importance which will help Pakistan to import power from countries like Tajikistan & Kyrgyz Republic. Initially, Pakistan can trade 1,000 MW of power which can be increased to 4,000 MW in future. The line will pass through Sangtuda (Tajikistan), Kabul (Afghanistan) and

[8] United States Institute Of Peace, Special Report- Pakistan's Power Crisis

[9] Participating countries of the CASA-1,000 MW power project have made a third-party access clause part of their agreement, which would allow other nations to use the transmission line and export electricity to Pakistan-The Express Tribune, PK

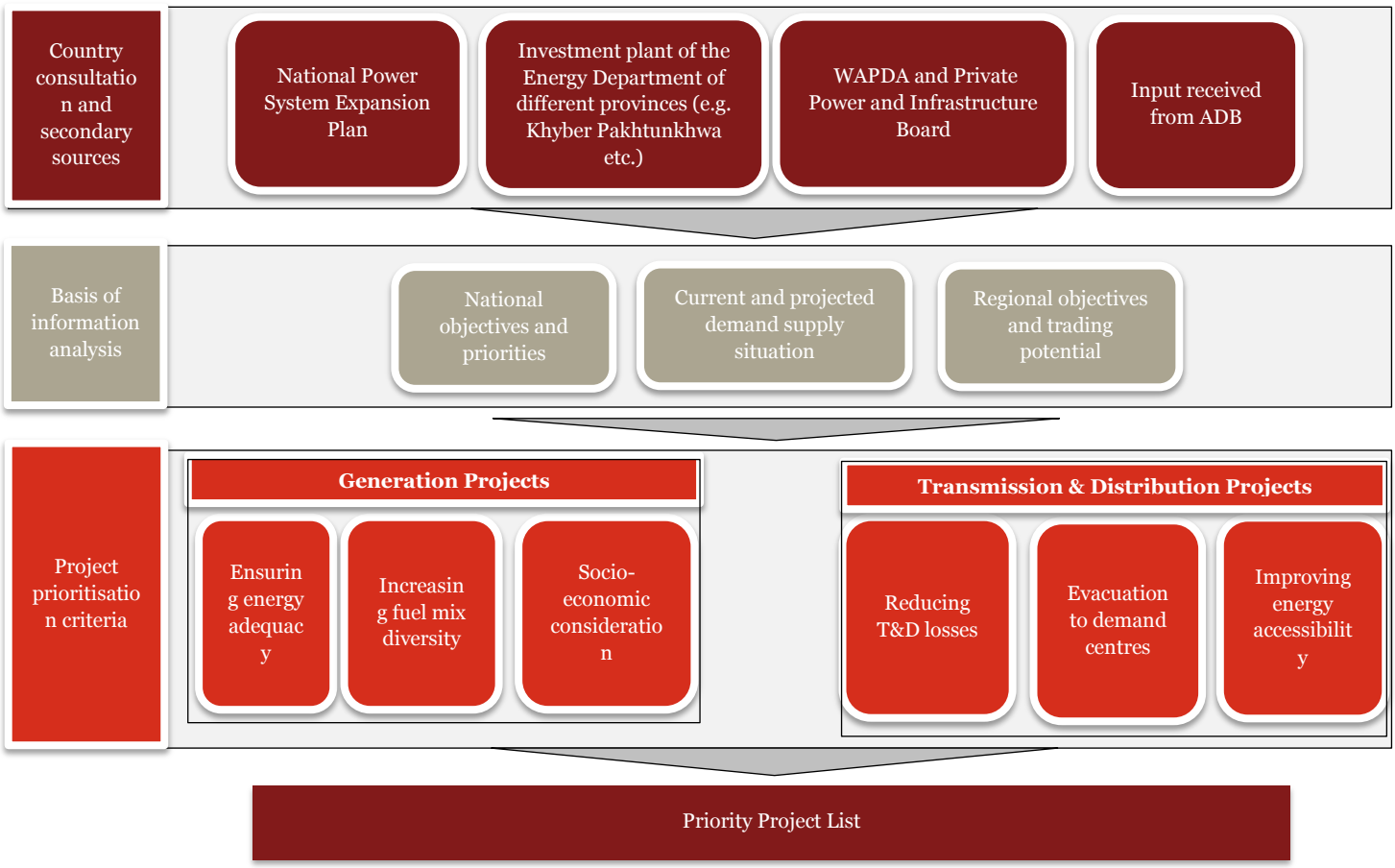
[10] Articles from Dawn, Tribune and World Bank

Peshawar (Pakistan). With the CASA-1000 project in place, Pakistan will be able to import cheaper hydroelectricity from hydro-rich countries like Tajikistan and Kyrgyz Republic during summer and whenever they have surplus thermal power, they can export it to these countries. This will help in diversifying the energy mix and reducing the cost of electricity. The supply of cheap electricity to Pakistan through CASA-1000 is expected to start from 2018 according to the announcements by the Tajik ambassador to Pakistan in February 2016. Tajikistan has already started upgrading its hydel power stations, which will be completed well before 2018.

In 2015, China offered to export 4,000 MW of electricity to Pakistan. The government has already announced to add 10,400 MW to the national grid with the help of China by 2017 under early harvest projects. Under the early harvest programme, Pakistan and China have made substantial progress for installation of three coal-based power plants to generate 3,300MW of electricity.

2.3. Approach and key considerations for project prioritisation

Based on assessment of the current and targeted macroeconomic status of the sector, we have framed our approach to prioritise projects based on the three key aspects as shown below:



An initial list of projects was identified from among the proposed projects outlined by state governments of Punjab, Sindh and Khyber Pakhtunkhwa, NTDC reports, the National Power Policy 2013, the Integrated Energy

Plan (2009-22), the Vision 2025 document and in consultation with ADB. A holistic view of the power sector was obtained to understand the key government priorities and thrust areas by taking into consideration the existing and forecasted demand-supply situation vis à vis the regional objectives. A consultative methodology for prioritising the projects, which included a mix of secondary research and inputs from our national consultants on a regular basis and subsequent analysis and review, have been followed to arrive at the list of priority projects.

Project Selection Criteria – Generation Projects

The schematic alongside represents the key criteria for selection of generation projects from the initial list developed. These criteria, along with rationale for selection, are further discussed in brief below.

Criteria	Overview
Ensuring energy security	Pakistan's current power generation mix is likely to lead to unprecedented dependency on energy imports. The power demand continues to outpace power generation by a huge margin. As of 204-15 the electricity generation was 15,500 MW against the demand of 21,000 MW.
Increasing fuel mix diversity	Pakistan's fuel mix has not been able to efficiently leverage the indigenous sources of energy such as coal, hydro and renewables. Depletion of indigenous gas has resulted in the increased usage of expensive furnace oil and high speed diesel oil in electricity generation and thereby adversely affecting power affordability. Hydro potential remains grossly underutilised due to controversies about proposed major dams. Disproportionate reliance on the imported oil which is nearly 85% of the total oil supply, is exerting a strain on the balance of payments besides making the energy mix unfavourable.
Socio-economic considerations	Overall project viability as well as socio-economic implications of the projects are major aspects for assessing the priority of projects.
Improving efficiency and limiting new investments	Most of the current thermal power plants are plagued by low conversion efficiencies and are expensive to maintain and operate. Most of the thermal power plants installed by IPPs use imported furnace oil which is very expensive.

Project Selection Criteria – Transmission Projects

The schematic alongside represents the key criteria for selection of transmission projects from the initial list developed. These criteria, along with rationale for selection, are further discussed in brief below.

Criteria	Overview
Reducing transmission losses	The current power transmission and distribution system with estimated losses of 23-25% due to poor infrastructure, mismanagement, and theft of electricity, is seen as current priority by the government. The National power policy envisages reduction in transmission and distribution losses from ~23-25% to ~16% by 2017.

Criteria	Overview
Evacuation to key demand centres	To address the key challenge of demand-supply imbalance, it is imperative that the main objective will be to lay transmission lines for transmitting power from large new HPPs on upper Indus and from coal-based & renewable generation facilities in the south.
Strengthening inter-country power transmission	Access to electricity, particularly in the far flung rural areas of the country, would require strengthening of the power transmission system which will allow wheeling of power across the other demand regions. Strengthening of 220KV rings around large cities to minimise losses and expand high voltage transmission lines further North.

2.4. List of priority projects and investment requirements

The list of generation, transmission and other key energy projects are presented in the tables below. It may be noted that the proposed time frame for commissioning of these projects is between 2017 and 2023:

List of Power Generation Projects

S. No.	Project	Brief Description and Benefits	Project selection criteria			Investment Requirement (USD Mn)
			Ensuring energy adequacy	Socio-economic considerations	Increasing fuel mix diversity	
1.	2 x 660 MW TPP at Bhikki (Sheikhupura)[11]	1320 MW imported coal based TPP to be developed by the Government of Punjab through public or private investment to address growing power demand and address energy security issues.	✓	✓	✓	1,500
2.	2 x 660 MW TPP at Haveli Bahadur Shah (Jhang)		✓	✓	✓	1,620
3.	2 x 660 MW TPP at Balloki (Kasur)		✓	✓	✓	1,620
4.	2 x 660 MW TPP at Trinda Saway (Rahim Yar Khan)[12]		✓	✓	✓	1,600

[11] Investment requirement for Project No. 1-3 is as per estimates from NEPRA
[12] Investment requirement for Project No.4 is based on inputs received from NTDC, PPIB and MoWP

S. No.	Project	Brief Description and Benefits	Project selection criteria			Investment Requirement (USD Mn)
			Ensuring energy adequacy	Socio-economic considerations	Increasing fuel mix diversity	
5.	2 x 660 MW TPP at Keti Bunder[13]	1,320 MW Imported/ Thar Coal based power project to be developed by Government of Sindh through a private partner on Build Own Operate (BOO) basis.	✓	✓	✓	1,300
6.	Daimer Bhasha HPP[14]	4,500 MW Diamer Bhasha HPP being developed by WAPDA would eliminate about half of Pakistan's power shortfall and irrigate millions of acres of parched farmland.	✓	✓	✓	14,000
7.	Shushgai /Zhendoli HPP[15]	144 MW HPP to be developed in Chitral district of Khyber Pakhtunkhwa to be developed through PPP mode.	✓	✓	✓	339

[13] Investment requirement for Project No.5 is based on inputs received from NTDC, PPIB and MoWP
[14] Investment requirement for Project No 6 is as per estimates from news articles (https://www.thenews.com.pk/print/15683-china-to-include-14-bn-diamer-bhasha-dam-in-cpec)
[15] Investment requirement for Project Np.7 is as per estimates from Khyber Pakhtunkhwa Board of Investment and Trade (KP BOIT)

S. No.	Project	Brief Description and Benefits	Project selection criteria			Investment Requirement (USD Mn)
			Ensuring energy adequacy	Socio-economic considerations	Increasing fuel mix diversity	
8.	Shogo-Sin Hydropower Project[16]	132 MW HPP to be developed in Chitral district of Khyber. Pakhtunkhwa to be developed through PPP mode.	✓	✓	✓	322
9.	Kaigah HPP[17]	548 MW HPP on the River Kandiah, near Village Karrang in Kohistan district of Khyber Pakhtunkhwa province. This project will help improve the D-S situation in the region.	✓	✓	✓	822
10.	Dudnial HPP[18]	Dudnial and Ashkot HPPs are planned by WAPDA with a total capacity of 1,760 MW in the northern region.	✓	✓	✓	960

[16] Investment requirement for Project No.8 as per estimates from Pakhtunkhwa Energy Development Organization (PEDO)
[17] Investment requirement for Project No.9 as per estimates from Private Power & Infrastructure Board/BOIT
[18] Investment requirement for Project No.10 and 11 calculated assuming a cost of USD 1.06 per MW

S. No.	Project	Brief Description and Benefits	Project selection criteria			Investment Requirement (USD Mn)
			Ensuring energy adequacy	Socio-economic considerations	Increasing fuel mix diversity	
11.	Ashkot HPP		✓	✓	✓	920
12.	ChakothiI Hattian[19]	500 MW HPP expected to be developed on a PPP basis.	✓	✓	✓	1,177
13.	Naran HPP[20]	180 MW HPP being developed by KPK will leverage the vast hydro resources in the region and improve energy security in Manshera.	✓	✓	✓	462
14.	Balakot HPP	300 MW HPP being developed by KPK will leverage the vast hydro resources in the region and improve energy security in Manshera.	✓	✓	✓	645

[19] Investment requirement for Project No. 12 as per estimates from PPIB
[20] Investment requirement for Project No.13 and 14 as per estimates from PEDO

S. No.	Project	Brief Description and Benefits	Project selection criteria			Investment Requirement (USD Mn)
			Ensuring energy adequacy	Socio-economic considerations	Increasing fuel mix diversity	
15.	Ghrait-Swir Lasht[21]	377 MW HPP being developed by KPK will leverage the vast hydro resources in the region and improve energy security in Chithral, will be developed through PPP mode.	✓	✓	✓	1,773
16.	Jamshill More Lasht	260 MW HPP being developed by KPK will leverage the vast hydro resources in the region and improve energy security in Chithral, will be developed through PPP mode.	✓	✓	✓	561
17.	Booni-Zzaith HPP	350 MW HPP being developed by KPK will leverage the vast hydro resources in the region and improve energy security in Chithral, will be developed through PPP mode.	✓	✓	✓	439
18.	Laspur-Murigram HPP[22]	230 MW HPP being developed by KPK will leverage the vast hydro resources in the region and improve energy security in Chithral, will be developed through PPP mode.	✓	✓	✓	525

[21] Investment requirement for Project No.14,15,16 and 17 as per estimates from PEDO
[22] Investment requirement for Project No.18 is based on inputs received from NTDC, PPIB and MoWP

S. No.	Project	Brief Description and Benefits	Project selection criteria			Investment Requirement (USD Mn)
			Ensuring energy adequacy	Socio-economic considerations	Increasing fuel mix diversity	
19.	Neelum Jhelum HPP[23]	Proposed 969 MW HPP project, involves diversion of Neelum waters through tunnels at Nauseri about 41 km upstream of Muzaffarabad and out falling in Jhelum River.	✓	✓	✓	3,975
20.	Golen Gol HPP[24]	Proposed 108 MW HPP being developed by KPK will leverage the vast hydro resources in the region and improve energy security in Chithral.	✓	✓	✓	271
21.	Tarbel 4th Exp	Proposed 1,410 MW HPP being developed by KPK will be developed in the Tehsil Ghazi, District Haripur, Khyber Pakhtunkhwa.	✓	✓	✓	1,800

[23] Investment cost for Project No.19 as per estimates from secondary sources (Link: http://www.researchviews.com/energy/power/hydro/DealReport.aspx?sector=Hydro&DealID=1076694)
[24] Investment cost for Project No.20 as per estimates from secondary sources (Link: https://www.thenews.com.pk/print/90456-CDWP-approves-18-projects-worth-Rs23-bn)

S. No.	Project	Brief Description and Benefits	Project selection criteria			Investment Requirement (USD Mn)
			Ensuring energy adequacy	Socio-economic considerations	Increasing fuel mix diversity	
22.	Kayal Khwar[25]	122 MW HPP located on Keyal Khwar, a right bank tributary of Indus River in Lower Kohistan District in Khyber Pakhtunkhwa and 310 Km from Islamabad.	✓	✓	✓	267
23.	Tarbel 5th Exp[26]	1,410 MW (Three Units 470 MW each) MW HPP being developed on Tarbela Dam (on Indus river), District Swabi, Khyber Pakhtunkhwa. Will ensure that load-shedding is substantially reduced.	✓	✓	✓	1,800
24.	Dasu (2nd Stage)[27]	2160 MW HPP second stage includes six (06) units with total installed capacity of 2,160 MW is a run-of-the-river project at the Indus River located 7 km upstream of Dasu Town, Kohistan, Khyber Pakhtunkhwa.	✓	✓	✓	1,800

[25] Investment requirement for Project No. 22 as per estimates from secondary sources (Source :Pakistan today news article)
[26] Investment requirement for Project No. 23 calculated assuming a construction cost of ~USD 1.27 per MW
[27] Investment requirement for Project No.24 is as per estimates from secondary sources (Link: http://www.dawn.com/news/1121658)

S. No.	Project	Brief Description and Benefits	Project selection criteria			Investment Requirement (USD Mn)
			Ensuring energy adequacy	Socio-economic considerations	Increasing fuel mix diversity	
25.	Suki Kinari[28]	Suki Kinari is an 870 MW Run-of-the-River hydro project located in Kaghan Valley, District Mansehra at a Distance of 265 Km from the Islamabad.	✓	✓	✓	1,800
26.	Kohala[29]	A proposed 1,100 run-of-the-river, high head project on the Jhelum river. The project will be developed on a build, own, operate and transfer (BOOT).	✓	✓	✓	2,400
27.	Chor Nullah HPP 660 MW district Kohistan[30]	Palas valley (Chor Nullah) is the left bank tributary of Indus River with its confluence 12 km upstream of Patan in Kohistan District, KPK.	✓	✓	✓	1,270

[28] Investment requirement for Project No.25,27 and 28 based on inputs from NTDC, PPIB and MoWP
[29] Investment requirement for Project No.26 as per estimates from secondary sources (Link: http://e.volinco.com/article/article_detail.aspx?article_id=133)
[30] Investment requirement for Project No.27 and 28 is based on inputs received from NTDC, PPIB and MoWP

S. No.	Project	Brief Description and Benefits	Project selection criteria			Investment Requirement (USD Mn)
			Ensuring energy adequacy	Socio-economic considerations	Increasing fuel mix diversity	
28.	Muzaffargarh Coal Power project in Punjab,1320 MW	Repairing and rehabilitating Muzaffargarh Thermal Power Station (MTPS) located in Punjab Province. Project aims to restore 475 MW of generation capacity, enough power to supply electricity to 4.4 million people.	✓	✓	✓	1,600
29.	Bata Kundi HPP [31]	Proposed 180 MW HPP is 17 Km upstream of Naran on the Kunhar River, a right bank tributary of Jhelum River.	✓	✓	✓	183

[31] Investment requirement for Project No.29 per estimates from PEDO

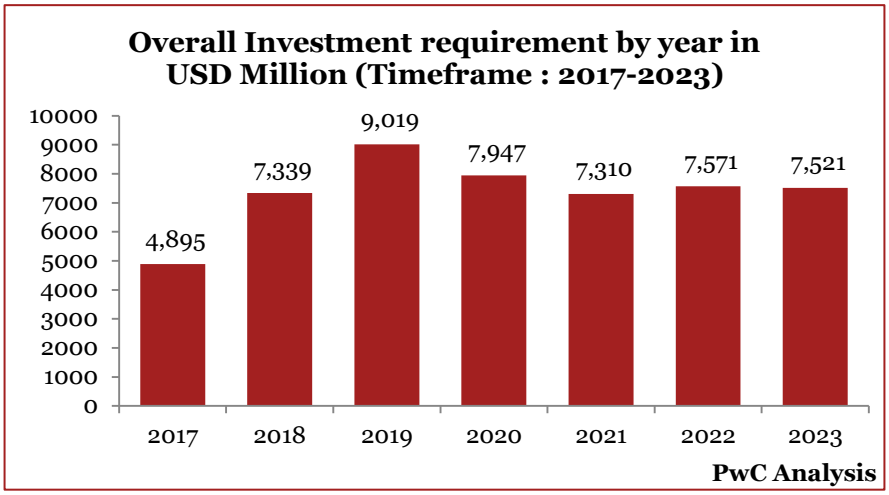
List of Transmission & Distribution Projects

No.	Project	Brief Description and Benefits	Project selection criteria			Investment Requirement (USD Mn)
			Reducing T&D losses	Evacuation to demand centers	Improving energy accessibility	
1	Dispersal of Power from 6600 MW Imported Coal Based Plants at Gadani	Evacuate power from the major power plants and transmit electricity from the south to load-centres in the north	-	✓	✓	2,300
2	Dispersal of Power From Diamer Bhasha Hydro Power Project (4500 MW)		-	✓	✓	2,000
3	Alliot Substation and Evacuation of associated HPPs	500 kV D/C T/L from Suki Kinari to Alliot (100 km) as well as Extension at Allot substation. Will help transmit power from HPPs in the region to other areas.	✓	✓	✓	200
4	Distribution System Investment Program	Various distribution improvement programs by DISCOMs	✓	✓	✓	3,280
5	Advanced Metering Projects	Advanced metering project being funded by ADB DISCOMs and other foreign borrowings	✓	-	✓	4,922

- Investment details for transmission Project No.1,2 and 3 are based on feedback received from MoWP
- Total Investment requirement for Project No.5 and No.6 is based on proposed future funding plans for the various DISCOMs (Source: NEPRA website) and PwC analysis.

Project implementation and year-wise investment requirement for the power generation & transmission projects

The proposed investment plan comprises of the generation, transmission & distribution projects with an estimated investment requirement of USD 60,452 million. We assume a project start-up year of 2017 and completion period of 7 years with a major portion of the required investment foreseen between the years 2017-2023. The chart alongside captures the estimated yearly investment requirement till 2023 for the selected projects assuming project start-up from 2017 onwards. Investment requirement between 2017 and 2023 is estimated at **USD 51,601 million** which is equal to **85%** of the total estimated investment plan for priority projects.



Assumptions:

- TPP Projects to commence construction in 2017 with a completion period of 7 years;
- HPP Projects to commence construction in 2017 with a completion period of 8 years;
- Mega HPP Projects such as Diamer Bhasha to commence construction in 2017 with a completion period of 10 years.

Investment phasing

Year	1	2	3	4	5	6	7	8	9	10
% of project cost (TPPs)	10%	20%	20%	16%	14%	10%	10%	-	-	-
% of project cost (HPPs)	10%	10%	15%	15%	12%	15%	13%	10%	-	-
% of project cost (MHPPs)	5%	10%	10%	10%	12%	12%	11%	10%	10%	10%

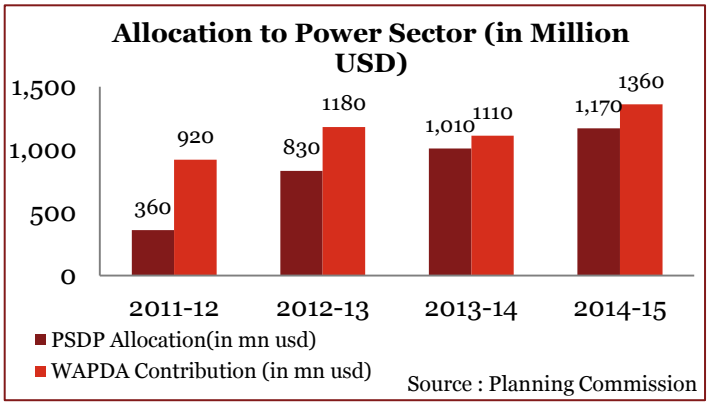
3. Options for funding and financing power sector investment plans

In line with the investment plan for Pakistan for 2017-2023, proposed funding from the National Government budget, other governments and assistance from Development Partners (ADB, World Bank and others) has been estimated and the funding gap determined. This gap needs to be filled up from other sources such as private investors, PPP etc. The following section describes the proposed funding from each source in details.

3.1. National government

Budgetary allocation for power sector

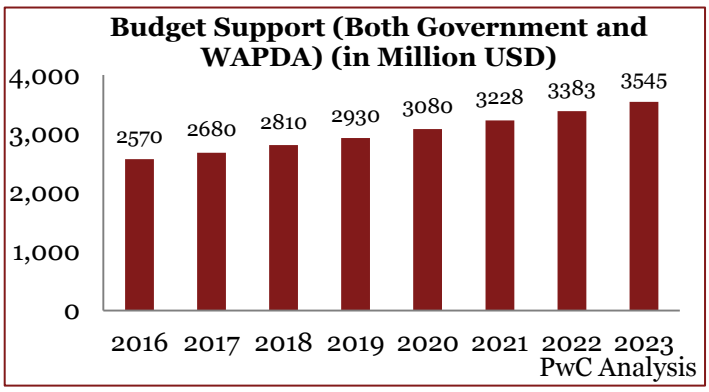
The economy of Pakistan has faced various challenges during the last few years which included balance of payment crises, energy shortage, high fiscal deficit and inflationary pressures. Structural reforms, particularly in the energy sector, are critical for strengthening of fiscal policies and effecting economic growth.



Degradation in the power sector has been one of the main constraints for growth and also a major reason for financial and economic instability of the country. Thus, the policy reforms and large investments in the power sector planned by the Government of Pakistan, targets to reduce load shedding, expand low-cost generation and supply, improve governance and cut losses.

Government budgetary support in the period of 2017-2023 is estimated at **USD 21,656 Million** (for capital projects) based on the following assumptions:

- Budget support assumed at 2% of the GDP based on the trend of last 4 years.
- Estimates include budget contribution and mobilisation of resources by WAPDA.
- Average GDP growth of 4.8% till 2023 (as per IMF projections till 2020).



It may also be noted that besides the funding towards power sector projects, the Government also provided subsidies amounting to **INR 292.3 Billion (USD 2.7 Billion)** for FY 2015.

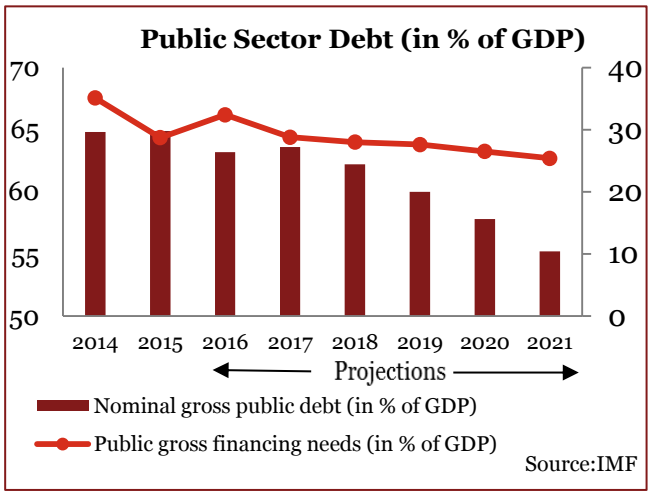
Government's ability to borrow

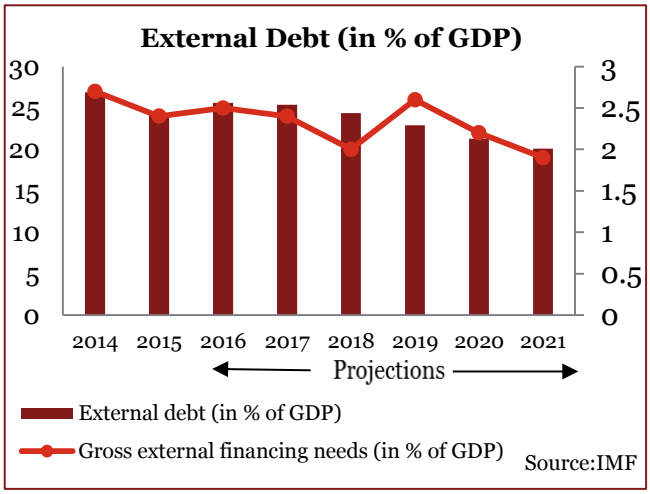
The Government's ability to borrow is broadly based on the current level and the projected level of debt in the near future. The following section provides a broad overview on the overall ability of the Government of Pakistan to borrow from various sources based on the debt sustainability.

Debt sustainability analysis

Pakistan's public debt dynamics has showed positive improvement in recent years as public debt accumulation has slowed down and there has been significant in most debt indicators. But still its indebtedness is not as unfavourable as compared to other emerging countries. This was due to the dependence on short-term debt instruments and, consequently, high gross financing needs.

Fiscal Responsibility and Debt Limitation (FRDL) Act, 2005, requires the public debt-to-GDP for Pakistan to be below 60%. The Public sector debt is expected to show a declining trend and reach about 55.2% of the GDP in 2021. External debt is also expected to show a modest decline in the future and this is consistent with the prospective modest external financing needs. Some of the salient points with respect to the debt situation has been provided in the graphic given below:



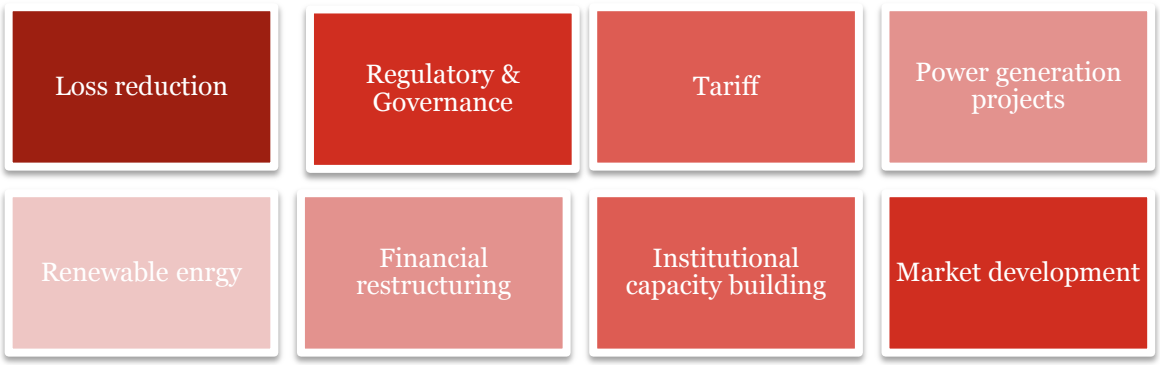


- Medium Term Debt Strategy (MTDS), 2014-2018 targets the public debt-to-GDP ratio in the range of 51.2% to 52.0% by end of 2017-2018.
- Currently, the debt/GDP ratio is close to 64%.
- Assuming that Pakistan sticks to the MTDS target, the net borrowings need to reduce.
- Based on historical trends, the government (including PSEs) can borrow a maximum of **USD 12 billion** per year across all sectors.

The IEP and various government agencies clearly recommend that the GOP should encourage the setup of private/public partnership projects in the power sector thereby speeding up funding. An important aspect of the CPEC projects is that these will be implemented by the private sector.

3.2. Assistance from development partners

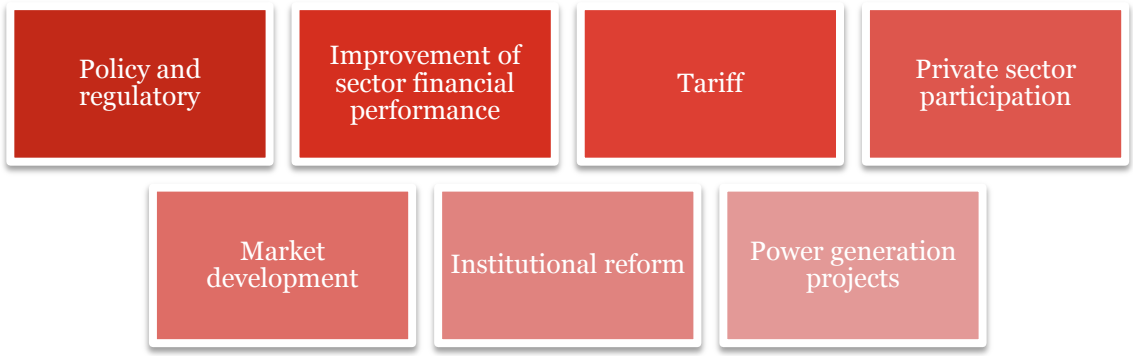
Asian Development Bank: ADB has approved a loan of USD 400 Million as a part of Sustainable Energy Sector Reform Program to support the government in tariff determination, subsidy, private sector participation and loss reduction in Pakistan's power sector. In addition, it has also funded USD 65 Million for the development a private sector hydropower project. ADB's assistance programme will focus on the below mentioned areas:



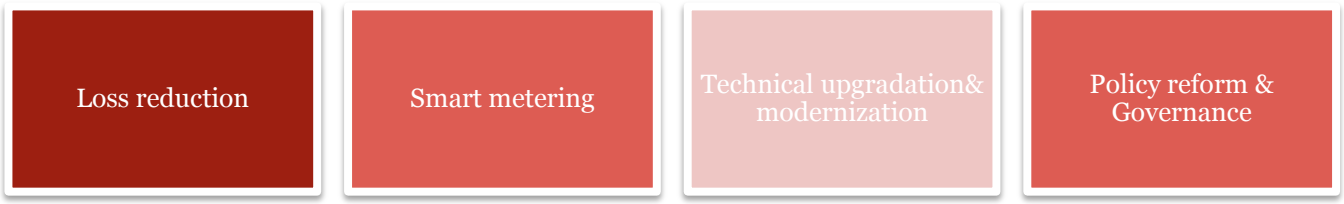
International Finance Corporation (IFC): IFC has been the leading funding agency in Pakistan in terms of renewable energy development. From 2010 till now, it has funded 5 hydropower projects worth USD 230 Million. It has also invested USD 15 Million in 2015 to facilitate the development of private wind farm and has acquired stake in China Three Gorges South Asia (CSAIL) as a part of Transformational Energy Initiative for Pakistan which plans to invest USD 7 Billion for development of renewable energy projects in Pakistan. IFC's key focus areas in Pakistan are the following:

World Bank: World Bank along with ADB and Japan has funded USD 600 Million as a part of Power Sector Reform Development Policy Credit to facilitate Pakistan in developing an efficient and consumer focused electric power system. It emphasizes mainly on policy and institutional reforms to improve the financial condition of the sector so that burden on public financing can be reduced. It is developed to cater to three objectives:

In addition, Multilateral Investment Guarantee Agency (MIGA) - the risk insurance and credit enhancement arm of World Bank, has also issued a guarantee of USD 82.7 Million for the development of Gulpur HPP. The key focus areas of World Bank are:



United State Agency for International Development (USAID): USAID has funded Pakistan mainly in the area of power distribution by providing support in the field of smart technology and loss reduction through technical upgradation. It has also provided support in policy reform aspects so as to reduce the burden of



circular debt on the government.

Assistance from the development partners plays a pivotal role in the development of Pakistan's power sector development. The coordination among the development partners has been considered as one of the best in the region. The table below lists some of the past and ongoing engagements of the above development partners in power sector of Pakistan:

Development Partner	Project scope	Duration	Amount (USD Mn)
ADB	Renewable Energy Development Sector Investment Program T1	2007-2016	105
	Power Transmission Enhancement Program T2	2007-2014	170
	Power Transmission Enhancement Investment Program T3	2011-2016	243
	Power Distribution Enhancement Investment Program T3	2012-2016	245
	Power Distribution Enhancement Investment	2013-2017	167.20

Development Partner	Project scope	Duration	Amount (USD Mn)
	Program T4		
	Jamshoro Power Generation Project	2013-2023	900
	New Bong Escape Hydropower Project	2005-2013	37.30
	Star (Partind) Hydropower Project	2011-2017	97
	Gulpur Hydropower Project	2015-2019	65
World Bank	Tarbela Fourth Extension Hydropower Project (IBRD	2012-2018	400
	Tarbela Fourth Extension Hydropower Project (IDA	2012-2018	440
	Sustainable Energy Sector Reform Program	2014-2018	600
AFD	Munda Dam Project–First Tranche	2013-2018	13.50
	Harpo Hydropower Project	2013-2018	65
EU/EIB	Keyal Khwar Hydropower Project	2014-2018	137
Germany (through KfW and GIZ)	128-MW Keyal Khwar Hydropower Project	2008-2018	135
IDB	Neelum–Jhelum Hydropower Plant Project	2009-Present	357.64
	Uch II Power Expansion Project	Ongoing	90
	Star (Patrind) Hydropower Project	Ongoing	60
	Jamshoro Power Generation Project	2014-2019	220
JICA	National Transmission Lines and Grid Stations Strengthening Project	2010-2017	233
	Sustainable Energy Sector Reform Program	2014-2018	49
USAID	Pakistan Energy Efficiency and Capacity	2009-Present	23.49
	Power Generation and Transmission Improvement Program	2012-2015	6.69

Assistance from the development partners – Future trends

It is expected that ADB, World Bank as well as other development partners like JICA, USAID, GIZ, IDB, KfW etc. who have invested in Pakistan's power sector in the past, would continue in the future.

World Bank Estimates

Year	Amount (in $ mn)	Remarks
2016	800	Based on the current CPS which proposes a spending of USD 2 Billion per year and allocation of 40% to power sector
2017	800	
2018	800	
2019	800	
2020	920	Increase in lending by 15% for the next CPS from 2020 based on past trends
2021	920	
2022	920	
2023	920	
Total	**6080**	

ADB Estimates

Year	Amount (in $ mn)	Remarks
2016	800	Based on COBP
2017	300	
2018	450	
2019	550	Based on the average proposed lending for 2016-18
2020	550	
2021	600	10% increase in lending assumed for the period 2021-2023 over the lending in 2019-2020
2022	600	
2023	600	

Year	Amount (in $ mn)	Remarks
Total	**3,650**	

Thus, based on Country Partnership Strategies/ Country Operations Business Plan, funding from key development partners for power sector projects is estimated to be USD 10,510 Million over 2017-2023:

– ADB and WB is estimated to fund around USD 3,650 Million and USD 6,080 Million respectively.

– Based on past trend of financing of USD 100 Million per year by other development partners (mainly JICA, USAID, GIZ, IDB, KfW etc.), it is estimated that they would fund around USD 780 Million over 2017-2023.

3.3. Other governments and private investments

Countries like China, Japan and the U.K. have invested in Pakistan's power sector in the past and it is expected that they would continue to do so even in future.

- China, UK and Japan have been the largest bilateral support providers for Pakistan.
- China's support has been mostly for the development of energy projects, such as construction of 6,600 MW coal-fired Gadani Power Park, due to be completed by 2018, which has also been funded simultaneously by investors from Middle East.
- China will also provide support for 8,000 MW of additional nuclear generating capacity by 2030.
- The government has signed an agreement with China to overcome the problem of energy shortages in the country.

The table below shows the investments for all the sectors of Pakistan by the government of other countries:

Countries	In USD Million (for all sectors)	
	2014	**2015**
China	602	1,209
Japan	184	138
Others	575	458
Total	1,361	1,805

Apart from the investments by the governments of other countries, various private investors have invested significantly in the power sector of Pakistan. Some of them are as follows:

- The first private sector HPP namely 84 MW New Bong Escape Hydropower Project was commissioned in March 2013. The project is built by Laraib Energy Limited with assistance from ADB and other financial institutions.
- The second private sector HPP of 147 MW is under construction and is to be commissioned in March 2017. The Korea Water Resources Corporation of South Korea is the sponsor and developer of the project.

Some of the upcoming investments by the private investors in the Pakistan power sector are:

- The China-Pakistan Economic Corridor (CPEC) is expected to make available 10,400 MW to Pakistan's national grid by 2018. Chinese banks and companies like Power Construction Corp. of China Ltd. will finance two coal-fired power projects in Pakistan (Thar coal project and another project near Pakistan's port city Karachi) worth USD 4.15 Billion.
- The construction of the 6,600 MW coal-fired Gadani Power Park, undertaken with financing from China and investors from the Middle East is due to be completed by 2018.

3.4. Envisaged funding probability of priority projects

Overview of investment plan and financing sources for 2017-2023

It is envisaged that from 2017 to 2023, the estimated requirement for development of the power sector is USD 51,601 Million. Further, it can be estimated that the power sector is likely to receive USD 21,656 Million as government budgetary support and USD 10,510 Million as assistance from development partners (i.e. World Bank, ADB) over 2017-2023 . The remaining is likely to be sourced from private sector and assistance from other countries. The envisaged funding probabilities from various sources are provided below.

Envisaged funding probability of priority generation projects

Projects	National Government	Other Governments	Development Partners	Private investment
2 x 660 MW TPP at Bhikki (Sheikhupura)	Medium	Low	Medium	Medium
2 x 660 MW TPP at Haveli Bahadur Shah (Jhang)	Medium	Low	Medium	Medium
2 x 660 MW TPP at Balloki (Kasur)	Medium	Low	Medium	Medium
2 x 660 MW TPP at Trinda Saway (Rahim Yar Khan)	Medium	Low	Medium	Medium
2 x 660 MW TPP at Keti Bunder	Medium	Low	Medium	High
Daimer Bhasha HPP	Medium	Low	Low	Low
Shushgai /Zhendoli HPP	Medium	Low	Medium	Medium
Shogo-Sin Hydropower Project	Medium	Low	Medium	Medium
Kaigah HPP	Medium	Low	Medium	Medium
Dudnial HPP	Medium	Low	Medium	Medium

Projects	National Government	Other Governments	Development Partners	Private investment
Ashkot HPP	Medium	Low	Medium	Medium
ChakothiI Hattian	Medium	Low	Medium	Medium
Naran HPP	Medium	Low	Medium	Medium
Balakot HPP	Medium	Low	Medium	Medium
Ghrait-Swir Lasht	Medium	Low	Medium	Medium
Jamshill More Lasht	Medium	Low	Medium	Medium
Booni-Zzaith HPP	Medium	Low	Medium	Medium
Laspur-Murigram HPP	Medium	Low	Medium	Medium
Neelum Jhelum HPP	Medium	Low	Medium	Medium
Golen Gol HPP Tarbel 4th Exp	Medium	Low	Medium	Medium

Projects	National Government	Other Governments	Development Partners	Private investment
Tarbel 4th Exp	Medium	Low	Medium	Medium
Kayal Khwar	Medium	Low	Medium	Medium
Tarbel 5th Exp	Medium	Low	Medium	Medium
Dasu (2nd Stage)	Medium	Low	Low	Medium
Suki Kinari	Medium	Low	Low	Medium
Kohala	Medium	Low	Low	Medium
Chor Nullah HPP	Medium	Low	Medium	Medium
Muzafargarh Coal Power project in Punjab	Medium	Medium	Low	Medium
Bata Kundi HPP	Medium	Low	Medium	Medium

Envisaged funding probability of priority transmission and distribution projects

Projects	National Government	Other Governments	Development Partners	Private investment
Dispersal of Power from 6600 MW Imported Coal Based Plants at Gadani	Medium	Medium	Low	Low
Dispersal of Power From Diamer Bhasha Hydro Power Project (4500 MW)	Medium	Low	Low	Low
Alliot Substation and Evacuation of associated HPPs	High	Low	Low	Medium
Distribution System Investment Program	Medium	Low	High	Low
Advanced Metering Projects	Medium	Low	High	Low

3.5. Private sector participation

Private Public Partnerships

Pakistan's public sector investment in energy and infrastructure has declined as a percentage of GDP since the early 1990s resulting in a huge backlog in development of infrastructure facilities. The government in Pakistan has maintained that PPPs are important in order to help overcome ongoing infrastructure challenges, including severe energy shortages that impede economic development. The Government launched its PPP programme in the power generation sector in the early 1990s and more than twenty IPP deals have been signed since then.

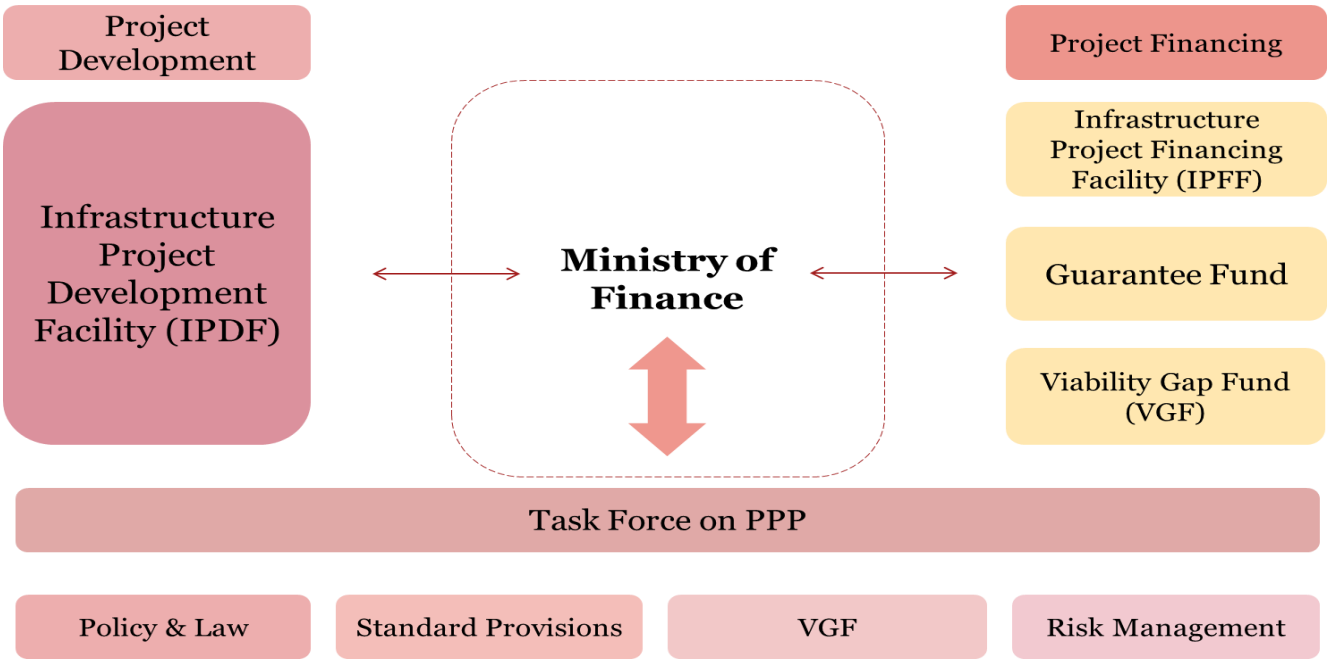
In 2006-07, the Ministry of Finance (MOF) established the Infrastructure Project Development Facility (IPDF) to develop regulatory policies and promote their implementation in all tiers of the government.

The PPP Policy of 2007, revised in 2010, facilitates PPPs across all infrastructure sectors and at both federal and provincial levels. Based on this policy, PPP programmes were initiated in the provinces of Sindh and Punjab. Sindh approved its PPP legislation in 2009 and Punjab in 2014. A Sindh PPP Unit has been set up in the provincial Finance Department, while Punjab's PPP Unit is located in the Planning Department. There is no specific PPP law at the federal level, but a regulatory framework is provided by the PPP Policy in combination with the laws on concessions and other forms of investment, as well as the sector-specific National Power Policy of 2013. The IPDF is in the process of drafting a PPP bill to bring the legal framework in line with international best practices.

The key objectives of the 2010 PPP Policy are the following:

Infrastructure Project Development Facility (IPDF)

IPDF, chaired by the Minister of Finance, acts as the PPP unit which assists the PPP Task Force whose role is to give advice on PPP reforms and legislations. IPDF was created to act as a channel between public and private sector for facilitating infrastructure development under PPP methodology. These along with the Debt Policy Coordination Office and the project-specific line ministries, form the basis of the new institutional architecture for federal PPPs. The schematic below provides an overview of the overall PPP programme structure in Pakistan and the key stakeholders involved.



Overall PPP assessment

It may be noted that some of the key challenges for PPP development in Pakistan are the following:

The public-private interface needs substantial strengthening, including enhancement of skills and institutional mechanisms within the government for effective interaction with the private sector.

Disaggregation and proper allocation of risk is the key to attract investments. There is a need to improve risk allocation among partners through a robust risk management system.

PPP pilot transactions currently entail considerable time and cost. The preparation periods and costs must be significantly reduced or else the much-needed private investments in infrastructure will not reach closure.

The federal government also needs to ensure provision for revenue guarantees that will safeguard against the commercial risk of the project and yet create incentives for the private sector to generate core and non-core revenues from the project.

4. Barriers to investments in the power sector

Financial health of power utilities and issue of circular debt

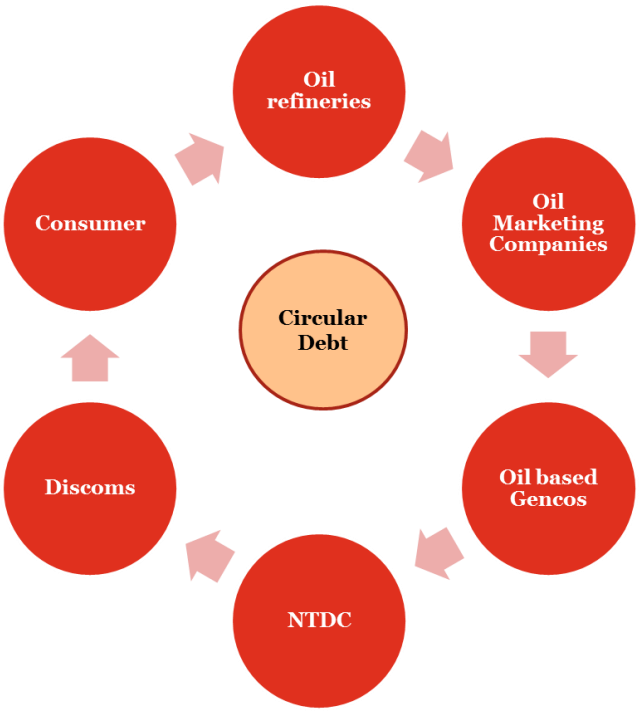
NTDC Limited acts as a Central Power Purchasing Agency (CPPA) which is responsible for procurement of power from GENCOs, Hydel & IPPs on behalf of DISCOMs, for delivery through 500 kV, 220 kV & 1,32kV network.

The Circular debt is the amount of cash shortfall within the CPPA that it cannot pay to power supply companies. This shortfall is the result of mainly the following reasons:

- The difference between the actual cost of electricity supply and revenue realised by the DISCOMs from sale of electricity to end consumers (resulting in Government subsidies);
- Poor collection efficiency of DISCOMs; and
- Insufficient payments made by the DISCOMs to NTDC out of the realised revenue.

This revenue shortfall cascades through the entire energy supply chain from electricity generators to fuel suppliers and producers, resulting in a shortage of fuel supply to the public sector thermal GENCOs and IPPs. In the year 2013, the government settled a 480 Billion-rupee circular debt after clearing dues to the IPPs in order to avoid sovereign default. Since the sector is still plagued with low tariffs, high T&D losses and poor collection efficiency of DISCOMs, the problem of circular debt may become even more prominent in the future. As such, government grants to retire circular debt is a short-term measure and a clear roadmap for reforms is needed to tackle the issue on a long-term basis.

The various stakeholders affected due to circular debt can be represented in the schematic diagram below:



Absence of guarantee for availability of fuel

The Power Policy of Pakistan, 1994 had provided impetus in bringing significant private investments in the power generation sector because the investors were not only free to choose the fuel for their projects but were also guaranteed both the fuel supply as well as power off-take by the government. As a result, all the private sector projects installed under 1994 policy, were based either on furnace oil or on gas as provided by the government. However, the fuel cost for these plants increased substantially in future years which resulted in unsustainable fuel generation mix. In order to address this issue through the prevailing new power policy, the government gives no guarantee about availability or supply of fuel but allows the bidders to make their own choice of fuel. This policy change has resulted in uncertainty of fuel supply to developers making investment less attractive than it was under the earlier policy.

The latest power policy of 2013 aims at reducing the average cost of generation from the current INR 12 to INR 10 per unit by relying on a less expensive fuel mix. Thus, the policy makers are trying to improve the fuel mix by giving incentives for exploration of indigenous resources like coal, water etc., but investors have not shown much interest in developing such projects till date.

Independence and autonomy of NEPRA

As per NEPRA Act 1997, the regulatory authority shall comprise of a Chairman appointed by the Federal Government as well as four other members appointed by the same authority based on the recommendations of the four provincial governments. Traditionally, power has been a provincial subject rather than a federal subject in Pakistan. Therefore, NEPRA comprises of nominees from the bureaucracy of the four provincial governments. This composition structure results in political influence over sector regulation and thus discourages transparency for investors. Further, the Act does not contain any provisions or guidelines on required competency and qualifications of the Chairman or members which impacts transparency in the selection process. Due to lack of proper qualification criteria in the Act, it has been observed in the past that most members of the NEPRA have been from the bureaucracy and they do not have requisite experience in power sector regulation.

Since June 2000, NEPRA is directly attached with the Cabinet Division. All the decisions regarding retail supply tariff and standards need to be approved by the government based on recommendations of NEPRA. Operational directives from the government are undermining the independence of the regulatory authorities. Thus, NEPRA is not completely autonomous as a regulatory authority and the government continues to exercise considerable control over it in matters of tariff, pricing, administration etc.

Institutional capability of NEPRA

Institutional capacity among other aspects depends mainly on the know-how and skill base of the personnel involved as well the availability of robust data which can guide the development of policy and regulatory frameworks. NEPRA is currently engaged in many reform activities like proposing new Multi-Year Tariff framework for select DISCOMs, determination of upfront renewable tariffs and improvement of energy mix of the power sector.

The reform activities require significant skill sets in terms of new areas of development such as renewables as well as implementation of Multiyear Tariff (MYT) tariff regime. Most of the members of the NEPRA are bureaucrats and thus have limited exposure towards power sector regulation, tariff, reforms and renewable energy. Similarly, NEPRA Act has undergone various amendments regarding key qualifications of the

Chairperson in a non-transparent manner which has not been able to generate investors' confidence in the abilities of the sector regulator. Broadly, NEPRA lacks capacity in terms of:

- Skilled manpower with technical capabilities for sector regulation and tariff determination;
- Tools and competencies to monitor licensee performance and compliance with standard operating procedures;
- Energy economics and tariff setting for renewable IPP and hydropower; and
- Skilled manpower to effectively monitor such a large number of utilities: Four GENCOS, various IPPs (around 30), WAPDA (Hydel), KESC, NTDC and nine DISCOMs.

Mandatory licensing

In Pakistan, separate licenses are required for carrying out generation, transmission and distribution functions. Only renewable energy generation less than 5 MW does not require generation license. The transmission activity is considered as a natural monopoly. Thus, only one licensee i.e. NTDC is responsible for operation and providing safe, reliable transmission and inter-connection services on a non-discriminatory basis.

As per NEPRA Act 1997, only one transmission license can be issued at one time. However, it also mentions that licenses for special purpose transmission in public interest may be granted, subject to seamless integration with the National Grid Company. As such, private participation in any function is possible only after obtaining license from NEPRA. Also, there are no provisions for outsourcing of functions by a licensee to a franchisee. Involvement of multiple agencies in the sector is also a contributing factor towards the delay in issuance of licenses.

Tariff determination process for generators

As mentioned earlier, the investors have an option to invest in the power generation via competitive bidding route or solicited proposals from the government. In a competitive bidding process, the tariff of the project is generally determined based on lowest quote of the technically qualified bidder and if required, the project developer negotiates the tariff with the power purchaser. However, in Pakistan, the final tariff determined through bidding and negotiations with power purchaser, is further sent for approval to the regulator.

Thus, such regulation of tariff by NEPRA even for competitive bidding, makes the process more tedious and creates regulatory uncertainty.

Development of power market

The current power market in Pakistan is a single buyer market where CPPA under NTDC Limited is responsible for procurement of power from GENCOs, Hydel & IPPs on behalf of DISCOMs, for delivery through 500 kV, 220 kV & 1,32kV network.

The existing regulatory framework of Pakistan does not recognise power trading as a separate activity. Moreover, neither NEPRA Act 1997 nor the Power Policy 2002 of Pakistan has provisions for purchase of electricity by distribution companies by way of bilateral supply agreements. This limits the power market and also acts as a constraint for promoting competition in the sector.

Section 7.6 of the latest National Power Policy 2013 envisages wholesale markets to introduce multiple buyers and sellers in the market place but does not give any time-bound action plan to achieve the same.

5. Reform action plan for facilitating investments

In the previous section, we have identified key barriers which have resulted in inadequate investments in the electricity sector of Pakistan. The following are the list of reforms that may be introduced for facilitating investments and making the sector more attractive.

Strengthening of NEPRA (sector regulator)

An independent regulatory institution, with a clearly defined legal framework is supposed to be the backbone of an effective institutional framework. For an electricity regulator to be effective, the following governance characteristics are of prime importance:

- Independence/Autonomy
- Capability
- Accountability
- Transparency

An independent regulator can provide assurance to investors that prices, outputs and inputs will not come under the pressure of 'regulatory capture' or other types of pressure from economic and political interest groups. In this regard, the independence of NEPRA needs to be improved since currently NEPRA comprises nominees from the bureaucracy of the four provincial governments. It has been observed worldwide that any bureaucratic and political intervention in the working of sector regulator has always resulted in discharge of ineffective regulatory functions by the body.

NEPRA has been able to exercise financial independence as it is funded by levies charged from regulated services. The NEPRA operations are funded from licensing fees, filling fees etc. as prescribed by it from time to time and approved by the Federal Government. But more autonomy and independence needs to be provided to NEPRA.

The following activities are essential for ensuring the autonomy of NEPRA:

- An enabling guideline to ensure that the members and the chairperson are independent of the government
- The guideline should have stricter eligibility criteria for members of NEPRA so that the regulatory body has adequate regulatory manpower to discharge its responsibilities effectively. The members shall have technical knowledge and relevant professional expertise in the areas of tariff and regulatory provisions.

A brief snapshot of the suggested reform action plan to strengthen the sector regulator has been shown in the table below. However, as a pre-requisite it is really important to understand the key weaknesses in the sector regulation to identify the areas for reform.

Reform Action Plan for strengthening of NEPRA

Indicative Measures for ensuring strengthening NEPRA

- The selection criteria of the members and the chairperson may be specified so that more independence is ensured and also capacity of the regulator increases.
- Organisational structure may be strengthened by recruitment of sufficient manpower so that expertise in the areas of tariff setting for renewables, hydropower etc. is ensured.
- NEPRA may be given quasi-judicial status under NEPRA Act so that it may exercise regulatory functions independently subject to policy direction by the Government of Pakistan.
- Policy formulation and sector regulation shall be done by two independent agencies. Thus the policy formulators shall not be allowed to intervene in sector regulation by issuance of relevant guidelines or law.
- A separate dedicated team may be formed within NEPRA to monitor performance of licensees on various parameters to ensure efficiency improvement and compliances with SOP.
- The Act shall provide sufficient legal capacity and powers to the sector regulator to effectively promote competition.
- NEPRA currently caters to four GENCOS, various IPPs (around 30), WAPDA (Hydel), KESC, NTDC and nine DISCOMs. Separate sector regulators for the four provinces can be formed with NEPRA as apex or federal sector regulator similar to federal level regulator like CERC in India.

Case Study : *Kazakhstan*

In Kazakhstan, as per ***Article 8 of Law on Electric Power Industry, 2004*** ,unless otherwise allowed by the law, central executive bodies and local representative / executive bodies cannot interfere in the activities of companies which are involved in the generation and transmission of heat and power. Thus, policy matters have been dealienated from the functioning of the sector and any undue political influence has been curtailed by this move

Case Study regarding formation of CERC and SERC: India

In the year 1998, The Central government of India moved forward to enact the Electricity Regulatory Commission Act of 1998 which mandated the creation of the Central Electricity Regulation Commission with the charge of setting the tariff of centrally owned or controlled generation companies. Ministry of Power, India, has published the Electricity Regulatory Commissions Act, 1998. Apart from CERC, the act also introduced a provision for the states to create the State Electricity Regulation Commission (SERC) along with the power to set the tariffs without having to enact separate state laws. The Electricity Regulatory Commission Act 1998, has also clearly laid down guidelines for the constitution and appointment of both the CERC and SERC.

CERC intends to promote competition, efficiency and economy in bulk power markets, improve the quality of supply, promote investments and advise government on the removal of institutional barriers to bridge the demand supply gap and thus foster the interests of consumers.

The main functions of the SERC as envisaged in the act is to determine the tariff for electricity, wholesale, bulk,

grid or retail; to determine the tariff payable for use by the transmission facilities, to regulate power purchase and procurement process of transmission utilities and distribution utilities, to promote competition, efficiency and economy in the activities of the electricity industries, etc.The act thus laid the foundation for detaching government from tariff determination process from the entire value chain of the electricity sector.

Strengthening of policies to promote competition

Pakistan has been focusing on adding more generation capacity since Power Policy 1994 came in to force but most generation projects have been negotiated directly and have not been subject to competitive bidding process which could have ensured lowest cost of generation.

In order to allow entry of more players in the sector, it is imperative that enabling provisions are present in the act or power policy for the entry of private players. Pakistan has come up with Power Generation Policy 2015 in order to boost development of power generation projects. The introduction to the policy has the following key message for the sector:

"In order to overcome the electricity crises the Government of Pakistan is working on multi-pronged strategy including development of Power Projects based on indigenous & imported resources both in the public and private sector. The planned expansion in the generation capacity requires supporting expansion in the transmission infrastructure for the evacuation of Power. Hence the GOP has also embarked upon initiative to develop transmission lines in private sector."

However, for the Power Generation Policy of 2015 to actually deliver results with respect to capacity addition, the licensing process needs to be either simplified or done away with for power generation projects. Further, the policy needs to clearly lay down provisions or enabling environment for promoting private participation in the distribution sector.

A brief snapshot of the suggested reform action plan to promote competition has been shown in the table below.

Indicative Measures for promoting competition across value chain

- Currently, licensing is a time taking process due to involvement of multiple agencies in the sector. Hence, in order to attract more players towards the generation sector, it is important that process of licensing be simplified and a single agency be made to cater to the requirements of applicants.
- Requirement of licensing may be done away with for certain specific functions or projects. For example, for generation projects below a certain minimum MW limit. Currently, all three activities viz. generation, transmission and distribution require licenses with the only exception of RE generators below 5 MW.
- In order to allow entry of private players in the distribution, a Public Private Partnership Model in distribution (Distribution Franchisee) may be allowed wherein the franchisee can take over certain functions—metering, billing, revenue collection, and capital expenditure— while the government utility retains the legal responsibility for power supply.
- Enabling provisions for introduction of competition in retail supply side of the electricity distribution sector though segregation of Distribution companies (DISCOMs) into two parts – carriage (distribution) business and content (retail supply) business. This will bring efficiencies in the distribution value chain of electricity.

We can find numerous examples across the globe where delicensing has resulted in significant capacity additions by private players. In India, post the enactment of Electricity Act 2003 in which generation was de-licensed, there was significant improvement in the contribution of private players towards the installed capacity base. In India, the impact of delicensing coupled with other reforms has been huge where the percentage of private sector towards the installed capacity base has risen from **11%** in 2003 to around **39.5%** by the end of year 2015 (Ministry of Power Data). Similarly, relaxation in rules regarding captive generation along with simplification of procedures would also improve the generation capacity.

Investor protection for priority sectors

Investors shall be provided full and unconditional protection of the rights given to them by the Constitution, laws and international treaties which have been ratified by Pakistan. The Government of Pakistan has been focussing on investor protection and has emphasised this in its recently released Power Generation Policy 2015 as:

"GOP is fully aware of the private investors' needs of having a simple and transparent framework for their investment by providing all the facilities and ambiance for the safe investment with competitive concessions and attractive return on investment. Encouraging local and foreign investment is a key feature of the government policies in order to develop the infrastructure and power projects in Pakistan. Imported coal and other new fuels for power generation in Pakistan having different supply chain mechanism while the liquidity problems in the power sector and delays in payment to power generation companies also needs to be addressed."

However, despite having such investor friendly policies, utmost care has to be taken by the Government of Pakistan to ensure that with its history of political turmoil, the Implementation agreements and Power Purchase agreements are bankable so that investors' interests are safeguarded. In order to make the sector more lucrative, the government may provide additional incentives/ grants during the concession period. Like in case of Kazhakhstan, if the investor fulfils the obligations of the contract, the authorised body may choose to transfer the rights of ownership of the property to the investor.

Improvement in fuel mix by policy reforms

The current fuel mix in Pakistan power generation is dominated by Oil and Gas. Together they account for 65% of the total power produced. The contribution of renewable energy resources to the national energy mix is close to zero. This clearly indicates the need for key policy initiatives to promote indigenous resources like coal and also renewables. A few small steps have been taken in this regard like Quaed-e-Azam Solar Park and CPEC wind projects but still a lot needs to be achieved. In industrially advanced countries of the world, the mix has now tilted towards renewable energy sources. The National Power Policy 2013 has emphasised upon the need to improve the fuel mix but has failed to set any tangible, realistic target of improvement in the generation mix.

A brief snapshot of the suggested reform action plan to promote competition has been shown in the table below.

Indicative Measures for improving fuel mix
• Fix clear and tangible targets for RE Generation and frame associated plan to meet the targets
• Fix tangible targets for increasing share of Hydro, Renewables etc. in total energy mix
• Provide enabling environment and regulations to promote use of other fuels for generation

Treatment of existing recurrent circular debt issue

Pakistan electricity sector is affected by the issue of circular debt across the entire value chain. The various contributing factors towards circular debt are as follows:

- **Heat rate of GENCOs:** The actual heat rate of some ex-WAPDA GENCOs is more than NEPRA determined/ allowed heat rate. Thus, the additional heat rate consumed per unit production is not recovered from tariff resulting in circular debt directly.
- **Operational inefficiency of GENCOs:** GENCOs may be incurring more operation and maintenance costs (including employee cost) than that allowed by the regulator NEPRA. Thus, such unaccounted additional costs which are not covered under tariff directly contribute to the circular debt.
- **Transmission losses:** NTDC tariffs are usually set at a certain transmission loss level by NEPRA (2.5%). Any loss over and above the allowed loss levels is not recovered from any tariff thus contributing towards circular debt.
- **Operational Inefficiency of NTDC:** NTDC may be incurring more operation and maintenance costs (including employee cost) than that allowed by the regulator NEPRA. Thus, such unaccounted additional costs which are not covered under tariff directly contribute to the circular debt.
- **T&D losses:** The T&D losses of various DISCOMs are generally more than NEPRA approved figures of T&D losses for respective DISCOMs. Such costs are not covered under tariff calculations and thus contribute to circular debt issue.
- **Collection inefficiency:** The lack of incentive for DISCOMs to improve collection efficiency is resulting in collection efficiency levels of 80 % for most DISCOMs. The uncollected amount results in the cumulative liabilities of the power sector towards power purchase cost which adds to circular debt and increase in load shedding.
- **Delayed regulatory proceedings:** Delay in tariff notification, delay in payment by CPPA-G to GENCOs and IPPs resulting in additional delayed surcharge and financing costs etc.
- **Delayed payment of Tariff Differential Subsidies:** Delays or non-payment of TDS claimed from the government may further add to the rising circular debt.

A brief snapshot of the suggested reform action plan to tackle the circular debt issue has been shown in the table below. However, as a pre-requisite, it is really important to understand what is causing the accumulation of the circular debt.

Prerequisite for tackling Circular Debt issue

Before the action plan to tackle the circular debt issue, it is important first to segregate the circular debt into recognised and unrecognised financial losses:

- Recognised financial losses are on account of difference between NEPRA determined tariff and lower final end consumer tariff for each year.
- Unrecognised financial losses are mainly due to factors like costs disallowed by the NEPRA to be recovered through tariffs or failure on account of the distribution and transmission companies with respect to achieving the targeted loss levels.

Indicative Measures for improving financial position

- One time settlement by the Government of Pakistan to save the sector from imminent financial crisis.
- With the formation of new central purchasing entity, it becomes important to devise effective payment and balancing mechanism so that the financial burden on CPPA-G is minimal.
- Focus on improving heat rate of existing GENCOs.
- The utilities shall be asked to improve operational efficiencies and regular review shall be undertaken by NEPRA.
- Focus on reduction in power purchase cost by improvement in generation mix, taxation regime.
- Cost reflective tariffs shall be charged from consumers by setting performance based regulations for all the utilities instead of rate of return methodology.
- Circular debt issue can be fully tackled by increasing the competition and reaching the stage of power reforms where the tariff is market determined.

Introduction of multiple buyer seller market

Similar to Pakistan, many Asian and African countries have preserved an artificial monopoly over the wholesale trading of electricity even after the vertically integrated national power company is unbundled. The advantages of the single buyer model are below:

i. Ease of matching supply and demand: Since the single buyer is same as the company responsible for schedule and dispatch, thus it can effectively balance the demand with supply.

ii. The ministry has full control on investments related to addition of generation capacity and thus the government exercises control over the sector.

iii. The single-buyer model helps to maintain a unified wholesale electricity price, simplifying price regulation.

iv. The single-buyer model makes it possible to shield financing bodies of generation projects from market risk and retail-level regulatory risk making the investment commercially bankable.

The disadvantages of the single buyer model present a need to move towards an efficient wholesale market of electricity post unbundling of the state utility. The disadvantages of the single buyer model are:

i. The government has excessive power over the sector in terms of capacity addition and thus the capacity addition is not demand - supply driven.

ii. The Power Purchase Agreement creates a contingent liability for the government in case the state owned single buyer is not able to honour its commitment to the generators. This risk becomes significant in countries like Pakistan where around 40 % of power is procured from IPPs. Thus the sovereign credit worthiness is affected.

iii. Development of Cross border electricity trade with neighbouring countries having liberal market is affected because the government owned single buyer is not bothered about the avenues of lower power purchase cost.

iv. Most importantly, the distribution companies do not have incentive to focus on collections because no action is generally taken by the single buyer against low performing distribution company.

v. Allocation of cash proceeds to the generators may be skewed and based on other factors than dispatch and thus has scope for corruption and malpractices.

Open Access can be allowed in transmission giving the right to private power producers or any other generating utility to sell its power to any entity using transmission network (without any discrimination). Over a period of time and after successful implementation of open access, the market structure in the power sector of Pakistan may evolve from the single buyer to a multi-buyer model. The generator could sell power to any industrial buyer using the open access provision in transmission and the industrial/ large consumers will have the option to choose their supplier. But for non-discriminatory open access to be a reality, the enabling provisions must be included in the electricity act or power policy. The transition from a single-buyer model to a multi-buyer multi-seller model should result in a competitive power market so as to provide incentives for new investment while providing affordable and quality power to consumers.

Pakistan has taken a progressive step in the year 2015 by separating the transmission and dispatch NTDC from the wholesale electricity trading monopoly (newly formed CPPA-G). But still a lot needs to be done to bring efficiencies into the system for making the next major reforms towards introducing bilateral contracts between the generators and distribution companies. This will open doors for investment in the distribution sector as well because then the players would aim at achieving lower levels of power purchase cost and improve collection to earn profits.

Open access means the non-discriminatory provision for the use of transmission lines or distribution system or associated facilities with such lines or system by any licensee or consumer or a person engaged in generation. This system provides the buyer or seller the right to use the transmission line owned and controlled by other utility. Thus the generators and buyers can trade freely without having the right of transmission, by just paying appropriate wheeling charges to the transmission system owner.

Prerequisite for introducing trading and open access

- The power policy or act shall allow for open access and shall recognise power trading as a distinct activity.
- The regulator shall provide an enabling environment for short term and long term open access by drafting regulations/ guiding principles for the same.
- The transmission capacity allocation guidelines shall be prepared.

Indicative Measures for increasing competition in power market

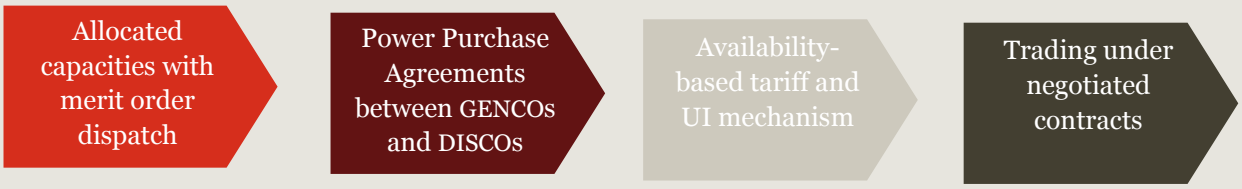
- The legal and regulatory framework shall recognise trading as a separate activity.
- Allowance for Open Access.
- Development of Short term market typically contracts of less than a year through bilateral agreements and power exchanges. The aim is the efficient procurement of power where multiple buyers and sellers compete with each other.
- NEPRA to come up with annual report on short term market.
- Development of market of electricity without any negotiated tariff.

Case Study : Trading and Open Access

With the enactment of Electricity Act 2003 in India, power trading was recognised as a distinct activity.

Through Trading Licensee and Open Access regulations in 2004, CERC created a framework for a robust and healthy short-term power market in the country. The short-term power market currently constitutes 9 % (about 100 BU) of the total electricity generation. In the last decade, the short- term power market has become an integral part of the electricity sector in the country. It has helped the electricity providers to balance their portfolios on day ahead basis and adjust to fluctuating power requirements. It has also enabled power producers and procurers to sell their surpluses.

Hence, a typical Indian market reform moving towards competitive market segment can be illustrated as below



Thus, eventually, a market mechanism shall be introduced in Pakistan power sector which shall provide for efficient price discovery and be monitored by the regulator. The wholesale power market which is characterised by long-term bilateral contracts between multiple buyers and sellers would continue to play a dominant role. A platform for anonymous trading of electricity contracts would help provide efficient price discovery.

Cost reflective tariffs

Currently in Pakistan, tariffs are designed keeping socio-economic considerations in mind. Thus, due to the subsidy being given by the government, certain consumer categories like domestic consumers pay tariffs lower than the actual cost of supplying power. Ideally, every consumer should pay for the services availed by it. The categories which are paying more than the cost of supply become less competitive as they are burdened by additional cost whereas the consumer categories which are subsidised have lower value attached towards incremental consumption of electricity. The distribution licensee has no incentive to provide supply to categories which have low cost coverage or do not have the ability to pay. Pakistan faced this issue with the privatisation of KESC when the utility was load-shedding in selected areas from where the collection efficiency was lowest. Similarly, with the gradual privatisation of the distribution sector, existence of subsidies would encourage cherry picking among distribution companies, who would want to attract consumers who are paying more than their cost of supply.

Indicative measures for cost reflective tariffs

- Make tariff setting independent of government by giving quasi- judicial status to NEPRA.
- Long term tariff regulations for all the licensees with incentive penalty framework based on performance.
- NEPRA shall ask distribution licensee to calculate average cost of supply per unit and highlight the same in the tariff petitions.
- Ensure transparency in tariff setting by public consultation and clear performance based regulations

Indicative measures for cost reflective tariffs

guidelines for tariff.

- NEPRA shall direct the utilities to calculate the cost of supply[32] for each consumer category and furnish the detail to it so as to understand the cost causation by each category towards the total cost of supply by the utility.
- Clear guidelines for competitive bidding in generation to ensure cost reflective power purchase cost.
- Development of competitive market determined tariff for electricity.

[32] Cost of Supply (CoS) is the judicious segregation of total cost incurred by the utility into various consumer categories. Thus, CoS allocation system distributes the total costs to different categories of consumers based on the cost causation by the particular category. Broad guidelines for calculation of Cost of Supply are:

- Identify and assign historical or accounting costs that determine utility's revenue requirement;
- Allocate costs to consumer category based on allocation factors such as contribution of consumer category to system peak; energy sold to each category as % of total sales; no. of consumers in each category etc.

Appendix A: List of Power Plants

S. No and Name of power station	Fuel	Installed capacity (MW)
Hydel WAPDA		
1 Tarbela	Water	3,478
2 Mangla	Water	1,000
3 Ghazi Barotha	Water	1,450
4 Warsak	Water	243
5 Chashma Low Head	Water	184
6 Allai Khwar HPP	Water	121
7 Jinnah Low Head	Water	96
8 Small Hydels5	Water	106
9 Khan Khwar HPP	Water	72
10 Dubair Khwar HPP	Water	130
Sub-Total (WAPDA Hydel)		**6,902**
Others		
11 Jagran Hydel	Water	30
12 Malakand-III Hydel	Water	81
Total Hydel		**7,013**
GENCOs		
13 TPS Jamshoro #1-4	Gas/FO/RFO	850
14 GTPS Kotri #1-7	Gas/HSD	174
Sub-Total GENCO-1		**1,024**
15 TPS Guddu Steam #1-13	Gas/FO	1,655
16 Guddu 747	Gas	747
17 TPS Quetta	Gas	35
Sub-Total GENCo-11		**2,437**
18 TPS Muzaffargarh #1-6	RFO/FO/Gas	1,350
19 NGPS Multan #1&2	Gas/RFO/HSD/FO	195
20 GTPS Faisalabad #1-9	Gas/HSD	244
21 SPS Faisalabad #1&2	FO/Gas/ RFO	132
22 Shandara G.T.	Gas	44
23 Nandipur	RFO	286
Sub-Total GENCo-111		**2,251**
24 FBC Lakhra	Coal	150
Sub-Total GENCO-IV		**150**
Sub-Total GENCOs		**5,862**
Nuclear		
25 Chashma Nuclear (PAEC)-I	Uranium	325
26 Chashma Nuclear (PAEC)-II	Uranium	340
Sub-Total (Nuclear)		**665**
Hydel IPPs		
27 New Bong Escape	Water	84
Sub-Total (Hyde) IPPs)		**195**
Thermal IPPs		
28 KAPCO	RFO/Gas/HSD	1,638
29 Hub Power Project (HUBCO)	RFO	1,292

S. No and Name of power station	Fuel	Installed capacity (MW)
30 Kohinoor Energy Ltd. (KEL)	RFO	131
31 AES Lalpir Ltd.	RFO	362
32 AES Pak Gen (Pvt) Ltd.	RFO	365
33 SEPCOL	RFO	135
34 Habibullah Energy Ltd. (HCPC)	Gas	140
35 Uch Power Project	Gas	586
36 Rousch (Pak) Power Ltd.	Gas	450
37 Fauji Kabirwala (FKPCL)	Gas	157
38 Saba Power Company	RFO	134
39 Japan Power Generation Ltd.	RFO	135
40 Liberty Power Project	Gas	235
41 Altern Energy Ltd. (AEL)	Gas	31
42 Attock Generation PP	RFO	163
43 ATLAS Power	RFO	219
44 Engro P.P. Daharki, Sindh	HSD/Gas/FO	226
45 Saif P.P. Sahiwal, Punjab	Gas/HSD	225
46 Orient P.P. Balloki, Punjab	Gas/HSD	225
47 Nishat P.P. Near Lahore	RFO	200
48 Nishat Chunian Project. Lahore	RFO	200
49 Foundation Power	Gas	175
50 Saphire Muridke	Gas/HSD	225
51 Liberty Tech	RFO	200
52 Hubco Narowal	RFO	220
53 Halmore Bhikki	HSD/Gas	225
54 Uch-II	Gas	375
55 Davis	Gas	10
56 **Sub-Total Thermal IPPs**		**8,678**
Wind Power Projects		
57 Fauji Wind Power	Wind	50
58 Zorlu Energy Wind Power	Wind	56
Total Wind Power Plants		**106**
Total Installed Capacity		**22,408**
Total Installed Capacity K-Electric		**2,422**
Grand Total (Sub Total + K-Electric)		**24,830**

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