ADB TA 8727 REG

CAREC: Study for Power Sector Financing Road Map

Mobilizing Financing for Priority Projects

Afghanistan

September 2016

pwc

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CAREC

List of abbreviations

ADB	Asian Development Bank
ADO	Asian Development Outlook
AFN	Afghanistan Afghani
AT&C	Aggregate Technical & Commercial Losses
BCM	Billion Cubic Meters
CAGR	Compound Annual Growth Rate
CAPS	Central Asian Power System
CAREC	Central Asia Regional Economic Cooperation
CASA	Central Asia- South Asia
EAP	Energy Action Plan
EBRD	European Bank for Reconstruction and Development
ESCC	Energy Sector Coordinating Committee
ESO	Energy Supplying Organizations
FDI	Foreign Direct Investment
FSU	Former Soviet Union
GDP	Gross Domestic Product
G-T-D	Generation-Transmission-Distribution
HPP	Hydro Power Plant
IMF	International Monetary Fund
IPP	Independent Power Plant
kWh	Kilowatt- hour
MDGs	Millennium Development Goals
MTPP	Medium Term Priority Project
MW	Megawatt
PLF	Plant Load Factor
PPP	Public Private Partnership
R&M	Repair and Maintenance
RDC	Regional Dispatch Centres
RDTA	Research and Development Technical Assistance
REC	Regional Electric Grid Companies
RPMP	Regional Power Sector Master Plan
TA	Technical Assistance
TAPI	Turkmenistan-Afghanistan-Pakistan-India
TPP	Thermal Power Plant
UN	United Nations
UNDP	United Nations Development Programme
USD	United States Dollar
YoY	Year over Year

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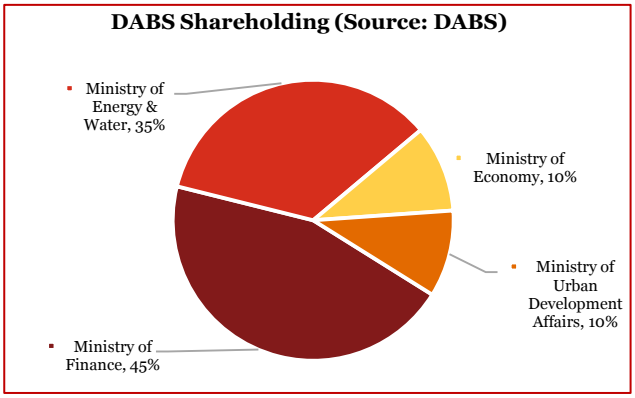
1. National power sector overview

In spite of considerable development of power sector infrastructure over the last decade in Afghanistan, the estimated grid-based electricity covers only about 30 - 35 percent of the population, that too mainly in the urban areas and along a few transmission corridors. The current Afghanistan electricity consumption stands at 130 kWh/year/person, which is low as compared to South Asia average of 667 kWh/year/person and global average electricity usage of 3,100 kWh/capita in 2012.

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

Currently, the power sector is governed by the Ministry of Energy and Water (MEW) and operated by Da Afghanistan Breshna Sherkat (DABS), which controls & operates all the activities of the power sector throughout the country.

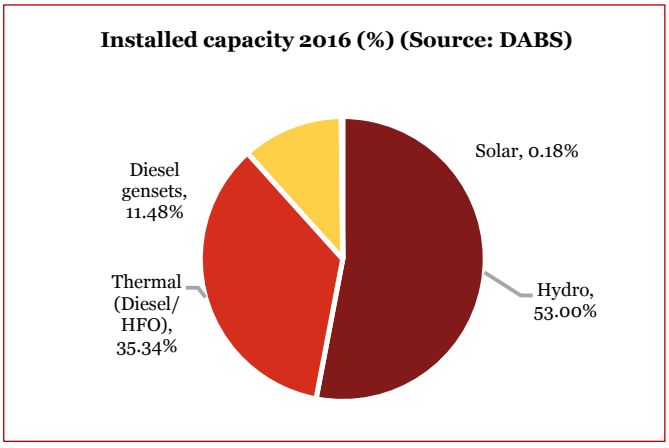


The Afghanistan power system is categorised into four different networks, namely North East Power System, South East Power System, Herat Zone System and Turkmenistan system which facilitate both internal and cross border interconnections with neighbouring countries like Uzbekistan, Tajikistan, Iran and Turkmenistan.

1.2. Power supply and demand

1.2.1. Power supply

The installed capacity of Afghanistan's power system stands at 566 MW, out of which hydro constitutes 53%, while diesel or HFO based thermal power plants constitutes 35.34%, solar 0.2% and small diesel generator sets constitute 12%. Apart from that, Afghanistan also has significant renewable energy potential with 300 sunny days a year for solar energy development and 158 GW of wind energy potential.

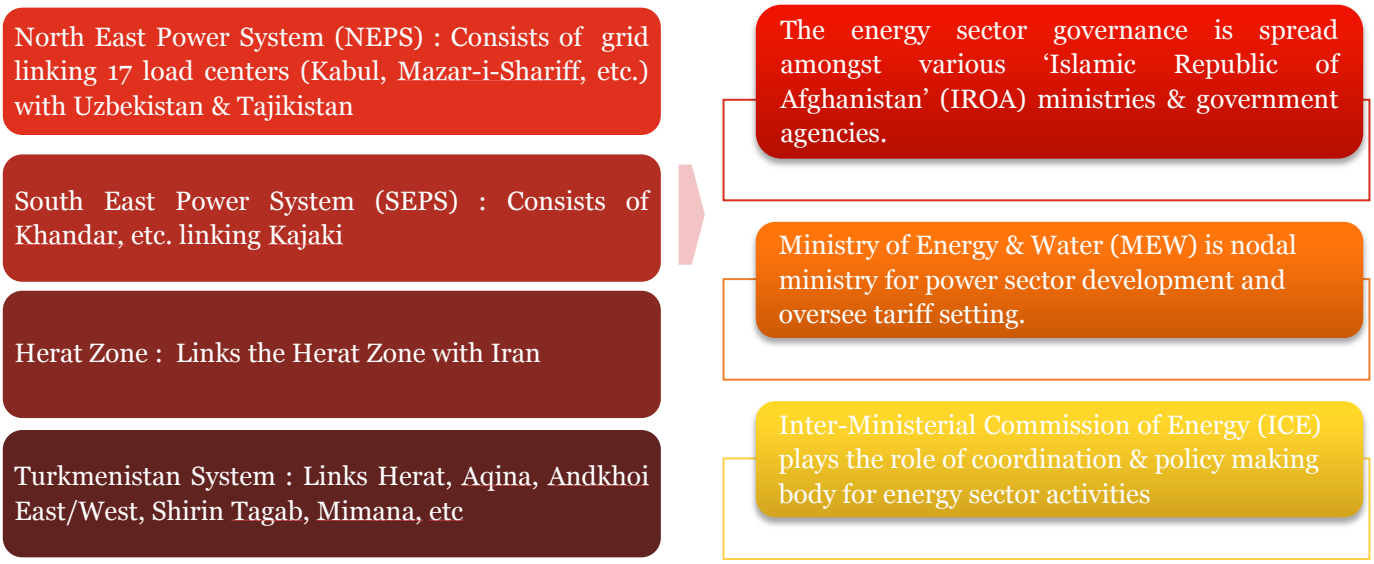


However, due to political instability and conflicts in the last two decades, generation capacity addition

have been limited and majority of electricity consumption (77% of total consumption, i.e. 4,454 GWh) is met through power import from neighbouring countries.

Afghanistan comprises 10 isolated grids or islands supplied by different power systems through 220 kV and 110 kV links. Different parts of Afghanistan imports power from Iran, Tajikistan, Turkmenistan, and Uzbekistan. Currently, there are five transmission lines used for power import from Turkmenistan, Uzbekistan and Tajikistan and three lines for import power from Iran. Considering that the grid in these countries operate in asynchronous mode, it is not possible to connect one network to the other in the system. This results in inefficient load dispatch and frequent blackouts. An investment of 2,767 million USD is required to develop the planned projects as per the

Country	Import (2016)
Iran	21%
Tajikistan	31%
Turkmenistan	13%
Uzbekistan	35%
	Source: DABS



CAREC Power Sector Master Plan.

1.2.2. Power demand

Electricity demand in the country has increased significantly in the last decade with household connections and metered connections increasing by almost 65% and 200% (2012) respectively. For example, demand for power in four of Afghanistan's largest cities is growing by 19% annually and by 2032, the demand is forecastecd to reach 3,500 MW.

On the other hand, supply has continued to increase at a very slow pace, i.e. overall 19% between 2010 and 2013, with most of the plants being either in shut down mode or operating at low efficiency. For example, in 2011, 8 out of the 45 plants did not produce power. Moreover, the increased eletricity consumption for heating coupled with non-availability of hydropower in winter further add to the widening demand supply gap.

Power demand-supply situation in Afghanistan (Source: DABS)				
	2010	**2011**	**2012**	**2013**
Demand (GWh)	4,200	4,507	5,054	5,700
Domestic supply (GWh)	916	884	983	1,114

Power demand-supply situation in Afghanistan (Source: DABS)				
Imports (GWh)	1,669	2,456	3,022	3,436

Therefore, to meet the increased demand, power import from neighboring countries has increased steadily and now constitutes almost three fourth of the total energy consumption.

1.3. Sector regulation

1.3.1. Key aspects of the legal and regulatory landscape

Institutional framework of the power sector

The MEW controls operation of the state owned enterprises engaged in the power, gas, petroleum and water sectors. The Da Afghanistan Breshna Sherkat (DABS) was created in 2008 as part of the strategy to commercialise the power sector and build a new electricity market structure. In the process, DABS replaced DABM to operate and manage power generation, import, transmission, and distribution infrastructure on a commercial basis throughout Afghanistan. There are seven oil fired thermal plants which are being directly controlled by DABS:

- Kabul power plant (105 MW Tarakhail and 95 MW North west thermal power plant)
- Kandahar power plant (36.27MW)
- Kandahar power plant expansion (10 MW)
- Lashkar Ga power plant (2.10 MW)
- Qalat power plant (2.64 MW)
- Aybak power plant (2.10 MW)
- Tirin Kot power plant (0.50 MW)

Moreover, DABS also imports electricity from neighbouring countries, namely Uzbekistan, Tajikistan, Turkmenistan and Iran to reduce the existing very high demand supply gap. Apart from MEW, the other ministries that are involved indirectly in the energy sector are:

- Ministry of Economy (MoEc)
- Ministry of Finance (MoF)
- Ministry of Rural Rehabilitation & Development (MRRD)
- National Environmental Protection Authority (NEPA)

As mentioned before, Afghanistan has significant amount of hydropower in their fuel mix and the following is a list of existing hydropower plants in Afghanistan:

Plant	River	Capacity (MW)
Mahipar	Kabul	66
Naghlu	Kabul	100.0
Sarobi	Kabul	23
Daronta	Kabul	11.5
Chak-i-Wardak	Logar	3.9
Jabul Saraj	Salang	2.5

Plant	River	Capacity (MW)
Kajaki I and III	Helmand	33.0
Grishk	Helmand	2,4
Pul-i-Khumri I	Pul-i-Khumri	4.8
Pul-i-Khumri II	Pul-i-Khumri	9.0
Khanabad (old)	Canal	1.7

Source: Presentation at the International Conference on Renewable Energy in Central Asia: Creating Economic Sustainability to Solve Socio-Economic Challenges, November 2010

Focused strategy on energy sector

Afghanistan as a nation has been facing violence and terrorism over the years that has resulted in the destruction of existing infrastructure and little development of new infrastructure. In order to address such challenges, Afghanistan's National Development Strategy (ANDS) was formulated. It is a Millennium Development Goals (MDGs) based plan that serves as Afghanistan's Poverty Reduction Strategy Paper (PRSP) and focuses on sectorial reforms as well. The Energy Sector Strategy is a part of Pillar III of the ANDS. Apart from other aspects, the document has also envisaged the important role of virtually non-existent private participation in the energy sector. It has been envisaged that the private sector may be called upon to *manage, operate, invest and/or own* energy entities and operations.

The Energy Sector Strategy document realizes that in the current state of institutional, policy and regulatory framework in the power sector, private investors may have relatively low interest to invest in a large-scale power plant. But private participation can be expected in specific areas of the sector like outsourcing of billing, selling off of the construction arm of DABS so that it can focus on operations, contract based distribution, etc. The document further evaluates the merits of unbundled utility vis-à-vis the existing bundled utility and thus explores the idea of *accounting unbundling* followed by *functional unbundling*

Recent government and donor initiatives emphasise the importance of the expansion and rehabilitation of the electricity sector. Efforts have been made in the following areas:

- Improving the supply of natural gas
- Increasing availability of hydro-electric generation
- Repair and rehabilitation of the electricity transmission and distribution systems
- Development of renewable energy sources in rural and remote areas
- Focusing on further increasing low-cost power imports
- Improving the capability of energy sector institutions

2. Power sector development and investment plan

Afghanistan has 440 billion cubic meters (bcm) of proven gas reserves in the northern and western regions, 73 million tons of coal reserves in its central highlands, and hydropower potential amounting to 25,000 MW in its eastern and southern regions.

But, as most of the population resides in rural areas, and due to lack of infrastructure, primary energy supply is mainly dominated by wood, dung, crop residue and kerosene which accounts for approx. 60% of total supply. Electricity as a primary source accounts for only 10% that too only in urban areas as rural areas do not have access to electricity due to lack of infrastructure.

2.1. Objectives driving sector development

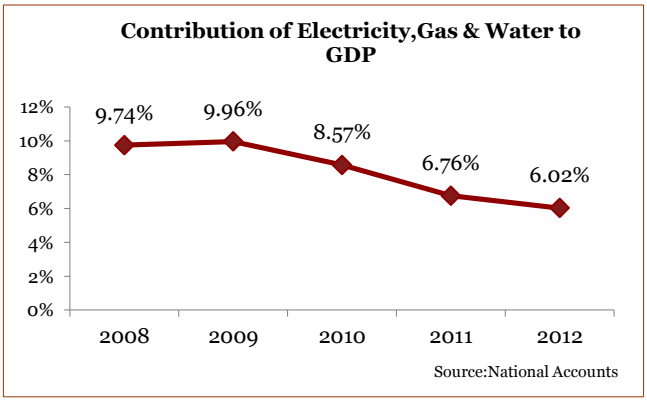
Economic growth in Afghanistan is mainly dependent on agriculture and services sector contributing almost 80% of total GDP. Strong recovery in agriculture and heavy external assistance led to expansion of industry and services which helped GDP to grow by 11.9% in 2012, following 7.2% expansion a year earlier. Private consumption buoyed by international aid remained the main source of growth. As per ADB Outlook 2016, the economic growth in the medium term will be mainly driven by improved business environment, private sector participation and development in the natural resource sector.

GDP growth (%) by sector (Source: ADB Asian Development Outlook)

Year	GDP	Agriculture	Industry	Services
2009	21.0	44.6	6.1	17.2
2010	8.4	-6.4	6.3	18.1
2011	7.2	-7.9	9.8	12.7
2012	11.9	31.5	7.2	7.3
2013	3.4	0.9	2.5	3.7
2014	1.7	1.0	1.3	1.8
2015	1.5	-2	1.4	2.8

The provision of adequate and reliable energy services at affordable and cost-based prices, in a secure and environmentally sustainable manner, and in conformity with social and economic development needs, is an essential element of sustainable development. This will also require sufficient contribution from the electricity sector which is evident from the fact that with increase in GDP, there has been 17% rise in electricity demand and fourfold increase in consumer base.

Afghanistan falls in the bottom 10 percentile globally in terms of annual per capita consumption which is around 130 kilowatt hours per year and only about 35% of its population is connected to the grid. The contribution of electricity, water and gas sector to GDP was highest at ~10% in 2009 which has shown a declining trend afterwards because of decline in hydropower generation and natural gas production.



The lack of grid connectivity and inadequate supply have resulted in electricity inaccessibility in rural areas and power failures in major cities like Kabul.

To address these issues, the government came out with a National Development Strategy in 2007, which provides for rehabilitation & expansion of power

generation, rural electrification, tariff reform and increase in electricity grid coverage, etc. In addition, focus has also been given to institutional strengthening and capacity development to carry out the above activities in a streamlined manner. However, only 63% of the target set in the energy sector has been met and challenges remain (e.g. very low rural electrification and limited private sector participation).

Therefore, with the envisaged average GDP growth of 5.6%, planned urbanisation (Kabul city expansion) and development in the mining sector (Hajigak and Aynak), growth in the energy sector is essential through focus on expansion of domestic power generation, increase in power import quantum from the neighbouring countries and energy accessibility.

Alignment of the power sector objective of Afghanistan with the CAREC Energy Work Plan, 2016 – 20

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

No	Element of EWP	Objectives of Afghanistan's power sector
1.	**Developing the inter regional corridor**	• Increase in the capacity of transmission links that are part of interregional corridor like transmission link to Uzbekistan Tajikistan, Iran and Turkmenistan • In the Power Sector Master Plan, 500 kV transmission line has been planned for connection to Pakistan to facilitate power trading in case of power surplus situation in Afghanistan and neighbouring countries in North
2.	**Promoting regional electricity trade and harmonization**	Afghanistan envisages a mutually beneficial long-term agreement for importing and exporting power with neighbouring countries and extending collaboration.
3.	**Managing energy-water linkages**	-
4.	**Mobilising financing for priority projects**	Afghanistan envisages increased private sector participation in power generation and distribution. The various planned projects in those areas will be financed through collaboration of public and private sectors through: • Foreign investments; • State budget and investment programmes; • Cooperation with international financial organisations and development partners.
5.	**Implementation of energy sector priority projects.**	The Power Sector Master Plan lists out key power generation and transmission projects that need to be implemented between 2017 and 2023. The prioritisation is based on the ability to meet demand, diversification of fuel mix and increasing efficiency.
6.	**Capacity building and knowledge management**	The Afghanistan National Development Strategy focused on the capacity improvement of the institutions.

No	Element of EWP	Objectives of Afghanistan's power sector
7.	**Promoting and prioritizing clean energy technologies**	Afghanistan is in the process of developing its solar potential in the RE space apart from hydro that has already been exploited and policy for private participation in renewable energy is already in place to attract investment.

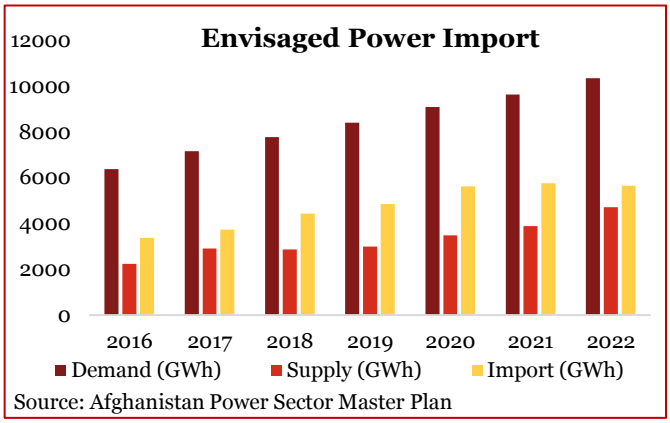
2.2. Projected supply and demand

Afghanistan's electricity demand is projected to grow at an average of 8.5% every year from 6,370 GWh in 2016 to 10,339 GWh in 2022. The increase in demand is mainly attributed to the following reasons:

Increase in connection rates in NEPS & SEPS + Increase in household consumption in NEPS & SEPS + Extension of Kabul City in the north (urban residential area) + Development of Hajigak iron and Aynak copper mines

To cater to this growing demand, the government has identified several projects to increase the domestic supply by an average of 14% every year. A total of 7,514 MW of hydropower plants and 1,600 MW of thermal power plants have been planned in the Power Sector Master Plan to meet the defined target.

But, as forecasted, this increase in domestic supply will also not be able to bridge the demand supply gap which is envisaged to be as high as 5,600 GWh by 2022. This calls for large quantity of power import from the neighbouring countries to cater to the growing demand.



Source: Afghanistan Power Sector Master Plan

Trading potential

Afghanistan, being an important energy resource corridor between Central Asian & South Asian countries, acts as the central entity in terms of power trading and has a number of electricity agreements with countries like Uzbekistan, Iran, Tajikistan and Turkmenistan.

Moreover, capacity of transmission systems is also being increased through construction and rehabilitation of various transmission lines and substations. For example, with the development of revised CASA 1000 inter-regional link, Afghanistan will be able to import additional 300 MW from Tajikistan and Kyrgyz Republic. Other, major planned projects include Kabul–Kandahar transmission interconnector linking the NEPS and SEPS, a 500 kV line between Andkhoy and Herat, a 220-kV line between Herat and Kandahar, a line connecting the Naghlu hydropower plant with new substations in eastern Kabul to create a transmission line ring around the city, rehabilitation of the SEPS 220-kV and 110-kV transmission lines.

Renewable energy development

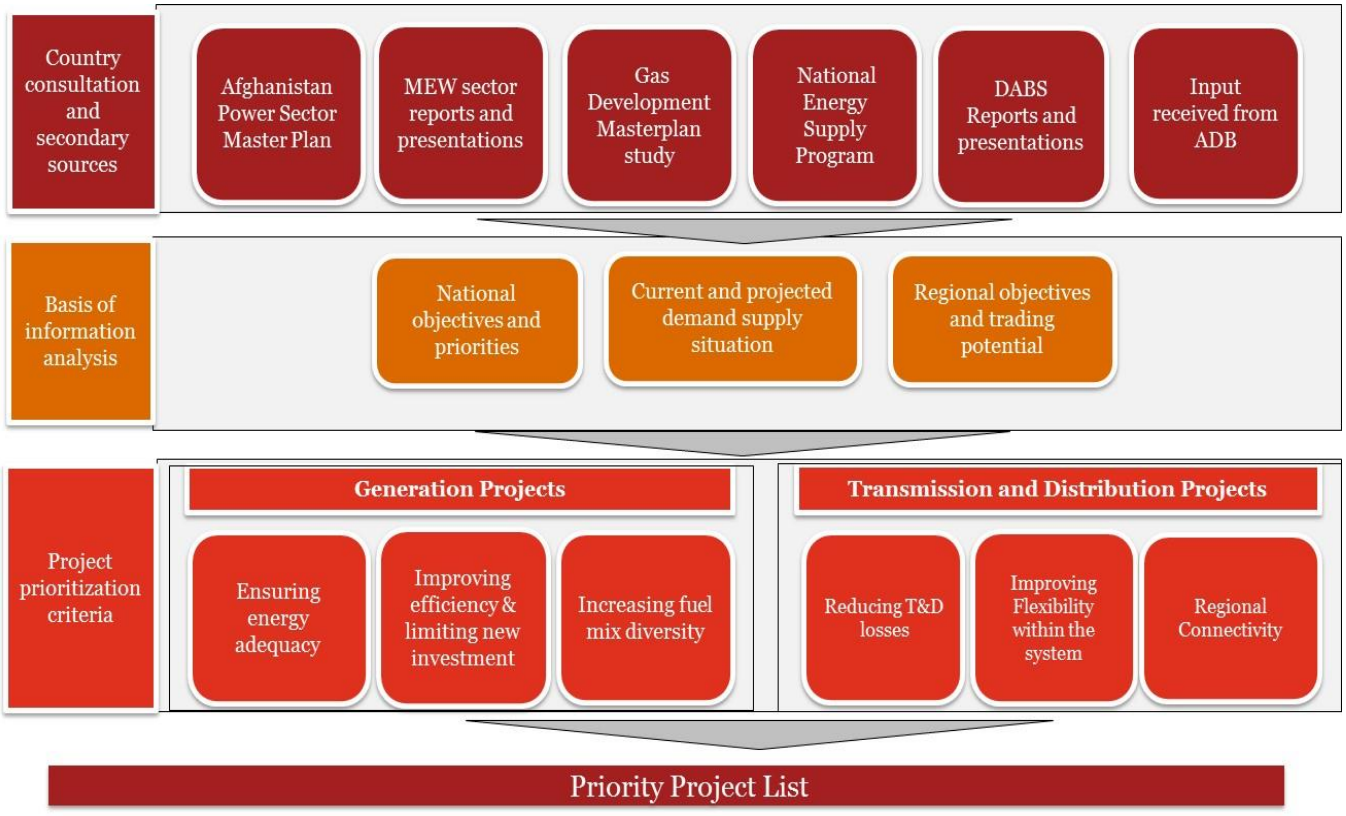
Renewable energy development in Afghanistan is mainly dominated by hydro plants, whereas other sources like solar, wind, biomass is quite negligible. Considering the low population density in Afghanistan, off-grid renewable energy projects will be more beneficial than setting up transmission grids through the country at high costs. Various micro hydro and small scale off grid solar projects have been taken over for development by private developers and the government with investment support from development partners. For example, South Korea and United Nations Commission on Human Rights also pledged support for the development of a small-scale wind energy project to provide electricity to a refugee camp in the country.

According to the Power Sector Master Plan, 12.8 MW of solar projects have already been developed and 1.5 MW of solar projects are in the construction stage. Apart from solar energy, wind energy and biomass also have high theoretical potential in the country.

In its recent initiative, the government of Afghanistan in India-Afghanistan Renewable Energy Summit, 2015, has requested Indian developers to invest in off grid renewable energy projects in Afghanistan.

2.3. Approach and key considerations for project prioritisation

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



An initial list of projects were identified from the Afghanistan Power Sector Master Plan (May 2013)[1], Afghanistan National Development Strategy (2008-2013) and in consultation with ADB. This was further

[1] Project Number: 43497 (May 2013), Islamic Republic of Afghanistan: Power Sector Master Plan (Financed by the Japan Fund for Poverty Reduction)

discussed with the CAREC energy focal points, ministries and various donor agencies. A holistic view of the power sector was obtained to understand the key government priorities, thrust areas and the existing and forecasted demand supply situation vis-à-vis the regional objectives. This provided us with an understanding of the priorities for the power sector based on which we worked out the key considerations/ criteria for project prioritisation. 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 table below 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 adequacy	• To achieve energy adequacy and reduce power imports, the key is to focus on increasing current power generation capacity. • Afghanistan relies heavily on power imports to meet its domestic demand. • Share of power imports in the total supply increased from 36% in 2006 to 73% by 2011-12. Domestic power generation is between 800-1,000 GWh. • Afghanistan's per capita energy consumption is among the lowest globally. • It is envisaged that the share of domestic power generation will account for almost 2/3rd of the power consumption by 2032.
Improving efficiency and limiting new investments	• Rehabilitation of power plants is important in the Afghan context given the limited financing capability of the government. • Rehabilitation of existing HPPs cost ~30% of the construction cost of a new plant. • Modernisation & rehabilitation of power plants are necessary to compensate for the large gap between peak demand and available capacity.
Increasing fuel diversity mix	• Predominantly hydro-based generation mix exacerbates power shortages during winter. • Thermal generation has fallen from 213 GWh to 39 GWh between 2006 and 2011. • The key focus is to achieve a healthy balance between thermal and hydro based power generation.

Project selection criteria – Transmission projects

The table below 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 & distribution losses	• Afghanistan has very high technical & commercial loss of around 35%. • This is very high compared to other Central Asian countries, where the maximum AT&C losses are under 23%. • The current focus is to reign in these losses in the short-term.
Improving reliability within the system	• At present, only around 70% of the households in big cities (Kabul, Mazar-e-Sharif and Herat) of Afghanistan, have access to power. • One of the key goals of the Afghanistan power sector is to provide power supply to the entire population. • The Afghan government has outlined the need for sufficient power supply and towards the establishment of an integrated network for the entire country.
Regional connectivity	• The present transmission system for imports is operating at its full potential and needs expansion. • Construction of new lines needed to maximise power exports from other CAREC members such as Uzbekistan, Pakistan, Tajikistan and Turkmenistan.

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[2]. It may be noted that the proposed time frame for commissioning of these projects is between 2017 and 2023:

List of Power Generation Projects

No.	Projects	Investment type	Brief description	Key benefits	Investment requirement (USD Mn)	Project selection criteria		
						Ensuring energy security	Socio-economic considerations	Increasing fuel mix diversity
1	Surobi 2 HPP	New	The Surobi 2 hydroelectric project downstream of the Surobi 1 HPP will have an installed capacity of 180 MW and average annual energy production of 890 GWh.	The project will help meet both base load and peak load demand in the Kabul Zone besides mobilizing domestic renewable water resources.	300	✓	-	-
2	Kunar A HPP	New	The proposed 386 MW Kunar A hydropower project will be located on the Kunar River about 7 km of Asmar and have a regulation reservoir with an active storage capacity of 1.0m m^3.	The project will help to meet local electricity demand better in the Kunar valley.	2,000	✓	-	-

[2] Source: Afghanistan Power Sector Master Plan 2010

No.	Projects	Investment type	Brief description	Key benefits	Investment requirement (USD Mn)	Project selection criteria		
						Ensuring energy security	Socio-economic considerations	Increasing fuel mix diversity
3	Kunar B HPP	New	The Kunar B hydropower project is located on the Kunar River about 22 km upstream of Asmar. It has a regulation reservoir with a storage capacity of 7.0m m^3 and a 105 m high earth fill dam.	This project will improve overall power situation in Afghanistan.	600	✓	-	-
4	Baghdara HPP	New	Baghdara HPP is a storage-based project located on the Panjshir River. The installed capacity is 210 MW and the average annual energy production is 967 GWh.		526	✓	-	-
5	Gulbahar HPP	New	Gulbahar HPP is located on the Panjshir River approximately 1.5 km upstream of Gulbahar city having regulation reservoir capacity of 0.760m m^3.	Multipurpose project facilitating water use for irrigation and electricity generation.	500	✓	-	-
6	Kajaki Addition HPP	New	Additional unit of Kajaki HPP will generate 100 MW with the installation of second power house.	The project aims to increase the active storage capacity from 1.7m m^3 to 2.7mm^3.	200	✓	✓	-

No.	Projects	Investment type	Brief description	Key benefits	Investment requirement (USD Mn)	Project selection criteria		
						Ensuring energy security	Socio-economic considerations	Increasing fuel mix diversity
7	Kukcha HPP	New	Proposed 445 MW HPP along the Kukcha River in the north-east with an annual average energy production of 2238 GWh.	This projects helps to meet the demand in Faizabad.	1,400	✓	-	-
8	Kama HPP	New	The Kama hydroelectric plant will be located on the Kunar River immediately upstream of its confluence with Kabul River. Proposed installed capacity is 145 MW.	Multipurpose project facilitating water use for irrigation and electricity generation.	270	✓	-	-
9	Sheberghan TPP	New	Proposed 200 MW plant would be tied into the NWPS grid and will draw from the existing natural gas wells.	The project will help diversify the current energy mix.	450	✓	-	✓
10	Kilagai HPP	New	Kilagai HPP is an irrigation and power supply project. It will benefit people in Baghlan province.	The project will ensure reliable supply of water for irrigating land; provision of water to newly irrigate; hydropower generation of 60 MW to benefit producers and consumers.	250	✓	-	-

No.	Projects	Investment type	Brief description	Key benefits	Investment requirement (USD Mn)	Project selection criteria		
						Ensuring energy security	Socio-economic considerations	Increasing fuel mix diversity
11	Olambagh HPP	New	The Olambagh hydropower project is located on the Helman River in Kandahar Province. The installed capacity is 3 x 30 MW and the average annual energy production is 443 GWh.	It will ensure better electricity supply in adjoining regions.	400	✓	-	-
12	Naglu MW Solar PV	New	The project proposed installed capacity is 100 MW.	It will help diversify the fuel mix bringing in additional RE generation.	180	✓	-	✓
Total					**7,076**			

- Investment requirement for Project No. 1 – Project No. 11 are as per estimates from the document "Islamic Republic of Afghanistan: Power Sector Master Plan, May 2013 "
- Investment requirement for Project No.12 is based on feedback received from ADB

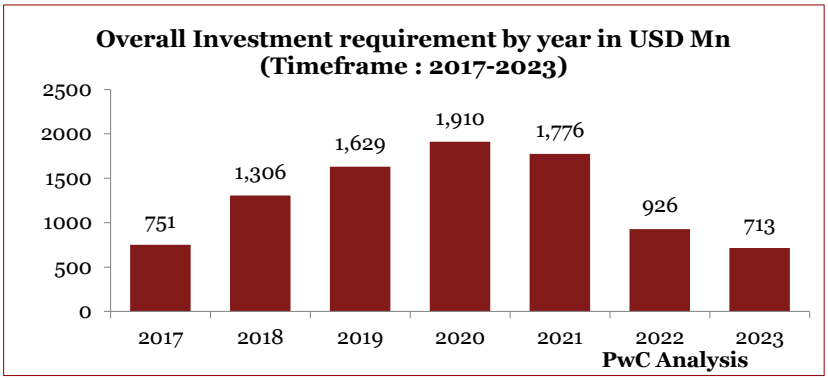
List of Power Transmission Projects

No.	List of Power Transmission Projects	Investment type	Brief Description and Key Benefits	Investment requirement (USD Mn)	Project Selection Criteria		
					Creating a unified national power transmission network	Reducing T&D losses	Evacuation to key demand centres
1.	TKM-AFG-PAK 500-kV project through western-southern route	New Transmission Line	Proposed 500 km long TKM-AFG-PAK 500-kV project through western-southern route will improve power supply to Afghanistan.	500	✓	✓	✓
2.	Connection to Pakistan	New Transmission Line	The connection to Pakistan should be of 500 kV design and the line will start from the new 500 kV substation at Arghandi, which will be part of the Hindu Kush crossing project. It will present an opportunity for power exchange from Pakistan once surplus power in Afghanistan or from the neighbouring countries in the north is available.	114	✓	✓	✓
3.	Energy Supply Improvement Investment Program	New Transmission Line	Project will reinforce ongoing projects and finance new investments to boost energy trade and regional cooperation,	1,220	✓	✓	✓

No.	List of Power Transmission Projects	Investment type	Brief Description and Key Benefits	Investment requirement (USD Mn)	Project Selection Criteria		
					Creating a unified national power transmission network	Reducing T&D losses	Evacuation to key demand centres
			strengthen the country's energy infrastructure, increase energy supply to accelerate electrification rate, and improve operational efficiency in the sector.				
4.	Charikar to Bamyan.220 kV TL	New Transmission Lines	Proposed 125 km 220-kV transmission line from Charikar to Bamyan.	100	✓	-	✓
Total				**1,934**			

- Investment requirement for Project No.1 and 4 are as per estimates received from ADB feedback
- Investment requirement for Project No.2 is as per estimates from "Islamic Republic of Afghanistan: Power Sector Master Plan, May 2013 "
- Investment requirement for Project No.3 is estimated based on the total cost from ADB list of approved & proposed projects for Afghanistan

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



Based on the priority projects list, estimated investment requirement is **USD 9,010 million**. The entire set of projects included are envisaged to be completed between 2017 and 2023.

Key assumptions:

- TPPs and distribution projects to commence in 2017 with a completion period of 7 years;
- HPPs to commence by 2017 with a completion period of 5 years;
- Transmission projects to commence in 2018 with a completion period of 4 years.

Investment phasing

Year	2017	2018	2019	2020	2021	2022	2023
% of project (HPPs)	15%	25%	20%	20%	20%		
% of project cost (TPPs & Distribution projects)	10%	20%	20%	16%	14%	10%	10%
% of project cost (Transmission project & Solar PV project)		15%	25%	30%	30%		

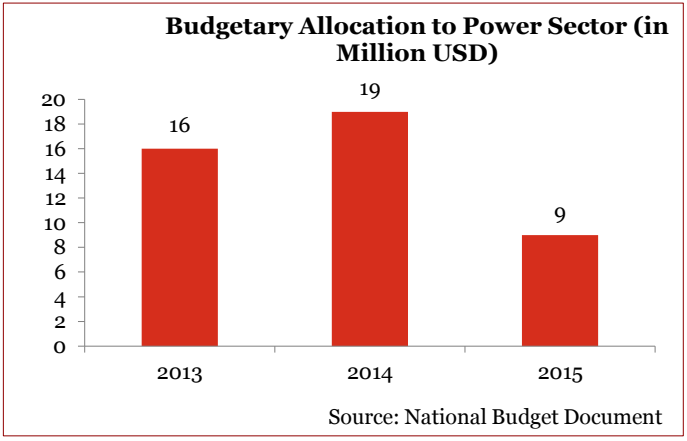
3. Options for funding and financing power sector investment plans

In line with the investment plan for Afghanistan from 2017-2023, proposed funding from national government budget, other governments, assistance from development partners (ADB and World Bank) have been estimated. A gap in financing requirement was identified which need to be filled up from other sources such as private investors, PPP, etc. The following section describes the proposed funding from each sources in details.

3.1. National government

Over the past decade, with some important reform efforts and support from development partners, Afghanistan has maintained macroeconomic stability, enforced significant structural reforms, built policy buffers, and made an enormous progress in reconstruction and sector development; however, significant vulnerabilities still remain in the country.

For sustainable development, abundant and cost effective energy supply is critical. The investment for the energy sector by the government of Afghanistan has drastically decreased from 2014 to 2015 as evident in the graph given alongside. This is mostly attributable to allocation of significant portion of the budget to ensure national security.

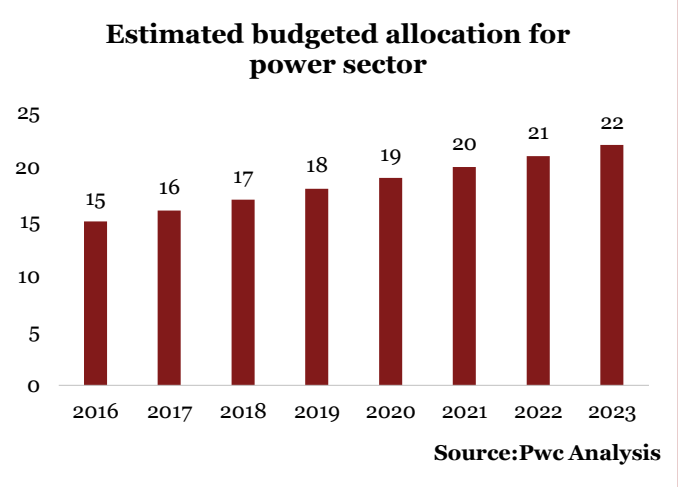


Over the medium term (2016-2023), investments in the power sector is expected to increase. The country also seeks to become a significant energy resource corridor and energy transit route between energy-rich Central Asian countries and energy-scarce economies in South Asia.

Government budgetary support over 2016-2023 is estimated at over 133 Mn USD based on the following assumptions:

- Average GDP growth of 5.6% till 2023 (as per IMF projections till 2020).
- The budgetary support was assumed to be 0.07% of GDP based on trend between 2013 and 2015.

Most of the investments from the government budget in power sector is for construction of dams/ hydropower projects and building transmission network to ensure power supply reliability and energy security.

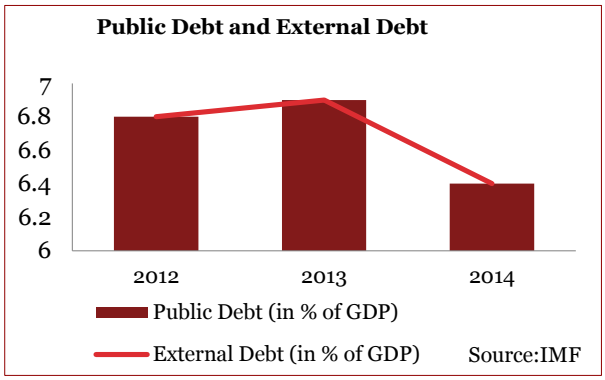


Government's ability to borrow

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

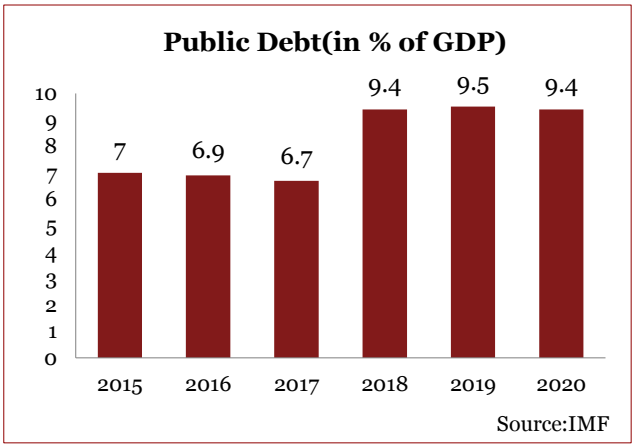
Debt sustainability analysis

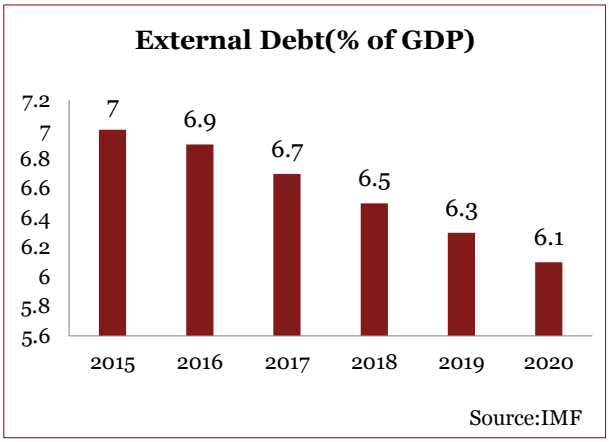
Debt levels in Afghanistan are moderate but large expenditure needs and limited domestic revenue capacity in the economy indicate high dependence on financing by the development partners.



Extensive debt relief was provided to Afghanistan after it reached the Heavily Indebted Poor Country (HIPC) completion point. Afghanistan's debt is modest but it is extensively dependent on grants which were **~43.4%** of GDP in 2013. In 2014, total public debt was 6.4% of the GDP which consist of only external debt and no domestic debt. According to IMF, under a scenario of low grant financing, the present value of public debt reaches about 130% of GDP. Public external debt is at high risk of distress according to the IMF-World Bank framework.

The external debt is expected to decline from 2017 and reach around 6.1% of the GDP in 2020.





- The public sector debt is 7% of GDP in 2015.
- As per IMF projections, total value of public debt is expected to increase in 2018 and will be around 9.4% of GDP by 2020.
- Under the current scenario, Afghanistan's borrowing capacity is severely restricted and it would continue to depend on foreign grants in the medium term.

3.2. Assistance from development partners

The major development partners in Afghanistan are the World Bank, ADB, JFPR, KfW, USAID, etc. The table below lists some of the engagements of the development agencies in the power sector of Afghanistan.

Development Partner	Project scope	Duration	Amount (USD Mn)
World Bank	Emergency Power Rehabilitation Project	2004-2013	125
	Kabul Aybak/Mazar-e-Sharif Power Project	2007-2013	57
	Afghanistan Power System Development Project	2008-2013	60
	Naghlu Hydropower rehabilitation Project	2014-2022	80
	Central Asia South Asia Electricity Transmission (CASA)	2014-2019	400
ADB	Infrastructure Rehabilitation and Reconstruction Project	2003-2007	45.1
	Power Transmission and Distribution Project	2005-2013	50
	Regional Power Transmission Interconnection Project	2007-2013	47
	MFF Energy Sector Development Investment Program, Tranche 1	2008-2018	164
	MFF Energy Sector Development Investment Program, Tranche 2	2009-2018	81.5
	MFF Energy Sector Development Investment Program, Tranche 3	2010-2016	75.4

Development Partner	Project scope	Duration	Amount (USD Mn)
	MFF Energy Sector Development Investment Program, Tranche 4	2012-2017	200
	MFF Energy Sector Development Investment Program, Tranche 5	2013-2019	49.1
	North–South Power Transmission Enhancement Project	2013-2017	216
KfW	Rehabilitation of Pul-e-Khumri Hydropower Plant	2007-2016	42
	Decentralized Power Supply in Northern Afghanistan	2011-2016	48
	NEPS Connecting Northern Towns (Phase I–II)	2011-2017	49
GIZ	Renewable Energy Development	2007-2015	45
USAID	Afghan Clean Energy Program	2010-2011	23.8
	Technical Support to the Afghan Energy Information Center	2009-2011	7.2
	Tarakhil Power Plant Operations and Maintenance Program	2010-2012	28.2
	Kabul and Kandahar Commercialization Support Projects	2009-2012	59.9
	Kandahar Helmand Power Program	2010-2016	266
	Power Transmission Expansion and Connectivity Project	2012-2018	814
	Sheberghan Gas Development Project	2011-2016	135

Assistance from multilateral/ bilateral financing institutions will play a pivotal role in Afghanistan's power sector. The table below provides an analysis of the trends of multilateral support to the power sector in Afghanistan.

No	Sector	Current Degree of Multilateral Support	Expected Trend	Comments
1	Power Generation	Medium	↑	Most of the power generation in Afghanistan is owned by the government; hence, is envisaged that assistance from the development partners will continue to be of importance.
2	Power Transmission	Medium	↑	The transmission sector requires more support from multilateral financing institutions as the government plans to establish transmission lines in the medium term in order to improve power supply reliability and energy security.
3	Renewable Energy	Low	↑	Currently, the requirement for assistance of the development partner is low but it is likely to increase in future as the government plans to utilise the RE sources for generation.

Assistance from the development partners – Future trends

It is expected that ADB and World Bank will continue to be amongst the top development partners. It is estimated that Afghanistan will receive USD 796 Million worth of assistance from ADB and USD 640 Million worth of assistance from the World Bank over 2017-2023[3].

ADB estimates

Year	Amount (in Mn USD)	Remarks/Assumptions
2016	165	Based on COBP
2017	0	
2018	136	
2019	120	Based on the 10 year allocation of USD 1.2 Billion
2020	120	

[3] Based on Country Partnership Strategies/ Country Operations Business Plan

Year	Amount (in Mn USD)	Remarks/Assumptions
2021	140	
2022	140	
2023	140	
Total	**796**	

WB estimates

Year	Amount (in Mn USD)	Remarks/Assumptions
2016	100	Based on historical trends and projected commitments
2017	100	
2018	100	
2019	100	
2020	110	
2021	110	
2022	110	
2023	110	
Total	**640**	

Further, based on the past trend of financing (USD 200 Million per year) the estimated financing by the development partners (mainly USAID, KfW and GIZ, etc.) over 2017-2023 is **USD 1,400 Million**.

Thus, the total quantum of support from key development partners of power sector projects is estimated to be **USD 2836 Million** over 2017-2023.

3.3. Other governments

India is one of the significant investor in Afghanistan's power sector and has been associated with a number of development projects in Afghanistan. Recently, India has helped to construct the 202 kms long 220 kV DC transmission line from Pul-e-Khumri to Kabul and a 220/110/20 kV sub-station at Chimtala. India was also associated with rebuilding the Salma Dam power project in Herat Province.

3.4. Envisaged funding probability of priority projects (generation, transmission and distribution)

Overview of the investment plan and financing sources for 2017-2023

Investment plan and funding pattern, 2017-2023

It is envisaged that from 2017-2023, the estimated funding requirement for development of the power sector is 9,513 Million USD. Further, it can be estimated that the power sector is likely to receive 133 Million USD as government budgetary support and 2,836 Million USD as assistance from the development partner (from sources such as World Bank, ADB and sourced from private sector and assistance from other countries) over the years 2017-2023.

Envisaged funding probability of priority generation projects

Projects	National government	Other governments	Development partners	Private investment
Surobi 2 HPP	Low	Medium	High	Low
Kunar A HPP	Low	Medium	High	Low
Kunar B HPP	Low	Medium	High	Low
Baghdara HPP	Low	Medium	High	Low

Projects	National government	Other governments	Development partners	Private investment
Gulbahar HPP	Low	Medium	High	Low
Sheberghan TPP	Low	Medium	Medium	High
Kajaki Addition HPP	Low	Medium	High	Low
Kukcha HPP	Low	Medium	High	Low
Kama HPP	Low	Medium	High	Low
Kilagai HPP	Low	Medium	High	Low
Olambagh HPP	Low	Medium	High	Low

Envisaged funding probability of priority transmission projects

Projects	National government	Other governments	Development partner	Private investment
Connection to Pakistan	Low	Medium	High	Low
Herat Interconnector	Low	Medium	High	Low
Energy Supply Improvement Investment Program	Low	Medium	High	Low

3.5. PPP in Afghanistan

In Afghanistan, the first step towards the development of PPP framework was taken back in 2008 with the introduction of the Law on Public Procurement. It provides the guideline for contract award for private investment in the construction & operation of public works and other service concessions. However, the maturity of PPP process has been limited except for the formation of Central PPP unit under the Ministry of Finance. The purpose of this body is to provide quality technical assistance to the political decisions on all crucial financial aspects of various types of projects (e.g. public budget sustainability, public services tariffs affordability, etc.).

The Ministry of Finance and the PPP Unit have been jointly working on draft PPP regulations along with the revision of existing procurement law. As both the regulations and the procurement law have not yet been revised, according to the Ministry of Justice, projects cannot be tendered as PPPs unless they get an exception from the National Procurement Authority formerly known as the Special Procurement Authority).

However, along with the Ministry of Finance, other ministries like the Ministry of Public Health are also setting-up peripheral PPP units whose objectives will be different like development of feasibility studies and drafting of contracts for PPP projects, before applying to the Ministry of Finance.

Key Issues facing PPP development

- The improvement to the legislative framework aimed at strengthening PPPs is still at the “work in progress” stage. Key amendments to the procurement law are still pending and need to be addressed immediately.
- Owing to ongoing fiscal constraints and risks involved in investing in Afghanistan, at least initially, PPP development in Afghanistan will depend on support from multilateral funding agencies to a great extent.
- Lack of significant PPP experience and institutional and individual capacity. Therefore, capacity building and training to build institutional and individual capacity will be required to enable the identification, development and implementation of PPP projects.

Essential requirements for achieving successful PPPs in Afghanistan

- Development and introduction of a specific PPP Legislation and/or PPP Law
- Developing an effective framework to address economic development and sustainability
- Transparent and competitive procurement process
- Existence of capable private players/ consortiums
- Appropriate risk and authority sharing between the public and private sectors

4. Barriers to investments and reform action plan for facilitating investments

4.1. Barriers to investment in the power sector

Absence of sector regulator

The draft Electricity Law has emphasised the need for establishment of Afghanistan Electricity Regulatory Authority (AERA) to regulate the Electricity Services market and to assure a properly functioning market for such Electricity Services. The AERA shall have an organisational structure in the framework of the MEW, and shall be supported by dedicated revenues from electricity service licensee fees and by grants from donor agencies and international financial institutions (IFIs) processed in accordance with the provisions of law.

A five-member commission will be formed to lead and regulate the relevant affairs of the AERA. Each commission member shall have more than five years of professional experience in the Electricity Service sector. The Commission should consist of at least one power system engineer, one attorney, one economist, accountant or financial analyst, and one person with experience in an organisation which is a significant consumer of electricity. The remaining position to be filled on an at-large basis and the Commission shall have at least one woman member.

The Electricity law has been recently approved by the cabinet and the AERA is soon to be formed. This is expected to address the regulatory uncertainty in the sector impeding private investments to an extent.

Limited institutional capacity

Afghanistan has been facing war and disturbance since a long period of time; hence, it is not able to retain talent resulting in skilled workforce migrating to other countries. This is seriously hampering any reform effort being made towards the sector. The ministries and DABS are facing limited technical capacity and there are very few trained/skilled personnel available below senior levels.

Absence of a national grid

Currently, Afghanistan's power system and network is not integrated, which is important for reliable power supply. It operates in nine different 'islands' (power grids) depending on power supply sources. The different regions are supplied by different sources, and due to technical limitations these regions are not synchronised. For instance, Turkmenistan's network supplies power to the Northern provinces of Faryab, Jowzjan and Sar-e Pol and, on a separate network, partly to Herat. Uzbekistan supplies to regions of Parwan, Samangan and partly to Kabul. Tajikistan supplies to Baghlan, Balkh, Kunduz and Takhar provinces and, in summer, it transmits power to Kabul (in winter, Tajikistan faces electricity shortages itself), while Uzbekistan additionally feeds Balkh province in summer. Iran supplies electricity to partly Herat and Nimruz provinces. The south of Afghanistan, that is, Kandahar and Helmand provinces, are supplied partly by the Kajaki hydropower plant.

The absence of a uniform national grid means that the evacuation of power generated in one region cannot be transmitted to other regions. This discourages investment in power generation since power off-take is not

guaranteed and power sale gets localised. Thus, generators will not have much choice to enter in to power purchase agreements (PPA) with buyers from other island (power grid) which may be willing to pay more for the power procured.

4.2. Reform action plan for facilitating investments

In this section, we have discussed some indicative reform measures that the government may consider for facilitating investments and making the sector more attractive for private investors.

Unbundling and institutional strengthening

At present, Afghanistan is in a process of recovering from the long drawn history of war, political unrest, terrorism, etc. As such, crucial sectors like energy and power needs immediate strengthening and capacity building to enable building up of a new and renovated infrastructure for development of the country.

For this, it is important that there is clear accountability in the power sector and as such the first step may be to unbundle the single vertically integrated structure so that clear accountability can be allocated to various functions like generation, transmission, load dispatch, distribution and trading. This will also encourage investments and private participation in specific areas like generation, trading, etc. The indicative reforms are given below:

Indicative measures for institutional strengthening

- A single integrated grid should be established and clear regulations should be in place for efficient operation of the grid. For this, the different islands should be synchronised and integrated. This will ensure security and reliability in supply, increase transparency and uniformity in operations.
- The integration of the grid with other regional grids will also be crucial for providing energy security in Afghanistan and enabling its development. Focussed efforts should be made to explore various possibilities of energy and power transfer from the neighbouring countries.
- The dependence on oil as a fuel needs to be reduced and other cheaper sources of fuel should be allocated priority. This is important to reduce the cost of power and make it affordable.
- Restructuring of the power sector and unbundling of single vertically integrated body into different generation companies, different retail supply companies, Transmission Company and regional distribution companies. The transmission and distribution functions being natural monopolies may be owned and controlled by the government.
- For areas like generation and retail supply, the market might be made open (gradually in phases) and multiple players may be inducted through enabling legislative framework. This will bring competition in the sector, improve efficiency and enable more investments to come.

Setting up of an independent regulatory framework

An independent and strong regulator can provide assurance to investors that prices, outputs and inputs will not come under the pressure of 'regulatory capture' and pressures from economic and political interest groups. 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. The draft Electricity Law has emphasised the need for establishment of AERA to regulate the electricity services market and to assure a properly functioning market for such electricity services.

In general, regulators can be independent in two ways: a) from the regulated stakeholders and b) from the political authorities. The first type of independence means that the regulator should not be under the influence of the private interests of the regulated industry. The second type of independence refers to the fact that the regulator should maintain an arm's length relationship with the government. The regulator shall be protected from short term political influence.

Current scenario in Afghanistan

Currently, the functions of framing both policies and regulations of the power sector are vested with the Ministry of Energy and Water (MEW) and there is no independent regulator responsible for various regulatory functions like tariff determination, determination of standards of performance, issuing licenses, etc. The need for such an independent body has been brought out in the draft Electricity Law but the same needs to be implemented.

Roadmap

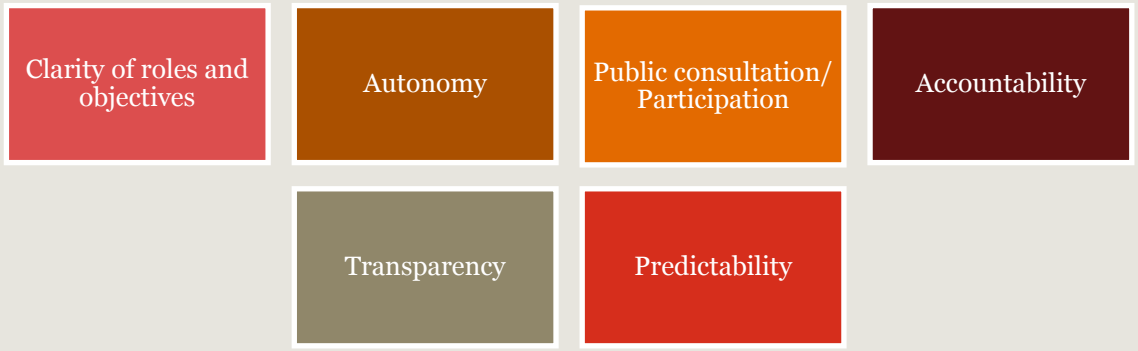
A brief snapshot of the various options for ensuring independence of sector regulator can be illustrated below:

Possible options	Task details
Formation of committee within the purview of MIE	The Ministry of Energy and Water (MEW) can make a committee to formulate a design framework for future reforms, legal and regulatory framework, and change in institutional structure. This committee can take care of the regulatory issues in the power sector
Independent agency within the MIE as an advisor	The independent committee can be assigned the role of an advisor to the decision makers of MEW initially. In this phase, the committee can be set up as an agency within the ministry without need of any change in the existing legislation
Independent agency outside the ministry	The agency may be eventually instituted as an independent agency outside the ministry. The independent agency will play an advisory role in a wide variety of regulatory issues to MEW, but will have no decision-making powers on regulatory matters. This option will require amendments in existing legislation. The agency shall be responsible for only sector regulation while the policy decisions would continue to be taken by the MIE. The agency shall have financial autonomy (regular revenue stream from license fees or appropriations of general treasury (see case study) as well as operational autonomy (authority to hire resources and experts, etc.) to operate effectively.

Case Study 1: Effective regulatory governance

In order to study the effectiveness of regulatory performance, the approach used by Stern and Holder has been presented in this case study.

Stern and Holder (1997) identify six inter related aspects of regulatory framework and provide results from a survey of regulatory practice for infrastructure industries in Asian countries.



The six pillars, as defined by Stern and Holder are mentioned below.

Characteristics	Definitions
Clarity of roles	The regulatory function is well established in the legislation and regulatory functions are clearly delineated from policy-making and commercial functions.
Autonomy	The regulatory body needs to be financially as well as administratively autonomous.
Public Consultation	A formal consultation with the public / public bodies is done before decision-making.
Accountability	The regulatory body shall be made accountable by giving the stakeholders the right to appeal (including legal right of redressal) against the decisions.
Transparency	The decisions as well as the rationale for arriving at decisions are published regularly. The transparency shall also be ensured in matters related to appointment of members, expenses of the regulator and other such matters
Predictability	The decision-making process shall be credible and key regulatory instruments or documents shall not be changed without change in the law governing them.

Promotion of renewables

In alignment with the global focus on renewables, Afghanistan also needs to focus on RE development and attract investments in the sector. Reforms need to be brought in to promote development of renewable projects and ensure financial sustainability. Some indicative measures are given below:

Indicative measures for promoting renewables

- To promote renewables and provide a clear vision, and clear and tangible targets for RE generation may be fixed along with an associated plan to meet the targets.
- Frame clear policies for providing incentives to renewable projects which ensure that the projects have affordable tariff.
- Framework should be developed to ensure off-take of power from renewable sources (mandatory procurement of power from renewables).

Appendix A: Macroeconomic overview

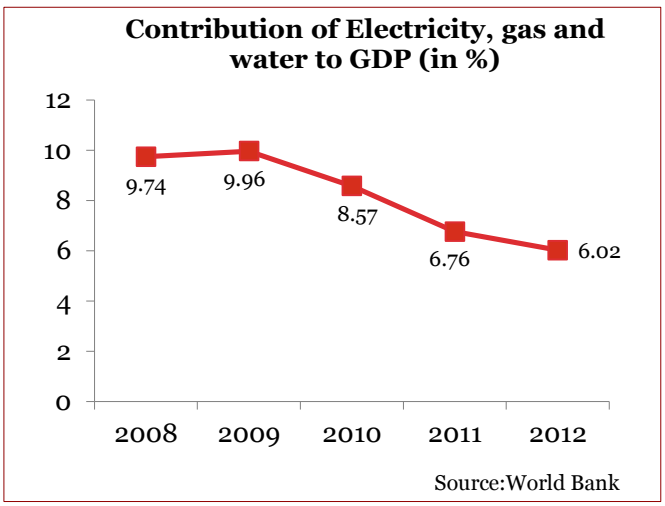
Macroeconomic overview – Historical

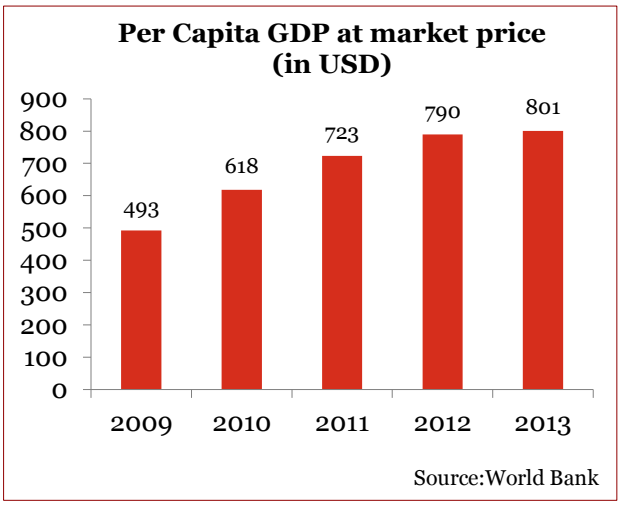
Growth rate reduced since 2013 because of deteriorating security and continuous political uncertainty that weakened consumer and investor confidence. The budget continues to be heavily dependent on support from the development partners, as grants funded 67% of national budget expenditures. In order to achieve an inclusive growth in the economy, the country needs to ensure macroeconomic stability, structural reforms, and political and security stability.

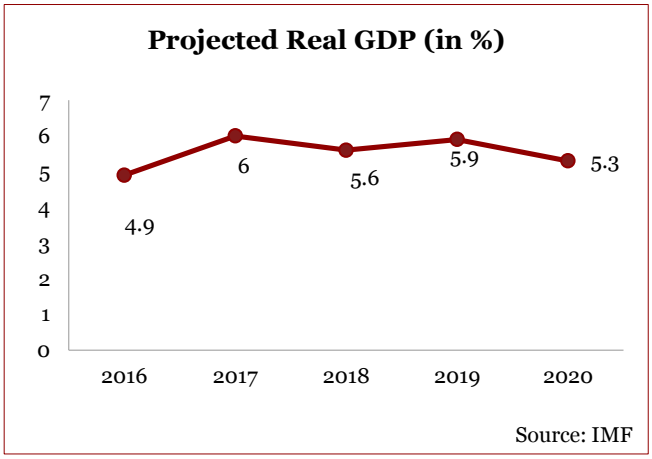
GDP by sectors (in %) (Source : ADB Outlook)				
Year	**Overall GDP growth**	**Agriculture**	**Industry**	**Services**
2008	3.6	-14.9	5.7	13.8
2009	21	44.6	6.1	17.2
2010	8.4	-6.4	6.3	18.1
2011	7.2	-7.9	9.8	12.7
2012	11.9	31.5	7.2	7.3
2013	3.2	0.0	3.1	5.3
2014	1.3	-0.1	2.4	2.2
2015	1.5	-2	1.4	2.8

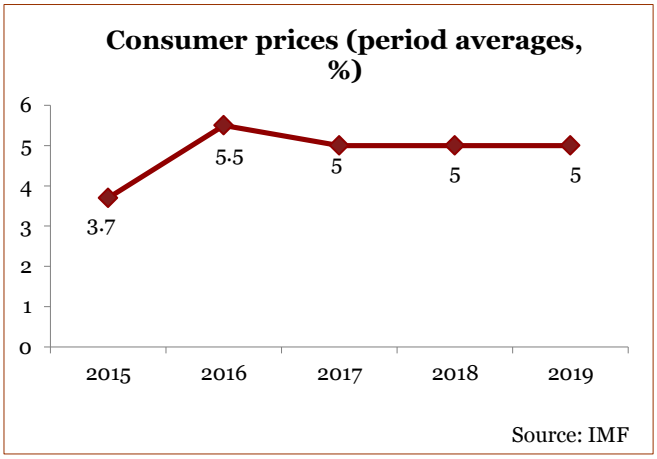
Agriculture remains the main source of real GDP growth, employment and subsistence. Increased private capital outflows in 2015, mostly due to a marked increase in emigration, put pressure on the foreign exchange market resulting in a 17% depreciation of the Afghani against the US dollar and a 300 Million USD decline in gross international reserve. In the longer term, an improved business environment and better economic governance are forecast to encourage private sector growth and the development of the natural resource sector (copper, iron ore, and oil).

More than a third of the population live below the poverty line with the per capita income of ~800 USD. Afghanistan is in the bottom 10 percentile globally (around 100 kWh per year) in terms of per capita electricity consumption. Contribution of electricity, water and gas sector to GDP has reduced due to a decline in hydropower generation and natural gas production.







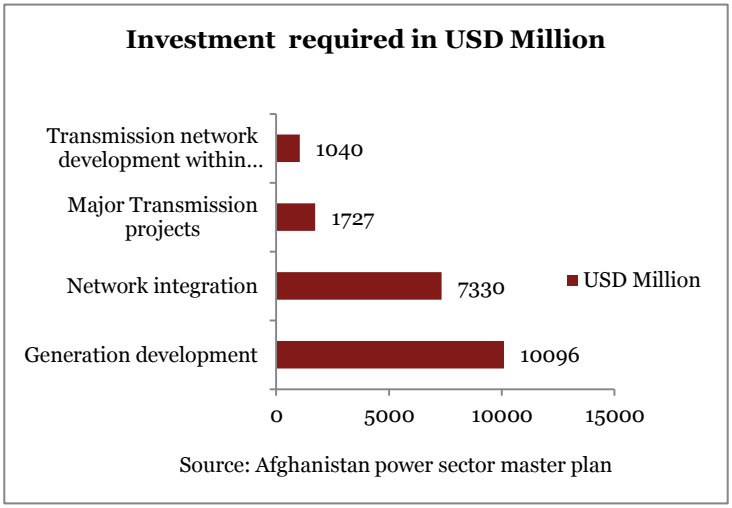


Macroeconomic overview – future outlook

- The economic growth in the medium term will be driven by an improved business environment, private sector-led growth and the development of the natural resource sector (copper, iron ore, and oil)
- Inflation is expected to be steady at 5% during the medium term with expected sensible fiscal and monetary policies, good agricultural production, and favorable international commodity prices
- Over the medium term, the GoA aims to achieve all the MDGs that would result in reduction of poverty in the economy
- Afghanistan plans to reduce its heavy dependence on foreign aid, as set out in the government's plan for its "transformation decade" from 2015 to 2024

Appendix B: Updating the energy sector development Plan for Afghanistan: Investment requirement

To ensure power supply reliability and energy security in the country, a list of greenfield and rehabilitation projects in the power generation and transmission sector was prepared. This will require a total investment of 20,193 Million USD, comprising 10,096 Million USD & 7,330 Million USD for generation development and network integration, 1,727 Million USD for major transmission projects and 1,040 Million USD for the transmission network development within the provinces till 2032. The development of all the projects on schedule will strengthen the domestic supply and will reduce import quantity from 73% to 25% by 2032.



Source: Afghanistan power sector master plan

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Important Notice

Our assessment is based on information provided by the government agencies (as applicable) and research from sources in public domain held to be reliable. If any of these are not entirely complete or accurate, the conclusions drawn therein could undergo material change. PwC will not be responsible to rework any such assertion or conclusion if new or updated information is made available. We have not carried out anything in the nature of an audit nor, except where otherwise stated, have we subjected the financial or other information contained in this report to checking or verification procedures. Accordingly, we assume no responsibility and make no representations with respect to the accuracy or completeness of the information in our report, except where otherwise stated.

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