

CPEC Energy Projects and Changing Fuel Mix

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Preamble

At the time of independence in 1947, Pakistan had total installed power generating capacity of just 60 MW which was enhanced to 119 MW in next 12 years when WAPDA was established in 1959. By 1970, the power generating capacity further increased to 1331 MW with building of Mangla Dam and functioning of several thermal and hydro power projects. The building of Tarbela Dam in 1976, further added up 3000 MW electricity into the system and by the end of 1990 total electricity generation capacity reached the level of 7000 MW. During the next 15 years i.e. from 1990 to 2005, more thermal power plants running on oil and gas were installed in the country which increased the power generating capacity three times from 7000 MW to 17,500 MW – the share of thermal power being 64% of total capacity, followed by hydro-power (33%). Other energy sources are LPG, coal and nuclear.

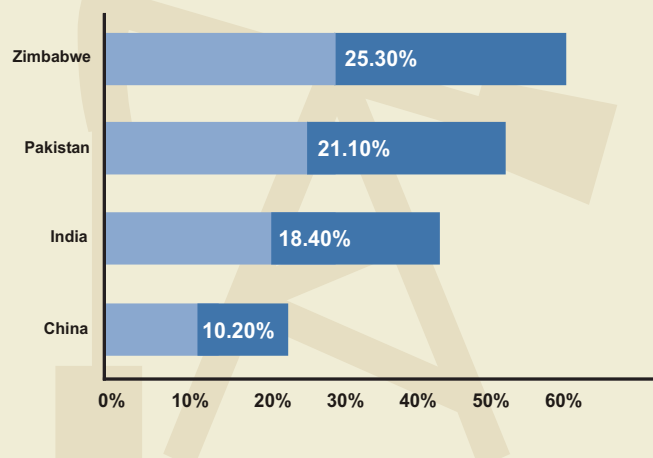
The current power generating capacity of Pakistan stands at 24,830 MW with 53% and 47% share of public and private power companies, respectively. The electricity demand is growing at an average of 6% to 7% per annum and since 2006-07 the electricity demand and supply gap is persistently going up and presently it is estimated at around 5000 MW. The main reason cited by experts for this widening demand supply gap is rising population and over-reliance on fossil fuel for power generation. This has negatively impacted national economy, especially production capacity of industries which are experiencing acute shortage of power and gas to meet timely exports. With fast depleting gas and oil reserves and the impending demand forecasts, it has become indispensable that we must explore avenues to generate more energy to meet the energy challenges and keep our industries running.

In the above backdrop, energy projects, including coal-fired, hydro, wind and solar, planned to be set up under the 'China-Pakistan Economic Corridor (CPEC)' seems a move in the right direction that would generate additional electricity to meet power shortfall. Over USD33 billion investments are to be made in CPEC energy projects under 'Early Harvest Scheme' that would be producing around 10,400 MW of electricity by March 2018. In addition, 1000 MW power will also be imported

from Tajikistan and Kyrgyzstan as part of CASA -1000 project by end of 2018. Other non-CPEC energy projects such as 1223 MW Balloki and 1180 MW Bhakki power projects would also be completed. The energy projects under CPEC would be completed by Chinese investors in Independent Power Plants (IPPs) mode and the Pakistan government would only ensure purchase of power from the investors.

“Excessive reliance on imported fuel oil for electricity Generation has led to Fuel crisis and increased cost of power supply in Pakistan”

Fossil fuel are a burden on the trade balance of many countries
Share of net fossil fuel imports in all 2015 merchandise imports



Import dependency on Fossil Fuels

Many countries around the world heavily depend on imports of fossil fuels viz. crude oil, coal and natural gas to meet their energy demands. Due to this heavy dependency, many countries, including Pakistan are facing negative balance of trade. This is also evident from the fact that China which the second largest world economy, China, spent around USD 170 billion in 2015 on fossil energy imports which constitutes one tenth of its total import value. According to WTO data, both Pakistan and India are spending around one fifth of their entire net import expenses on fossil fuels. Pakistan is ahead of India in imports of fossil fuels and spends around USD 15 billion i.e. 22 percent of its import bill. In 2015, the share of fuel oil in total import bill stood at 25% i.e. USD 11.79 billion. Excessive reliance on imported fuel oil for electricity generation has led to fuel crisis and increased cost of power supply in Pakistan.

Energy Projects under CPEC

Coal-fired power plants dominate the energy projects to be established under CPEC. Out of 17 power plants, eight are on coal-fire having installed capacity of 8,880 MW which accounts for 64.5% of total capacity. Three hydro-power plants would also be set up that would produce 2,690 MW of electricity. The total estimated cost of all energy projects is USD 21.2 billion. Table-1 summarizes the details of these 17 CPEC-energy projects:



Table 1: Summary of CPEC Energy Projects

No.	Energy Projects	No. of Projects	Total Installed Capacity (MW)	Total Estimate Cost (US Billion)
1	Coal Fired Power plants	8	8,880 (64.5%)	12.35 (58.26%)
2	Hydro Power Plants	3	2,690 (19.5%)	5.62 (26.51%)
3	Wind Farms	4	300 (2.20%)	0.66 (3.11%)
4	Solar Parks	2	1,900 (13.80%)	2.57 (12.12%)
	Total	17	13,770 MW	SSD 21.2 Billion

(Source: Research by R&P Dept., ICMA Pakistan)

Now, let's analyse the different CPEC energy projects in detail.

1) Coal-Fired Power Projects

There are eight coal-based power plants to be set up under CPEC, three in Sindh; three in Punjab; and two in Balochistan

as depicted in Table-2. Excepting Gwadar and HUBCO power plants, all the other coal-fired power plants will be generating 1320 MW of electricity. Majority of the coal to be used in these power plants will be imported which could be quite expensive. We will discuss this aspect separately in this paper.

Table 2: Summary of Coal-Fired Power Projects

No.	Projects	Province	Total Installed Capacity (MW)	Estimate Cost (US Billion)	Primary Input
1	Port Qasim Power plant	Sindh	1320 (2*660 MW)	1.98	Imported Coal
2	Engro Thar Power plant	Sindh	1320	2.00	Local Coal
3	SSRL Mine Mouth Power plant	Sindh	1320 (2*660 MW)	2.00	Local Coal
4	Rahim Yar Khan Power plant	Punjab	1320	1.60	Imported Coal
5	Sahiwal Power plant	Punjab	1320	1.60	Imported Coal
6	Gwadar Power plant	Balochistan	300	0.60	Imported Coal
7	HUBCO Power plant	Balochistan	660	0.97	Imported Coal
8	Muzaffargarh Power plant	Punjab	1320	1.60	Imported Coal
	Total		8,880	12.35	

(Source: Research by R&P Dept., ICMA Pakistan)

2) Hydro Power Projects

Three hydro power stations would be constructed viz. Suki Kinari in KPK; Kohala in AJK and Karot power station that

would serve both AJK and Punjab. The total electricity generation would be 2,690 MW and the entire cost of these projects would be around USD 5.62 billion.

Table 3: Summary of Hydro Power Projects

No.	Projects	Province	Total Installed Capacity (MW)	Estimate Cost (US Billion)	Primary Input
1	Suki Kinari Power station	KPK	870	1.80	Hydel
2	Kohala Power station	AJK	1100	2.40	Hydel
3	Karot Power station	AJK/Punjab	720	1.42	Hydel
	Total		2,690	5.62	

(Source: Research by R&P Dept., ICMA Pakistan)

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3) Wind Farm Projects

Four wind farms would be established under the CPEC, all of them in the Sindh Province, being

close to the coastal belt. The electricity generated from these small wind farms would be only 300 MW.

Table 4: Summary of Wind Farm Projects

No.	Projects	Province	Total Installed Capacity (MW)	Estimate Cost (US Billion)	Primary Input
1	Dawood Wind Farm	Sindh	50	0.13	Wind
2	UEP Wind Farm	Sindh	100	0.25	Wind
3	Pakistan Wind Farm	Sindh	100	0.15	Wind
4	Sachal Wind Farm	Sindh	50	0.13	Wind
	Total		300	0.66	

(Source: Research by R&P Dept., ICMA Pakistan)

4) Solar Park Projects

There are only two solar energy projects under CPEC that will be constructed in Punjab. These

solar parks that cost around USD 2.57 billion will be generating 1900 MW of Electricity.

Table 5: Summary of Solar Park Projects

No.	Projects	Province	Total Installed Capacity (MW)	Estimate Cost (US Billion)	Primary Input
1	Zonergy Solar Park	Punjab	900	1.22	Solar
2	Quaid e Azam Solar Park	Punjab	1000	1.35	Solar
	Total		1,900	2.5	

(Source: Research by R&P Dept., ICMA Pakistan)

Coal's Share in Global Electricity Generation

Coal plays a dominant role in electricity generation worldwide. Coal-fired power plants currently produce around 41% of global electricity and in many countries the percentage of electricity produced is more than 50 percent. Table-6 lists down

the countries where highest percentage of electricity is generated from coal source.

As can be seen, Pakistan is standing down the list with a meager 0.2% share which point towards the fact that there is huge potential for generating electricity through coal. As estimated,

there is potential for 100,000 MW of coal-based electricity generation in Pakistan, highest being from huge coal reserves in Thar. The main reason for hitherto nonutilization of coal as energy source in Pakistan is lack of modern technology and our dependence on imports for coal requirement.

Coal Imports by Pakistan

Pakistan annually imports around 5 million tons of coal, mostly coking coal for the steel industry and non-coking coal for the cement industry. It is expected that with the setting-up and operation of several coal-fired power plants under CPEC during next two to three years, the total volume of coal imports would go up appreciably to 15 to 20 million tons annually. This would definitely add to the cost of imports and impact the trade balance.

“The main reason for hitherto non-utilization of coal as energy source in Pakistan is lack of modern technology and our dependence on imports for coal requirement”

It is important to note here that in anticipation of immense demand for cement in different CPEC-related projects, most of the Pakistani cement manufacturers have announced expansion plans, which means that imports of non-coking coal by the industry will also increase substantially.

Coal – A missing link in Pakistan’s Energy Mix

Coal has been and remains the missing link in Pakistan’s energy mix. As indicated earlier, the share of coal in electricity generation is just 0.2 percent which is quite negligible, keeping in view huge coal reserves in Pakistan, especially in Thar (Sindh). The following figures bears testimony to the coal potential in our country:

Sindh	186 billion tons
Punjab	235 million tons
Balochistan	217 million tons
KPK	90 million tons
AJK	9 million tons

As part of CPEC’s early harvest projects, around USD 5.8 billion worth of coal-fired power projects would be completed by early 2019 which would increase the share of indigenous coal in electricity generation to almost 30 percent by the year 2030. This means that around 30 million tons of coal needs to be mined annually.

Pakistan is now moving from gas dominated energy mix to coal. Let’s have a look at the current and proposed energy/Fuel mix of

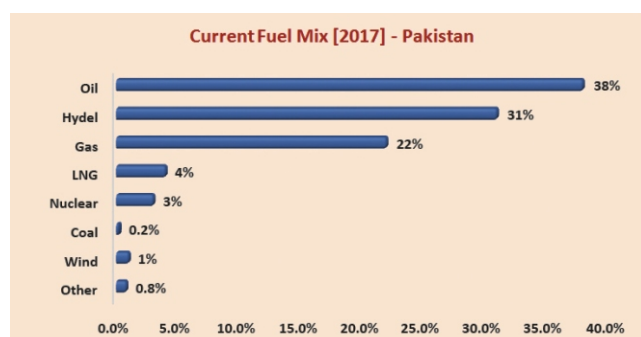


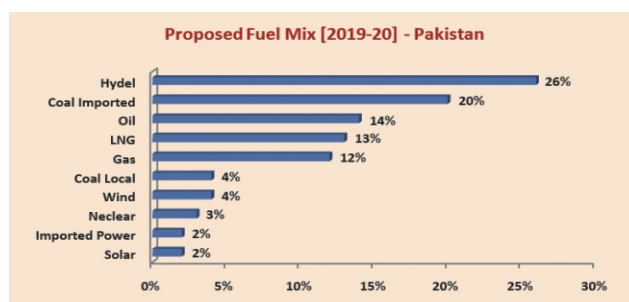
Table 6: Global Electricity Production from Coal (as % of total energy)

No.	Country	% of Electricity from Coal
1	South Africa	93%
2	Poland	83%
3	India	75%
4	China	73%
5	Kazakhstan	72%
6	Australia	61%
7	Indonesia	53%
8	Czech Republic	52%
9	Greece	51%
10	Germany	46%
11	Bulgaria	45%
12	USA	40%
13	Malaysia	38%
14	Japan	34%
15	Denmark	34%
16	Turkey	31%
17	UK	30%
18	Pakistan	0.2%

(Source: World Bank Data)

Pakistan, keeping in view of increasing coal’s share in electricity generation:

Currently, Pakistan is dependent heavily on imported oil for electricity generation which is around 38 percent, followed by 31% from Hydel and 22% from Gas. Other components of fuel mix are LNG, Nuclear, Coal etc.



From the proposed fuel mix 2019-20 chart, it is quite evident that share of imported coal in power generation is likely to be 20 percent, whereas share of local coal would be 4 percent. The reliance on imported coal would not be feasible as it would add to the cost of imports. There are already some after-thoughts in the government circle to reduce the percentage share of coal-fired power projects in the mix of CPEC energy component.

In addition to building up of new dams for producing hydro-electricity, it would also be more feasible for the government to utilize the immense coal reserves potential and increase share of local coal in CPEC projects.

Merits and Demerits of Coal and Thar Coal Project

Let’s have a look at the merits and demerits of coal as an energy source with special reference to the importance of ‘Thar Coal’ which constitutes the biggest share in overall coal reserves in Pakistan.

Table 7: Merits and Demerits of Coal as Energy Source and Thar Coal Reserves

No.	Merits	Demerits
Coal as Energy Source		
1	Coal is cheapest source of fuel for electricity generation	Coal burning is not considered to be environment friendly
2	Coal is mostly available indigenously and easily sourced	Coal-fired power plants are harmful for environment/climate
3	Tariff rate of coal-based power plants are lower	Coal mining is dangerous and explosions are common
4	Many developed countries still rely on coal-based electricity	Countries relying on coal may be accused of eco-dumping
5	Coal energy is affordable due to its stable price unlike others	Pakistan imports coals which is burden on foreign exchange
6	Power generation scale of coal is great as compared to others	
7	Coal mining is a labour-intensive industry and as such create jobs	
Thar Coal Reserves		
8	Pakistan has one of lowest carbon footprint in the world	Coal reserves at Thar has lower heating values
9	Pakistan is not in top 20 list of countries affecting global warming	Thar coal is only good for mine mouth power generation
10	Thar has highest and best reserves of coal in the world	Coal transport from Thar to other destinations is not feasible
11	Thar coal is far superior than other lignite mines in the world	Absence of rail tracks for coal transportation from Thar
12	Thar is a viable option for Pakistan to produce electricity at Thar	
13	Thar coal project may feed coking coal for steel industry	
14	Thar lignite can be transported to India, China, Germany etc	
15	Thar coal-generated power can reduce power shortage	
16	New technology has enabled environment-friendly coal power	

(Source: Research by R&P Dept., ICMA Pakistan)

Environmental Concerns

Some quarters within Pakistan and abroad are projecting that the government should not opt for coal-fired power plants for electricity generation due to environmental considerations. ICMA Pakistan research reveals that the environment factor is though quite important; however, electricity generation from coal is still a 'choice' for many countries in the world, despite the fact that they are contributing towards environmental pollution. It is worth pointing out here that as per global ranking the top countries which are contributing towards 'global warming' include USA, China, Russia, Brazil, India, Japan and Germany. Pakistan does not come in the list of top 20 countries and even if we go for generating all our energy through coal, Pakistan would still be too behind these countries.

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Conclusion and Recommendation

There is every reason for Pakistan to go for coal-fired power plants to generate electricity for resolving the energy crisis in the country, subject to the condition that modern technology be used for minimizing the environmental hazardousness. The Integrated Gasification Combined Cycle (IGCC) technology is being adopted by coal power plants these days which need to be acquired by Pakistan.

Secondly, the government should re-visit the energy portfolio of CPEC by insisting the Chinese government to bring modern technology for utilizing the indigenous coal, especially in Thar for reducing dependence on imported coal. Though, for time being, imported coal may also be used by CPEC energy projects with option to convert to the local coal in due course of time. At the same time, CPEC energy projects should also make it mandatory for Chinese firms to transfer technology and capacity building of human resource for local industrialization.