China-Pakistan Economic Corridor as a Viable Economical Solution to Energy Shortfall in Pakistan

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Abstract

Energy is the backbone of any country which stabilizes other segments and sectors of any country. Pakistan has been facing energy crises, in past decades due to expensive energy projection approaches, political frustration, subsidies, limited reserves, and non-implementation of modern sources. China-Pakistan Economic Corridor (CPEC) deals majorly with the energy management and administration of Pakistan to ensure the shipping of China and GDP growth of Pakistan. The initiative of CPEC in 2013, by the states of China and Pakistan has proven the management and administration of effective energy projection and distribution. The interest of both states is true in management in the sense, the energy crises of the country are minimized and the management is altering as effective. The present study is conducted from the same perspectives, highlighting the viability of CPEC for energy crisis management of the country. The study is descriptive and qualitative in approach based on previous research, articles, and CPEC projects. The results of the study expressed that CPEC is the only viable solution to the energy crises of the country, reducing the energy cost, utilizing renewable sources, altering the hydel projection of energy, eradicating provincial disputes, and ensuring future prosperity. The viability of CPEC projects for energy management was highlighted when in 2013, the future shortfall of energy was expected at 7000 MW, which was recorded as 2500 MW in 2020 which could be minimized after the completion of the CPEC energy projects. After completion of projects, the installed capacity will be reached up to 66 GW.

Keywords: CPEC, Energy Shortfall, Viable Solution

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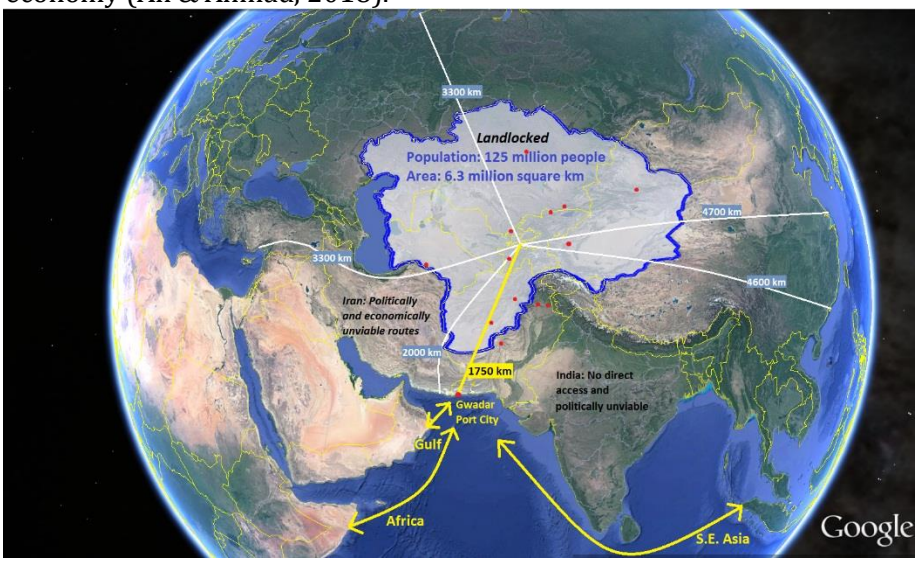
Introduction

The region, where Pakistan is located, has the immense importance of its status in of political, economic and strategical dimensions as the region has been the power hub of international powers since 20th century. Britain, USA and Russia had been intended to deploy their supremacy in this region throughout the time but after effecting the interests of the inhabitants (Ali & Ahmad, 2018). Among the world powers, China, the only neighbouring country, whose support always with Pakistan by several types of projects to enhance Pakistani economy (Ali & Ahmad, 2018).



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The geostrategic position is clear in the map, unfolding the destination via connecting with the regional countries situated on its north, west and east direction. The warm port, Gwadar, is the gateway to the landlocked countries especially of Central Asia and neighbouring. The dynamic and vital protentional of the port expressed by the figure, through which the peaceful trading and business could be accomplished. The peaceful and the shorten route, found by China, through Gwadar, is expecting the nation-wise harmonies and establishing the international order of business for the number of states.

CPEC and Energy

The long-term project China-Pakistan Economic Corridor (CPEC) is a game changer deal between two neighbouring countries; Pakistan and China who are considered as natural allies. The project has the prosperity bringing capacity for Pakistani economy with the new avenue. In May 2013, the idea of CPEC was presented by Li Keqiang (The Chinese Premier) who proposed it in his Pakistani visit. The project of CPEC is aligned with New Silk Road which is the vision of Chinese government to minimize their raw material and oil consumption through shipping. 46 Billion $ are invested by China in the project of CPEC which is going to ensure the prosperity of both nations (Bhattacharjee, 2015). The biggest foreign investment in other country, initiated in 2013, is the not only in the road but

collaboratively in the sector of energy, motorways, railway, special economic zone and communication. The linked rout of this corridor is from Kashghar (China) to Gwadar (Pakistan) which is a 1,152 km long motorway. The main objective of the corridor is giving access China to Arabian Sea to reduce the trading consumptions and enhance the exports. The geopolitical and economical significant relationship of Pakistan and China is affirmed stone by the route (Ali G. , 2015).

In the present era, the central figure of human development is energy which is known as the primary need of human growth and development. United Nations declared 2012 as the year of energy development which remarks that the modern world is in concern with the sustaining supplies of energy sources yet the fact is also present that many of countries have to face energy crisis even in the modern era around the globe. There are many challenges being faced by them as inadequacy of accession, affording, sustaining and ecological implication of the existed supplies of energy. In the present world, 1.1 billion peoples have lack of electricity access, out of which, the majority lives in the underdeveloped states (IEA, 2017).

There are strings of energy challenges, faced by Pakistan even the rate of electrification in the country is too low as compared to the neighbouring countries because no accession to electricity is faced by 51 million people still (USAID, 2016). 25% of the shortfalls of the produced energy has also been faced by the grid-linked people. The expensive electricity production is there in the country by the thermals which has over-cost and is burden on the people. Pakistan energy sector is not exploring the standpoint so far for consumer parameters.

The purpose behind the present research is understand the impact of CPEC on energy development in the country so that the geopolitical relationship of the country could be better understand in balancing the needs of neighbouring country.

Objectives

The present study is with the following aims:

- To understand the importance of Energy Resources for National Development.
- To find out the viability of CPEC Project to minimize the Shortfall of the energy needs in Pakistan.

Research Questions

The following research questions are going to be answered in present study:

1. Can CPEC be proven as the viable solution of energy shortfall of Pakistan for national development?
2. How energy supply and demand can be balanced through CPEC project in Pakistan?
3. Under CPEC project, which initiatives would be considered more to minimize the shortfall of energy in Pakistan?

Significance of the Study

The present study is unique and descriptive in its nature which is going to demonstrate the significance of CPEC in minimizing the energy crises of Pakistan. The study is unique in its nature as it has addressed the core issue of energy shortfalls in Pakistan and how these

shortages can be covered through renewing the sources and through enhancing the production capacity of the existed tools of energy provision.

Research Methodology

The present study is based on the secondary type of data in which the existed articles, journals, researches and the reports of CPEC officials, Pakistan, China and International Institutes are observed. This type of secondary data is taken under the spectrum of CPEC and current energy crises so, that the research would be undertaken in the current perspectives. The present study is qualitative and descriptive by approach, describing the current perspectives of the issues and the possible viability of CPEC.

Limitation of the Study

The present study is vast in its description so it is confined to the electrical crises of the country and the role of CPEC in the solution of electrical crises.

Energy Demand and Supply of Pakistan

Table No. 1

Energy Demanding Sectors	% of Total Energy Consuming
Agriculture	1.60%
Commercial	4%
Domestic	23.20%
Industrial	35.10%
Other Government	2.50%
Transport	33.70%

The energy demand is shown by the Table No. 2, describing the industrial, domestic and transports as the most demanding sectors of Pakistan. The demand of the energy is too high than of the supply which constitutes the gaps. Supply rate and the demand rate of electricity is respectively 5.3% and 8.1% (PEYB, 2016) which shows that the electricity shortfall in the country is ultimate reality. The gap is 2.8% which define the crises of the country which is twice bigger than the agricultural demand. The power generation installed capacity of Pakistan was 38,718 MW on June 30, 2020 while on June 30, 2019, it was 38,995 MW which show the 279 MW decreasing due to the deletion supply as some of the power projects counted failure to generate the power (SIR, 2020).

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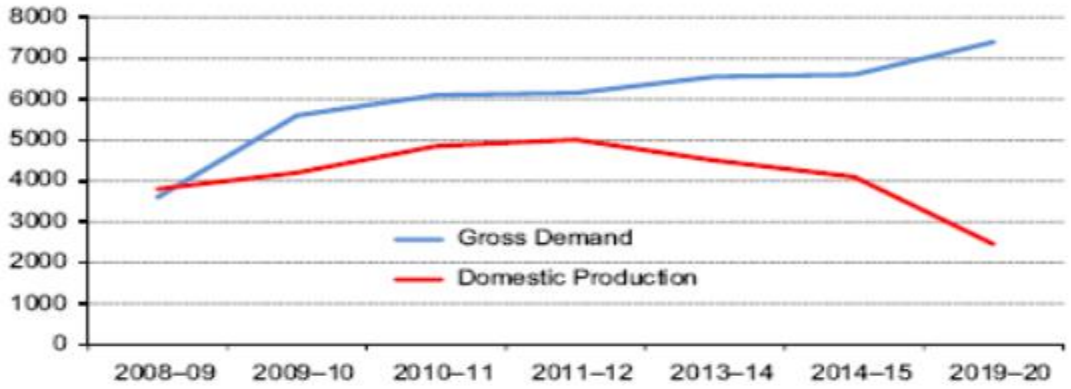


Figure No. 1
Spruces: (Khan, Mehmood, Shahzad, Chightain, & Javed, 2014)

The ongoing crises of energy started in 2007 due to lack of policies and administration. Out of total population, 40% had access to the electricity in 1994, t the shortage of the power was 2000 MW, recorded at that time. The shortage of power started initially and 8% annually recorded and electricity demand increased yearly, as 960-1300 MW was necessary to add year-wise. High scale of investment had been required for energy projection. Since 1980s, 60% of the power was generated by the hydro sources. In 1994, the first power policy in the country was initiated to plan the long-term project yet the demand and the supply had huge gaps. In 2013, the hydro sources and gas-fired sources had receptive share of 36% and 29% of the projection while 1% had the share by coal. The oil generate electricity was added to the system by 35% which was estimated as the costly production. The severe energy shortfall is in the country which is show the demand and projection gape of 7000 MW (Khan, Mehmood, Shahzad, Chightain, & Javed, 2014), The need of situation addressing is essential to minimize the gape in future to check the state from nothing scenario (Kessides, 2013).

Energy Projection Timeline
Table No. 2

Year	Oil (MW)	Hydro (MW)	Thermal (MW)	Nuclear (MW)	Wind+ Solar (MW)	Gas (MW)	Total Installed Capacity (MW)
2011		6627	13709	787			21123
2012		6627	13222	787			20636
2013		6928	13222	787	50		20987
2014		7097	14251	787	106		22241
2015		7115	16599	787	356		24857
2016	8678	2893	1751	381	1431	10241	25374
2017	6785	7116	810	1142	1465	8868	26186
2018		8365	22283	2640	994		34282

2019		10061	24216	3198	1521		38995
2020	427	9861	24817	1467	1778	369	38719

Source: Researcher's own Collection

Table No. 2.1

Year	Oil	Hydro	Thermal	Nuclear	Wind+ Solar	Gas	Total Installed Capacity (MW)
2011		31.37%	64.90%	3.73%			21123
2012		32.11%	64.07%	3.81%			20636
2013		33.01%	63.00%	3.75%	0.24%		20987
2014		31.91%	64.08%	3.54%	0.48%		22241
2015		28.62%	66.78%	3.17%	1.43%		24857
2016	34.20%	11.40%	6.90%	1.50%	5.64%	40.36%	25374
2017	25.91%	27.17%	3.09%	4.36%	5.59%	33.87%	26186
2018		24.40%	65.00%	7.70%	2.90%		34282
2019		25.80%	62.10%	8.20%	3.90%		38995
2020	1.10%	25.47%	64.10%	3.79%	4.59%	0.95%	38719

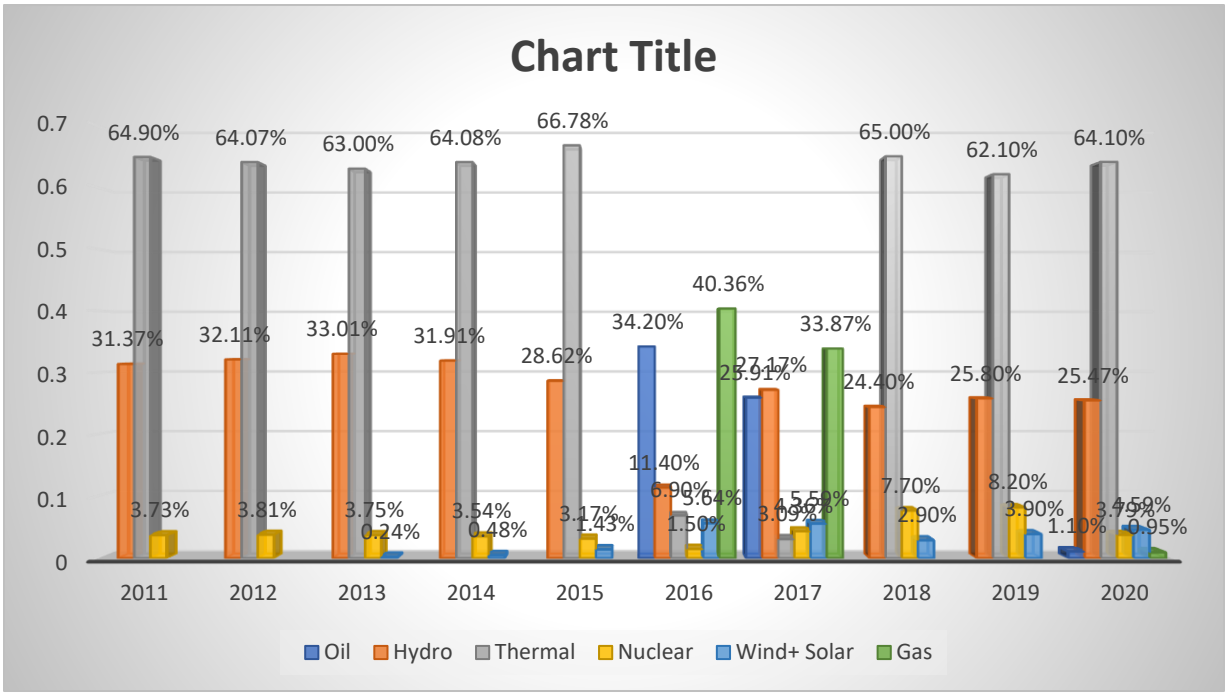


Figure No. 2

Main Reasons of Electricity Shortfalls in Pakistan

At present situation, the demand of energy is higher than supply in Pakistan while the supply-demand gap is showing the projection that the gap will be higher throughout the time. There are serious confrontations of "energy crises" in Pakistan. The main factors of the crises are the financial issues, circular debts, low gas exploitation, resources of coal and hydel (Energy, 2019). Hydel and the coal have least contribution in energy projection of Pakistan while only oil and gas are the main sources of energy project in Pakistan which are the expensive methods of electricity projection (MOPDR, 2013). The common issues of the energy sector of Pakistan are irrational prices because of overstaffs, low maintenance and subsidies. The current energy crises are also due to the incompetency in technical & management, weak governance, energy conservation lacking and unsatisfying legislature structure in Pakistan (Report, 2013). No protection is made for the end consumer of energy and no attraction is for the investor by the energy regulating bodies of Pakistan (Zeb, Haider, & Shaheen, 2015) so the ultimate result is energy crises.

Chinese's Investment in Energy Sector of Pakistan

A number of energy projects are constituted under CPEC, including infrastructure networks, economic zones and transportation (Shah, 2015). The OBOR strategy of chine is vast which encompasses this strategy which have 21st Maritime Silk road and Silk Road Economic Belt. (Small, 2016) mentioned that the major project of CPEC under 46 Billion $, are of transportation and energy sector of Pakistan. This project will strategically link Kashghar (China) to Arabian Sea which is strategically importance for both of the countries.

Energy sector of Pakistan is dealt as the largest component of CPEC in which $33 Billion are proposed to invited which is approximately 72% of the total investment. The inclusion, made in this project, is of electricity and gas generation through the natural sources (Malik: 2015). Shah (2015) says that $ 2.5 Billion is also dedicated for Iran-Pakistan Gas Pipeline Project from Iran to Nawabshah (Sindh) and Gwadar (Balochistan). The deficiencies produced by War and Disability of the infrastructure, had led to the shortage of power generation in Pakistan. These deficiencies will be resolves through these projects (Walsh: 2013). The GDP of the country has been subtracted from 2-2.5% due to the shortage of energy power. These types of shortages are going to be addressed through CPEC in Pakistan.

Energy Projects Under CPEC

No.	Province	City	Type	Project	MW	Estimated Cost (US $ Million)	Type of Priority
1	Punjab	Sahiwal	Coal	Sahiwal 2x660 MW Coal-fired Power Plant	1320	1912.2	Priority
2	Sindh	Karachi	Coal	2×660 MW Coal-fired Power Plants	1320	1912.2	Priority
3	Balochistan	Hub	Coal	HUBCO Coal Power Project	1320	1912.2	Priority
4	Sindh	Thar	Coal	Engro 2x330 MW Thar Coal Power	660	995.4	Priority

				Project			
	Sindh	Thar	Coal	Surface Mine in Block II of Thar Coal Field, 3.8 million tons / year		630	Priority
5	Sindh	Thar	Coal	SSRL Thar Coal Block-I 6.8 mtpa & Power Plant (2×660 MW) (Shanghai Electric)	1320	1912.12	Priority
6	Sindh	Thar	Coal	HUBCO Thar Coal Power Project	330	497.7	Priority
7	Sindh	Thar	Coal	Thal-Nova Thar Coal Power Project	330	497.7	Priority
8	Balochistan	Gwadar	Coal	300 MW Imported Coal Based Power Project	300	542.32	Priority
9	Sindh	Thar	Coal	Thar Mine Mouth Oracle Power Plant (1320MW) & Surface Mine	1320	To be determined, yet	Priority
10	Punjab	Lahore	Line	Matiari to Lahore ±660 kV HVDC Transmission Line Project		1658.34	Priority
11	Punjab	Bahawalpur	Solar	Quaid-e-Azam 1000MW Solar Park (I)	400	520	Priority
	Punjab	Bahawalpur	Solar	Quaid-e-Azam 1000MW Solar Park (II)	600	781	Priority
12	Sindh	Thatta	Water	Hydro China Dawood Wind Farm	49.5	112.65	Priority
13	Punjab	Jhehlum	Water	Karot Hydropower Station Jhelum	720	1698.26	Priority
14	KPK	Naran	Water	Suki Kinari Hydropower Station	870	1707	Priority
15	AJK	Kohala	Water	Kohala Hydel Project	1100	2364.05	Actively Promoted
16	AJK	Pir Panjani	Water	Azad Pattan Hydel Project	701	1650	Actively Promoted
17	Gilgit Baltistan	Gilgit Baltistan	Water	Phandar Hydropower Station	80		Potential Energy Projects
18	Gilgit Baltistan	Gilgit Baltistan	Water	Gilgit KIU Hydropower	100		Potential Energy Projects

19	Sindh	Thatta	Wind	UEP Wind Farm	99	250	Priority
20	Sindh	Thatta	Wind	Sachal Wind Farm	49.5	134	Priority
21	Sindh	Jhampir	Wind	Three Gorges Second and Third Wind Power Project	100	150	Priority
22	Sindh	Thatta	Wind	Cacho 50 MW Wind Power Project	50		Actively Promoted
23	Sindh	Thatta	Wind	Western Energy (Pvt.) Ltd. 50 MW Wind Power Project	50		Actively Promoted
Total					1318 9	21837.14	

Source: http://cpec.gov.pk/energy

Electricity Projection by Coal Sources

Pakistan is the enriched country with the natural resources; particularly with the coal reserves in Tharparkar (Sindh Province). 185 Billion Ton estimated colas is located in the District of Tharparkar. The cheaper source of electricity projection is considered as coal in the world. A survey of coal reservoirs was taken by State of Pakistan in 2004, which concluded that the reserves have the capacity of 100,000 MW electricity projection. This huge amount of electricity could be utilized for next 30 years for the country 's needs. The precious opportunity is let in Pakistan by CPEC to utilize the coal reserves for electricity projection. Out of total 23 projects, shown in Table No. 1, 10 projects are of coal which cost cheaper in electricity projection. 5 plants will use local while 5 will use imported coal in electricity projection. Subcritical technology will be used in Thar coal plants while the supercritical technology will be used in using of imported coal while more cost is needed for supercritical plant than of subcritical plants. Out of total energy of CPEC, 62.32% of the total energy will be produced after coal plants designing.

The early first project in spectrum of coal, is Sahiwal Coal Power Project, which is functioning now and the cost has estimated $1.91 billion for projection of 1320 MW electricity. This project has caused motivation for further project installation because, from Sahiwal to city of Okara, the economic activities will be increased. The installation of this early project between in these two cities is because of the security aspects. The state of Pakistan has administered the special security to ensure the functioning and projection of the plant. The two companies *Huaneng Shandong* and *Shandong Ruyi Science & Technology Group* of China 's owned, which constructed the project with the shares of 51% and 49% respectively in the project. The location of the project is 10 KM from Okara city while the land is freely provided by GOP (Government of Punjab). In installation of other projects, the coal will be imported from South Africa and Indonesia, through rails for the other supercritical project in Sindh and other Parts of Pakistan through Qasim Port Karachi (Abrar, 2017).

Hydroelectrical Means of Energy

Hydro Power plants includes the water sources which are meant to the natural sources of

energy production. The non-pollute and the clean electricity projection is meant by hydroelectrical production means which are friendly with the environment. The need of dams and the water reserves are necessary for electricity projection. The crises of the energy can be best covered by the dams which have long time effects. In CPEC, only 4 projects are actively promoted while 3 are priority based. The transformation from the hydropower project is also mostly claimed by the officials of the country especially on the Indus River.

Projection of Electricity with Wind

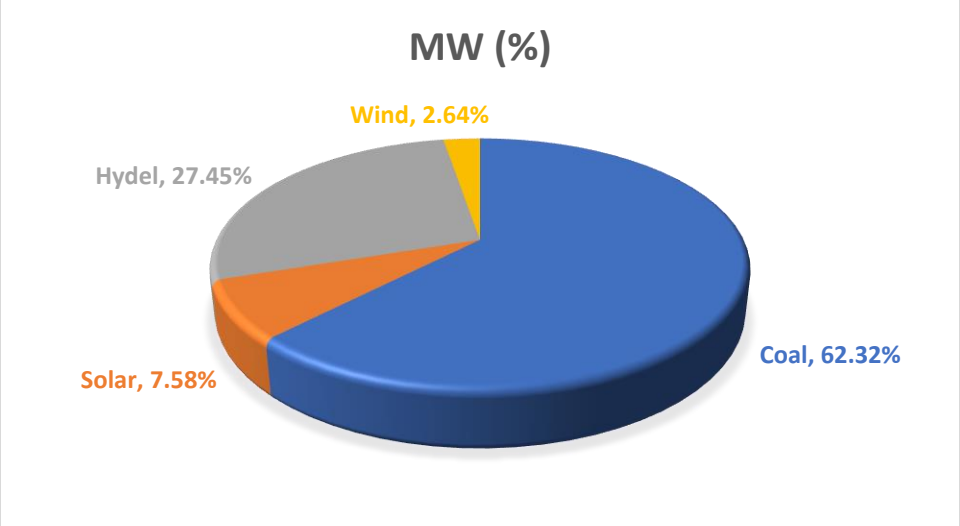
Few are the wind energy project in CPEC but in the history of Pakistan, no project had been installed as such. Wind energy is vitally produced in China so under CPEC projects, China has brought its experience in Pakistan. There is also need of awareness, projection, maximum support and installation of the projects in the country especially there, where the other sources cannot be easily provided. Under CPEC, the total wind projects are 5, out of which 3 are at priority basis to be competed.

Solar Energy Projection

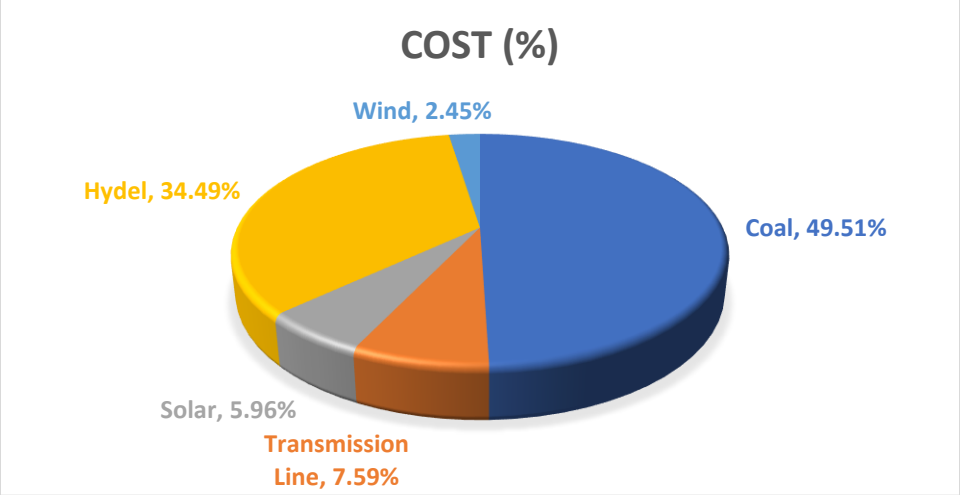
The good option for electricity projection is Solar Power plants which are also friendly with environment consisting on, no pollution and carbon exhaust. Near, Bahawalpur, Cholistan is selected for solar power plants in the province of Punjab. The addition of 1000 MW electricity will be mandatory through these two projects. Cholistan solar plants will be the largest plants of Asia, providing the gateway and opportunities to the local businessmen and market.

Table No. 3

Type of Projection	MW	Estimated Cost (US $ Million)	MW (%)	Cost (%)
Coal	8220	10811.84	62.32%	49.51%
Transmission Line		1658.34		7.59%
Solar	1000	1301	7.58%	5.96%
Hydel	3620.5	7531.96	27.45%	34.49%
Wind	348.5	534	2.64%	2.45%
Total	13189	21837.14	100.00%	100.00%



Graph No. 3



Graph No. 3(a)

Three categories of CPEC projection methods express the priority levels of the projects. Using alternator sources in spite of Water, are hydel and solar. The utilization of renewable sources, cost, less than the hydro projection. Projection of hydroelectricity as shown in the Table No, --and Graph No. --- that the hydroelectricity is costly as compare to coal electricity. The expected share in national transmission of hydroelectric is record as 27.64% with 34.49% of the cost, out of total electricity. At the same time, the cost of thermal electricity projection is noted as 49.51% but the projection is recorded as 62.32% of total electricity share in national dispatch. This method of cost reduction and projection, proves that viability of CPEC which administered by Chinese Government. Projection of solar wind electricity also cost the same which ensure the cost reduction and viably administered. India had been stopping water flows from east side of Pakistan so thermal source of energy is the ultimate and alternate major source of electricity projection of for Pakistan.

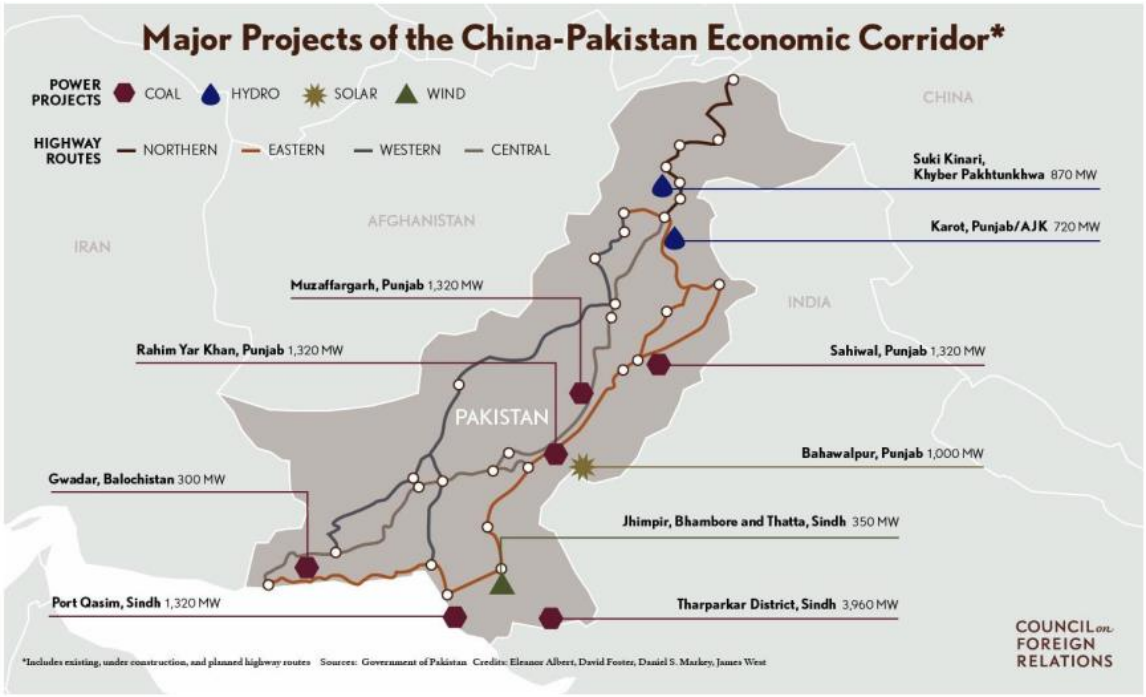


Figure No.4
Source: (Markey, 2016)

Pakistan has to suffer different political and international proxies. The geostrategic and geopolitical coalition is utmost necessary for the state of Pakistan. The Figure – show installed projects with the specific capacities. The map itself showing that China is in concern to rebuilt the energy sector for development of Pakistan and the development of his routs of Gwadar. The national interest of Pakistan, are ensure to be secured through different projects of China, as the capital of China is invested here so the coalition, ensure the mutual and strategic relationships of both countries. The figure also shows that the main cities are rebuilt by the energy projects to ensure the other sectors more securing and developing in Pakistan.

Conclusion

The integral part of Pakistani economic order is energy because there is tight bond is of energy demands and economic growth of the country. All the sectors are facing severe effects due to energy crises. The national economy had been bottlenecked by the energy crises in the past years it was requirement of vital solution for energy crises management. Between 2013-2020, 12,230 MW energy is incorporated to be added as supply in the existing capacity. The sustained delivery is affected yet because of the efficiencies of the distribution and congestion while the higher prices of energy projection in the past, also effected the supply and no vital solution could be found. CPEC is viable in reduction of electric price in the country. The adopted approach of coal and solar has given chance of price reduction. The dependent on the water sources for energy projection is recorded minimized as shown in the Table No. 2

and the Figure No. 3. The prices 12 to 18 Rupees per unit had been in the past which was due to the oil generated and hydel generated electricity. CPEC project is can be successful in cost reduction, as the transformation from the projection of electricity is there, from hydel and oil to the coal and renewable sources. Under CPEC projects, the maximum investment by Chinese Government is on the energy sector so the energy projection is the main focus. The renewable sources, as solar, nuclear, wind and biomass gas are preferably utilized by China to reduce the energy price and produce energy which is environmentally friendly. In Pakistan, construction of dams had been the matter of stretches between provinces. Kala Bagh Dam projected had been swept in the political disputes. Under CPEC project, the new and the modern sources are employed for energy projection rather than hydro. The depending on water reserved is made limited in spite the attention is paid on the thermal and solar projection of electricity (Table No. 3). The stretches of political and geopolitical injustice with the provinces by the federal government of Pakistan, had been covered up, by coming on the thermal electricity projection.

In the past, the maximum energy projects had been wasted on the beholding the eyes of politics and interference of the international establishment in the country. Proxy wars on the name of politics, geography, land and personalities had been imposed in the country by the international establishments and the native political statesmen which demolished the national interests. The CPEC project is based on the national harmony as the security of the projects is undertaken by Pakistan's army which is totally non-political administered. The viability of the project is ensuring as the projects security and the administration is in the hands of non-political hands of Pakistan. In interest of China 's geopolitical and cost reduction from shipping, the prolonged need of China is fulfilled to observe India and USA interference in the region. The long-term project is need for China also, making reduction of 12000 KM distance to 4000 KM. This cost saving project, also need the energy management which can only be possible by launching new, durable, renewable and viable energy projects in the hostage country even for own energy needs in the country on all the routs, ports and shipping places.

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