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Assessing the Potential Economic Gains of China-Pakistan-Economic-Corridor Energy Projects for Pakistan

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Abstract—As the extended part of One Belt One Road (OBOR) initiative that aims to interconnect the economic world, China– Pakistan– Economic– Corridor consists of different projects like road and railway, agricultural projects and energy projects in Pakistan. This paper aims to assess the current situation and the potential economic benefits of the energy projects of CPEC for Pakistan. Through research based on the statistical data, we find CPEC enormous contribution of \$35 billion investment in the energy sector will bring some positive changes in energy sector of Pakistan. Actually, CPEC is playing a vital role in economic development of Pakistan. The potential economic gains include the following: increasing of supply energy mix with cheaper prices—generating energy by utilizing local resources—coal, wind, solar energy and water which help decreasing energy import—decrease trade deficits, encourage Foreign Direct Investment (FDI), reducing unemployment, infrastructural development, industrial zones, trade and local manufacturing industries. This study also explores some risks and challenges to the economy of Pakistan from CPEC.

Keywords— CPEC, OBOR, Social-Economic Development; Pakistan.

I. INTRODUCTION

China-Pakistan-Economic-Corridor (CPEC) is a mega project in the history with the collaboration of China and Pakistan. Due to prodigious gravity of energy projects, CPEC is also named as Pakistan-China Energy and Economic Corridor (PCEEC) [1]. China being the leading business country of the present time, Pakistan being a good friend to China and the strategic position of Pakistan made this project happen on the soil and water of Pakistan which is considered to be utmost beneficial for both countries. Pakistan can be highly benefited from China being a technological advanced and innovative in the field of technology like making electric cars, green technology, robotic equipment and semiconductors etc. Furthermore, China being world second largest oil importer country [2]. Approximately, 54.8% of oil is imported through a

very long route of 12900 km from Persian Gulf and East Africa.



Figure 1. China-Pakistan Economic Corridor [3](Talwar, 2015)Source: Economic Times

Pakistan will also be greatly benefited with this project by fulfilling its energy needs and will overcome the energy crises to some great extent. Pak-China's relationship is actually based on four major perspectives namely economic interests and cooperation, security concerns, energy security and geostrategic interests [4]. The basic factor of socio-economic development is considered to be energy [5]. Energy has a positive impact on the development and employment opportunities which is ultimately a positive sign toward prosperity [6,7]. CPEC is expected to help Pakistan overcome these energy crises by investing \$33 billion on establishment of 22 energy projects till the end of 2020. Funding for these projects is made by China's state-owned bank (Exim Bank of China) at a discounted interest rate of 5% to 6% [8]. Pakistan is still suffering from energy crises while spending its 60% of

budget on import of fossil fuel which is a big strain for a crumbling economy like Pakistan [9]. On the other hand, until 1993, China was self-sufficient in oil but later (2000-08) with rapid growth and increased production China also fall short with energy at home and became the 2nd highest consumer of oil after United States of America (USA) in 2003 [10]. During that period china single-handedly counted for 51% of world increasing demand for energy [11]. This growing rate for oil consumption reached up to 90% before the COVID#19 and was moving higher but being affected by the virus the demand fall down by 40% (said Burkhard, (vice president and head of oil markets at IHS Markit) China drives global oil demand recovery out of corona virus collapse, Business News June 3 2020 [12]. This rising economic growth and demand for energy import, China needs access to energy suppliers through economically feasible and secure route. This is what the reality bases that China is looking at Pakistan as a dormant linkage in a regional framework of energy suppliers.

In current energy crises Pakistan is not in a position to be an energy exporter but its strategic position is so that it can be an alternative to the Energy Corridor to the Gulf countries, Central Asia and even Iran calls earnestly for energy interests of China [13]. About the benefits and importance of CPEC energy projects, many books and articles have been written and no doubt that CPEC is an enormous important step taken by Pakistan with the collaboration of Chinese government with intentions to upgrade its infrastructure, provide employment and business opportunities to the people of Pakistan, overcome energy crises, enhance economic activities, establish new industrial parks, improve its trade and bring an overall prosperity in the country [14].

Moreover, as Pakistan is not so stable economically to accomplish this mega project of CPEC. So, all the technological and financial cooperation is counted on China in order to transform and expand its energy resources [15]. China has already a very strong collaboration in nuclear energy sector, and now can be hoped to shift its contribution to other resources of total energy mix. To a lesser extent, cooperation was made in hydroelectric projects but Pakistan is also looking forward the cooperation from China under CPEC's energy projects for much-required technological expertise and financial support for renewable energy technologies like energy from wind and sun [16].

This paper aims to assess the economic benefits of the energy projects of CPEC for Pakistan. As there maybe controversy concerning of the win-win effects of the constructions of the CPEC energy projects, the findings in this paper will provide rich implications for policymakers both from Pakistan and China.

II. LITERATURE REVIEW

CPEC is a versatile project which cover not only roads and routes but also the communication network, agricultural sector, energy sector, industrial sectors etc. as well. Our literature review covers two main portions. One part explains the current situation of the CEPC under the China-proposed Belt and Road Initiative while in other part the potential economic gains of energy projects for Pakistan are explained. Since it is

commenced and initiated six years ago, CPEC, a flagship launched project of the China-proposed Belt and Road Initiative - with a gigantic financial investment and a wide range of infrastructure and energy projects, some of which have already completed and some are still under construction all over Pakistan - has nowadays become the talk of the town throughout the economic world [17]. Pakistan is lucky enough and pleased being a part of the Belt and Road Initiative (BRI) [18]. We can put the importance of BRT on the top of the list for Pakistan while consider the fact that Pakistan is a country which has a very limited access to the financial and capital market- such as Asian Development Bank (ADB), International Monetary Fund (IMF) and World Bank. So, the policy of BRI – proper development of infrastructure in the mentioned span of time according to the needed requirements of your country- economy will grow and improve simultaneously. The fundamental objective is to establish an environment for economic growth, reduce unemployment, support trade and provide more opportunities and empower the people of pilot countries [19]. The present literature discusses that CPEC is multilateral, long-term, and comprehensive project. As there are different views from different schools of thoughts about its impact on the region and its ultimate results for Pakistan, especially Indian and U.S economic policy makers and their legislative members see and analyze this huge investment from China and its inference on its neighbor countries [20]. This vision has a propensity to cast Pakistan simply as a helping hand to a mega strategic role in the Indian Ocean and Middle East for China. While others think of CPEC not only an investment scheme between Pakistan and China but a wide spread set-up of opportunities in the region - trade growth, economic collaborations and mutual cooperation [21].

Furthermore, the intentions of United States and Iran also show anxiety about the mega project CPEC. For Iran the problem and reason of feeling uneasy and distress is Gawadar port - a deep-sea port which Iran take into account as a competitor to Chabahar port - Sea-port in Iran on the Strait of Hormuz with Indian contribution [22]. So, in response to CPEC project of development of Gawadar port, Iran, India and Afghanistan also signed an agreement the major investment from India-\$500 million for the development of Chabahar in response to Gwadar as a strategic port, with the intension to find an alternative route for trade with the Central Asian countries while bypassing Pakistan [23].

Similarly, some studies show that CPEC will raise the import ratio and overall debt value for Pakistan. Research has claimed that the debt value of Pakistan will reach to \$3 billion by CPEC and that economic crises can result bringing Pakistan to “Circular Model” of economic crises [24].

Although CPEC will boost up Pakistan's economy but the above factors mentioned by Deng and Li in 2017 were also supported by Khaliq in 2018. According to him the total debt from China raised to \$19 billion and 14 billion were to be added by CPEC project which will raise Pakistan's total debt to \$40 billion by 2019. That's why there is the threat of becoming Pakistan as a colony of China [25].

But after some detailed research from some researchers have shown the positive impacts of CPEC for Pakistan .Studies

have shown that by linking Southwest of Pakistan to the Northwest of China, economic development will be encouraged by CPEC for both countries. There will be made a large investment in different projects under CPEC plan which will further attract the neighboring countries toward the investment which will help Pakistan drag out from the low economic growth, foreign direct investment and will bring improvement in the lifestyle of residents of the region [26]. Likewise, studies of [27,28,29,30,31]. We can conclude that CPEC is being flaunted as some sort of a magic dust that will make all of Pakistan's problems disappear. It has the potential for the much-needed economic benefits for Pakistan.

As economic growth has direct relation with production, that is totally dependent on energy, labor and capital. As the mainstream growth models or some bio-physical production models factually reveals that neither former factor of production is sufficient nor the latter two are sufficient for the production [32]. For economic productivity, power energy is a fundamental input. Furthermore, demand for energy rises as production expands which results in an increase in energy consumptions [33, 34]. Pakistan being an energy consuming country loses its 2.5% of its annual Gross Domestic Product (GDP) due to the shortfall of energy. This shortage of energy has hit grievously and have resulted a serious economic decline in industrial production sector, services sector and agricultural sector [35]. To overcome these shortages of energy Pakistan has put forward their struggles with the cooperation of Chinese government under the CPEC energy projects plan [36]. China's sponsors have already put their efforts in enhancement and upgrading of power energy divisions but with the increase in population the demand and supply ratio of power energy never remained in the favor of Pakistan [37]. The only hope is now tied with CPEC energy projects that will help Pakistan overcome this serious issue [38].

III. CURRENT SITUATION OF ENERGY OF PROJECTS UNDER PLAN IN PAKISTAN

The drum for CPEC being a part of BRI was beaten in 2013 when the Prime Minister of Pakistan Mr. Nawaz Sharif visited People Republic of China. CPEC is a long-term mega project having the time span from 2014 – 2030 [39]. CPEC contains five main integrants: (1) Gwadar (development and up gradation of Gwadar Port region and Gwadar city); (2) Energy projects (hydro, coal, solar and wind); (3) Infrastructure development; (4) Industrial growth and development; (5) Agricultural development and other areas of common interests like fiber optics etc. [40].

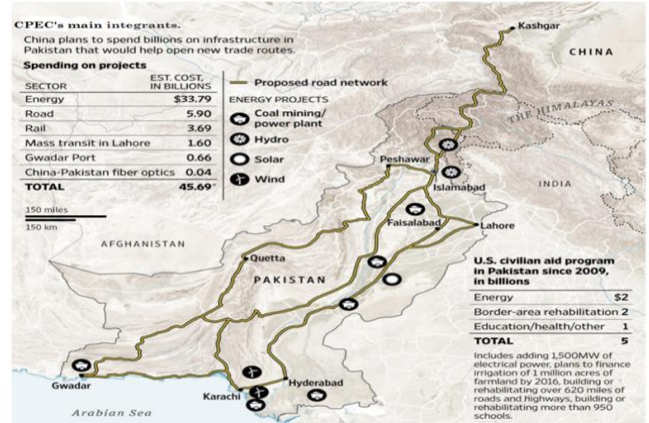


Figure 2. China Pakistan Economic Corridor map [41] (Shah & Page, 2015)

According to International Energy Agency (IEA) report Pakistan's energy generation capacity is 15000MW and demand is about 19000MW which sometimes reach 20000MW, and is expected to reach 25000 MW by 2025. Pakistan is already short of energy around 45000MW and the demand is increasing day by day with increase in population and their demands for energy. So, in such situation Pakistan has the only solution that is the fusion of local renewable power generation and storage technology which seems to be a prompt, proficient and after all a within the means which can also minimize the cost of improving and upgrading the infrastructure of power energy down to almost a naught. For the purpose to overcome energy crises, Pakistan has planned to make power storage system and planned renewable energy projects in collaboration with China under the CPEC plan that include 3 hydro-energy plants, four wind farms and a solar energy park. The power generation capacity of these energy projects is 3900MW and cost around \$7.5 billion. Furthermore, according to Pakistan Alternative Energy Development Board, Pakistan has the capacity of generating 2.9 million MW solar energy, 340000MW from wind and 100000MW hydro-power energy under CPEC energy projects. CPEC being a mega project presently costs \$62 billion is expected to make further investment of \$100 billion which will be required in different projects till 2030. A major portion of \$33.793 billion is already fixed to be invested in different energy projects [42]. The projects are expected to generate around 17000MW electricity from different sources including coal, wind, hydro-power and solar energy to control the fast growing and pressing need of energy for Pakistan [43]. These projects also cover the transmission of energy generated.

For the detail progress of CPEC energy projects (See Table. 1) which shows the power energy production sources, locations and their current status.

TABLE I. CPEC'S ENERGY PROJECTS, THEIR POWER CAPACITY AND CURRENT STATUS

#	Project Name and details	Progress Update
1	Sahiwal 2x660MW Coal-fired Power Plant, Punjab: Each capacity of the power plant with the production capacity of 660MW. Total production is 1320MW and estimated cost is \$1912.2million.	<ul style="list-style-type: none"> Project Completed in 28th October 2017 Current Status: Operational

2	2×660MW Coal-fired Power Plants at Port Qasim Karachi: Each with the production capacity 660 MW. Total production capacity is 1320MW and estimated cost is \$1912.2million	<ul style="list-style-type: none"> • 1st Unit Inaugurated in November 2017 • Second Unit Commercial Operation Date (COD) 25th April 2018 • Current Status: Operational
3	HUBCO Coal Power Project, Hub Baluchistan: Total capacity is 1320 MW and total estimated cost is \$1912.2 million.	<ul style="list-style-type: none"> • Commercial Operation Date (COD) achieved on 14th August 2019 • Current Status: Operational
4	Engro 2x330MW Thar Coal Power Project: Total capacity of output is 660 MW and total estimated cost is \$995.4 million.	<ul style="list-style-type: none"> • Commercial Operation Date (COD) achieved on 10th July 2019 • Current Status: Operational
	Surface mine in block II of Thar Coal field, 3.8 million tons/year: The production capacity is not yet confirmed and the total cost is approximately \$630 million.	<ul style="list-style-type: none"> • Financial close attained in April 2016 • Mining work in progress
5	Quaid-e-Azam 1000MW Solar Park (Bahawalpur) Quaid-e-Azam: Total production capacity is 1000MW and estimated cost is \$1301million.	<ul style="list-style-type: none"> • COD of 4x 100 MW attained in August 2016 • 600MW Under construction
6	Hydro China Dawood Wind Farm (Gharo, Thatta): Total capacity of output is 49.5 MW and total estimated cost is \$112.65 million.	<ul style="list-style-type: none"> • Commercial Operation Date (COD) attained 5th April, 2017 • Current Status: Operational
7	UEP Wind Farm (Jhimpir, Thatta): Total capacity of output is 99 MW and total estimated cost is \$250million.	Commercial Operation Date (COD) : 16th June, 2017 Current Status: Operational.
8	Sachal Wind Farm (Jhimpir, Thatta): Total capacity of output is 49.5 MW and total estimated cost is \$134million.	Commercial Operation Date (COD) attained 11 April, 2017 and Current Status is Operational.
9	Three Gorges Second and Third Wind Power Project: Total capacity of power production of both projects is 100MW and total cost of construction is \$150 million.	<ul style="list-style-type: none"> • COD: Three Gorges Second Wind Farm (TGTWF): 30th June, 2018 • COD: Three Gorges Third Wind Farm (TGTWF): 9th July, 2018 • Current Status: Operational
10	SSRL Thar Coal Block-I 6.8 mtpa& Power Plant (2×660MW) (Shanghai Electric): These two projects are total capacity of power production 1320 MW and estimated cost of construction is \$1912.2million.	<ul style="list-style-type: none"> • First Unit (660 MW) is targeted by Aug 2022 • COD of complete project is targeted by Feb 2023
11	HUBCO Thar Coal Power Project (Thar Energy): Total capacity of output is 330MW and total estimated cost is \$497.7million.	<ul style="list-style-type: none"> • Financial Closed (FC) achieved on 30th January 2020 • Target Commercial Operation Date(COD) date 31 March 2021
12	ThalNova Thar Coal Power Project: Total production capacity is 330MW and total cost of construction estimated is \$497.70million.	<ul style="list-style-type: none"> • Under Financial Closed (FC) • Target Commercial Operation Date (COD) 31 March 2021

13	Karot Hydropower Station: Total production capacity is 720MW and total cost of construction estimated is \$1698.26million	<ul style="list-style-type: none"> Land acquisition award done. Expected Commercial Operation Date (COD) December 2021
14	Suki Kinari Hydropower Station, Naran, Khyber-Pakhtunkhwa: Total production capacity is 870MW and total cost of construction estimated is \$1707million.	<ul style="list-style-type: none"> Financial Close achieved on 31st December 2016 and Expected Commercial Operation Date (COD) December 2022.
15	Matiari to Lahore ±660kV HVDC Transmission Line Project: The total cost estimated for the construction is \$1658.34million and the capacity of production is around 660 KV HVDC.	<ul style="list-style-type: none"> Feasibility study completed Expected COD in March 2021
16	300MW Imported Coal Based Power Project at Gwadar, Pakistan: Production capacity is 320MW and cost of construction is \$542.32million.	<ul style="list-style-type: none"> Groundbreaking done on 4th November 2019
17	Thar Mine Mouth Oracle Power Plant (1320MW) & surface mine: This power plant is of the capacity of 1320 MW.	<ul style="list-style-type: none"> Feasibility stage tariff obtained for coal.
CPEC-Energy Actively Promoted Projects		
18	Kohala Hydel Project, AJK: This project is of the capacity to generate power energy 1100 MW and total cost of construction is approximately \$2364.05million	<ul style="list-style-type: none"> Land Acquisition process started and Expected Commercial Operation Date (COD) 2026
19	Cacho 50MW Wind Power Project: This is a small project with the production capacity of 50MW.	<ul style="list-style-type: none"> Not yet finalized.
20	Western Energy (Pvt.) Ltd. 50MW Wind Power Project: This is a small project with the production capacity of 50MW.	<ul style="list-style-type: none"> Not yet finalized.
CPEC-Potential Energy Projects		
21	Phandar Hydropower Station: Power generating capacity of this power plant is 80MW	<ul style="list-style-type: none"> Under review of experts from both sides, China and Pakistan
22	Gilgit KIU Hydropower: This hydropower project is of the production capacity of 100MW.	<ul style="list-style-type: none"> Under review of experts from both sides, China and Pakistan.

Source: (CPEC Secretariat, "CPEC-Energy Priority Projects," China Pakistan Economic Corridor, accessed June 27, 2019 [44], <http://cpec.gov.pk/energy>)

IV. POTENTIAL ECONOMICS GAINS AND CHALLENGES OF CPEC ENERGY PROJECTS

A. Economics Gains

i. Increasing of supply energy mix with cheaper prices:

Power energy is considered a basic need to run the industries and increase production capacity in order to develop economy, Water and Power Development Authority (WAPDA) and Karachi Electric Supply Company (KESC) tried their best to control and fulfill this shortage but failed [45]. Pakistan was unable to have control over this serious issue being short with resources i.e. financial and technological. So CPEC is the ideal, supportive and most beneficial project for Pakistan to full Pakistan from energy crises and make the production and services industries of Pakistan run again in a smooth and progressive way which will help to grow its economy up to 2% [46].

CPEC is considered as a fate changer project for Pakistan. Being a multi-billion dollars project, which has its major portion of budget for energy projects in Pakistan can bring a huge positive change in energy sector of Pakistan. Pakistan is facing energy crises since long which result an annual decrease of 2.5% in the GDP. From CPEC, it is expected that it will bring improvement in the GDP of Pakistan up to 2% [46]. In fact, this much essential support has been on the cards exclusively because of CPEC power projects, particularly coal-fired power generation plants. Coal power generation capacity never touched the two digits figure over past two decades, However CPEC energy project based on coal fire power generation pushed forward the coal-based energy and it reach to the height of 12.7% in 2020 [47].

Major part of CPEC is consisted of Energy project. According to the report from Board of Investment (BOI) total amount to be invested by Chinese government was \$46 billion initially and out which \$33 billion were reserved for different energy projects i.e. Hydro, wind, solar and coal energy projects

[48]. The basic purpose behind this idea was actually the development of western china by developing its transportation, communication system, involving road and railway, gas and oil pipe line from Gawadar port in Pakistan to a western city of china Kashgar [1].

The significant sum of coal-fired generation capacity added in CPEC power projects point toward long-term intentions of expanding the country’s fuel mix away from oil-based power plants to coal-based power generation, to produce cut-rate electricity. The greatest economic gain from the CPEC energy projects is the generation of cheaper electricity. As large amount of energy will be generated through coal which is a cheap source for Pakistan as compared to oil. So, by using its local resources (coal) other than imported (oil) the energy produced will cost low. As per report of Pakistan’s State Planning Commission in 2011, Pakistan could save \$8 billion if they could convert fuel-oil-fired power plants to coal-fired plants. Which was almost equal to 4% of Pakistan GDP [49]. Average production of Electricpower in Pakistan is 8296.77 GWH from 2003- 2019, in August of 2018 reached an all-time high level of 15790 Gigawatt-hour and touched the record lowest figure of 4195 Gigawatt-hour in the month of December same year of 2010. It is expected power energy production will reach to 14400 GWH by the end of 2020[50]. While, predicting the future production of electricity we can estimate the trend to for next twelve months to be 10300GWH by the end of 2021.

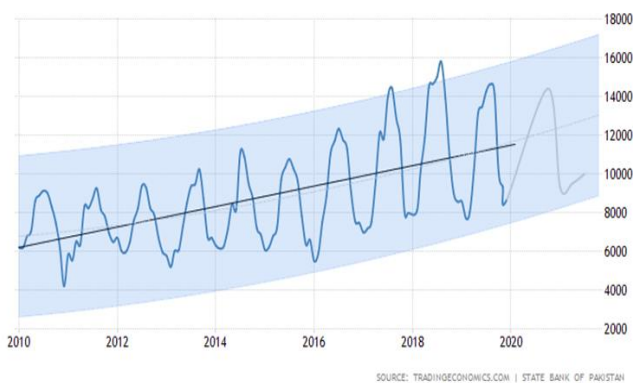


Figure 3. Pakistan Electricity Production 2010-2020 Data | 2020-2021 Forecast

Source. [51] <https://tradingeconomics.com/pakistan/electricity-production>

As we can see in the fig. 3 which show an econometric model about historical and forecast production value of electricity in Pakistan.

Similarly Sate Bank of Pakistan also reported in 2014 that if Asian Development Bank could convert oil-based power plants to coal-based power generation plants, it could have decrease import bill by \$418 million in case of importing coal and \$716 million if local coal was used [52]. In October 2019, the annual cost of fuel in power generation reduced from 7.9% to Rs5.02 per kilowatt-hour (kWh). “The turn down in fuel cost was led by the coal-based power generation cost, which shrank by 8.3%. In December 2019 Pakistan generated 2,357 gigawatt-hours (GWh) energy which more than double in amount as

compared to December 2018 [53]. Report of Pakistan Economic Survey 2019-20, showed that the installed capacity of electric power generation has reached 37,402 MW in 2020[54]. The total demand stood round about 25,000 MW- from residential and commercial domains, while the distribution and supply capacity of electricity is caught up around 22,000 MW [55]. This difference in demand and supply leads to a shortfall of nearly 3,000 MW. Although the installed capacity was 37402 MW but even then, the extra demand of 3000 MW did not fulfill [56]. Economic Survey 2019-20 of Pakistan revealed the growth rate of 64% percent that is installed capability to produce electricity has raised up to 37,402 MW by June 2020 which was figured out 22,812 MW in June 2013[57]. Until now 4,000MW of power energy has been added to the national grid under the CPEC energy projects and further more a total of 17,000MW electric power energy is expected-in near future to be generated and added to the national grid station under the CPEC energy projects [58].

ii. Decreasing of the energy import dependence

As we know that energy plays a vital role in the development of any country and is a basic need of the day from individual to state level as a whole. Pakistan is one of the countries which are taking steps toward development and faces lack of resources. As discussed before that energy is an important factor for development so same is for Pakistan as well and Pakistan falls short for that. Presently, average demand of energy is 19,000MW while generation capacity is around 15000MW [59]. Demand goes above 20,000MW during summer season due to extra burden of air-conditioning on electric power stations which results in power cuts and load shedding. It is forecasted that the demand will reach 49000MW by 2025 (reported by International Energy Agency).

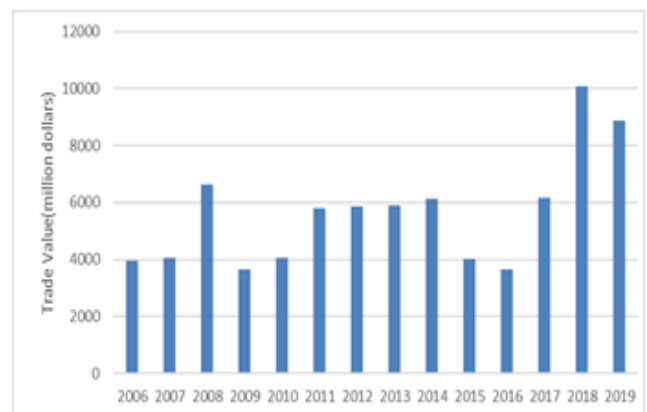


Figure 4. The overall situation of Pakistan's energy imports from 2006 to 2019. (That is, the annual trade volume of Pakistan's energy imports from the world)

The massive variance in demand–supply of power energy has constrained the Pakistani government to trade in pricey oil. A considerable national funds has been given out for the import of oil which not only deteriorate the country financially but also enforced the National Electric and Power Authority (NEPRA) to raise electrical energy prices [60]. Almost every sector has been badly affected, in particular Pakistan’s leading fabric production industry, which has resulted 50%–60% of the

textile industry shipment to cheaper energy countries i.e. China and Bangladesh. Figure 4 shows the overall energy import of Pakistan from all around the world, that is, the annual trade volume of Pakistan's energy imports from the world.

After completion of Hydro, coal based and renewable power energy projects under the CPEC plan, the demand will decrease for foreign energy import and Pakistan will become self-sufficient in power energy sector [61].

Eventually CPEC energy projects played a vital role in pulling out Pakistan from those energy crises. According to a report of Sustainable Development Policy Institute (SDPI) 2014, Pakistan went through a record energy disaster. According to the Economic Survey of Pakistan 2018-19, showed 2.5% growth rate, that is electricity production capacity went up to 34,282MW in 2018-19 as compared to last year 2017-18 which was 33,433MW [62].

iii. Decreasing of trade deficit

Industrial sector which is badly affected by energy crises for couple of decades will flourish again. Production will be increased which will increase net export and decrease the import. So, the Trade Deficit will be decreased. As in the fiscal year 2017-18 trade deficit was increasing continuously and has reach to \$14.6 billion. With the completion of some CPEC projects it imports decreased by 3.2 billion and exports went up to \$1.86 billion in the fiscal year 2018-19. So, trade deficit came down to \$10.8 billion [63].

Pakistan's trade deficit for 11 months (July-May) FY20 was USD 21.06 billion compared to a deficit of USD 29.15 billion from the corresponding period from FY19.

According to data released by the Pakistan Bureau of Statistics (PBS), the trade deficit for the month of May 2020 was recorded at USD 1.46 billion compared to a deficit of USD 2.247 billion from April 2020 showing an improvement of 35.02 percent.

Compared to May 2019 deficit of USD 2.921 billion, the trade numbers improved by 50.02 percent Exports increased by 45.35 percent to USD 1.391 billion compared to USD 0.957 billion in April 2020. However, compared to May 2019 exports decreased by 33.64 percent, Imports in May 2020 decreased by 11.02 percent, clocking in at USD 2.851 billion compared to USD 3.204 billion in April 2020.

Similarly compared to May 2019 imports decreased by 43.17 percent Overall the 11-month exports stood at USD 19.796 billion compared to USD 21.256 from the corresponding period of last year, showing an increase of -6.87 percent. Similarly Imports during the period decreased by 18.96 percent to USD 40.854 billion compared to USD 50.41 from the same period of FY19 [64]. But it was predicted and expected from some of the CPEC projects completion that exports will grow and import will be decreased in the years of 2019-20. The growth rate of 8.2% in exports and account deficit of 2.6% of the GDP rather than 4.6% as compared to the last year was recorded by International Monetary Fund (IMF) during this period [65].

In the second quarter of 2020, a Current Account deficit of 282 USD Million was recorded by Pakistan [66]. See figure 5 that shows the decrease in current account deficit of Pakistan.

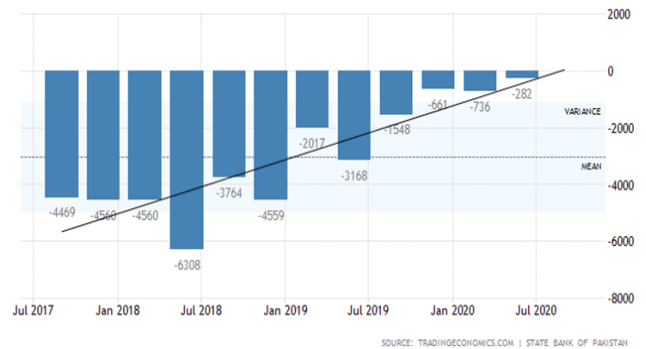


Figure 5. Pakistan's Current Account deficit (Million USD). Source: [66] <https://tradingeconomics.com/pakistan/current-account>

iv. Inducing Foreign Direct Investment (FDI)

A large number of econometric models are explained by excessive usage of energy that shows a positive correlation between energy consumption Foreign Direct Investment (FDI) [67]. It is calculated and proved that an increase rate of 1% in renewable energy contributes in expanding FDI by 0.185%. While in reverse situation an increase of FDI contributes to raising renewable energy by 0.292% [68].

Pakistan got major assist from an increase in Chinese investment, overall 91% growth in Foreign Direct Investment mainly in power projects under the frame of China-Pakistan Economic Corridor (CPEC) energy projects. Figure 6. shows the Chinese investment in Pakistan's energy sector.

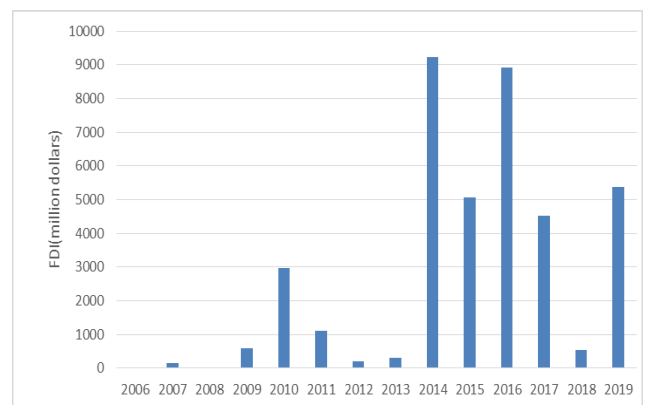


Figure 6. shows the overall situation of China's energy investment in Pakistan from 2006 to 2019. (i.e. China's energy investment in Pakistan each year)

It can be seen that the FDI from China increased rapidly after the implementation of the BRI from 2013.

As we talk about the sectors investment, the communication sector, mostly the 3G/4G service providers, attracted the largest foreign investment of \$73.5 million in May 2020, followed by oil and gas exploration firms \$18.6 million and financial businesses \$15.5 million, a renowned Chinese scholar Prof. Zhou Rong said on Monday [69]. Pakistan's foreign direct investment (FDI) has improved by 88% in fiscal

year 2020 to \$2.56 billion with major investment coming in the power and telecommunication sectors from China and Norway respectively.

Because of the setting up of stainless steel and petrochemical production industries, energy using up in the economy is supposed to growth at a higher speed (World steel association, 2016).Due, to the CPEC expansion, the growth rate of FDI for the period of Fiscal Year FY-17 stood at 12.75% [70]. It is anticipated that with the completion of CPEC the FDI will be enhanced in Pakistan due to rise in industrial

activities, energy supply security and reinforced infrastructure to encourage the markets [42]. Such a heavy investment in energy sector, Gwadar port, transport system, special economic zones and intensive energy use will attract foreign investors, increase Foreign Direct Investment (FDI) and trade activities. This can lead Pakistan to high industrial development and high economic growth. All these above-mentioned factors are closely related to energy [71]. So that’s why all these economic activities are possible only because of CPEC energy projects. See (table II) which shows the growth rate of FDI in Pakistan after the CPEC projects launched.

TABLE II. GROWTH RATE OF FDI IN PAKISTAN (MILLION US \$)

NAME	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY2020 (July)
Foreign direct investment	1698.6	1033.8	2392.9	2406.6	2780.3	1362.4	2401.4

Source.Data is from State Bank of Pakistan (SBP)[72].<http://www.sbp.org.pk/ecodata/NetinflowSummary.pdf>http://www.sbp.org.pk/ecodata/exp_import_BOP_Arch.xls

v. *Employment creation effect*

A great potential benefit of CPEC to Pakistan lies in employment creation effect. Around 700,000 new job opportunities for local people of Pakistan are expected to be created by 2030 under the mega project of China Pakistan Economic Corridor (CPEC).

“Up to now numerous CPEC projects have offered direct job opportunities to almost 75,000 people across the country. According to recent survey conducted by CPEC Centre of Excellence, Ministry of Planning, Development and Reform of Pakistan, CPEC might help create even 1.2 million jobs under its presently agreed projects indirectly [73]. Unemployment rate from 2010 to 2013 was around 6% which gradually decreased in 2014 and onward in 219 it reached to 4.1% [75]. Figure7clearly shows the decrease trend of unemployment rate in Pakistan.

So, it is hoped that with the completion of all energy projects of CPEC, this ratio will further be decreased and employment opportunities will increase when trade is improved and industries are operating. 2.3million new job opportunities are expected to be provided by CPEC by 2030 [75]. The average number of employed persons in Pakistan was 39594.79 Thousand from 1986 until 2018, approaching to an all-time highest number of 62230 Thousand in 2017. Figure8 Shows a positive employment forecast trend in Pakistan.



Figure 7.Trend of unemployment rate in Pakistan. Source: [74]<https://tradingeconomics.com/pakistan/unemployment-rate>

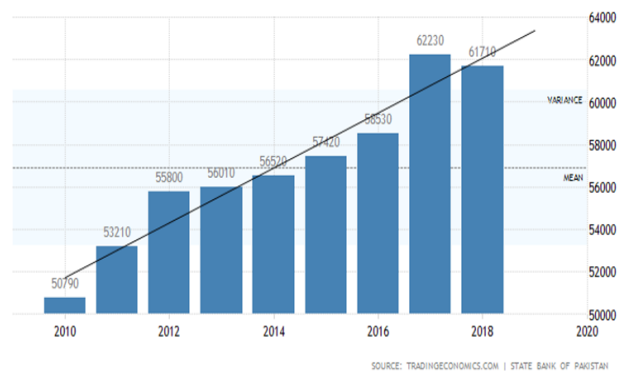


Figure 8. Employment trend rate per year in Pakistan. Source: [76]<https://tradingeconomics.com/pakistan/employed-persons>

vi. *Potential growth of different sectors*

CEPC Energy projects have contributed to the potential growth of manufacturing, textile and agricultural industries of Pakistan that has a positive effect on the overall GDP of

Pakistan. As we can see in the table.III and, the trend shown in fig.8, the trend of employment rate in Pakistan.

TABLE III. GROWTH IN THE OUTPUT RATE OF MANUFACTURING SECTOR OF PAKISTAN

Date	Output Billion US (\$)
12/31/2013	31.37199
12/31/2014	33.0924
12/31/2015	34.60978
12/31/2016	33.66358
12/31/2017	36.54362
12/31/2018	38.32723
12/31/2019	34.65827

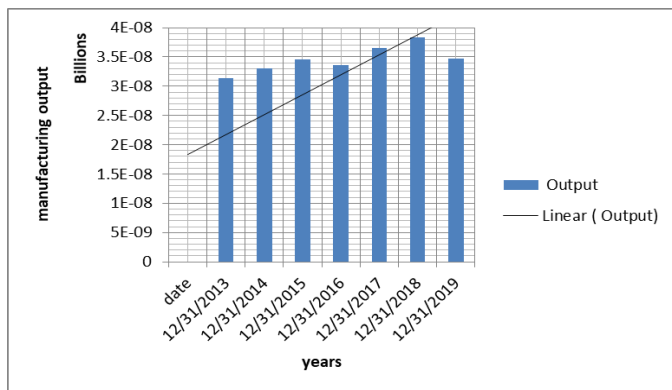


Figure 8. Growth in the output rate of manufacturing sector of Pakistan

Source.

[77] <https://www.macrotrends.net/countries/PAK/pakistan/manufacturing-output>

The CEPC Energy Corridor has pushed forward the industrial sector of Pakistan in a positive way and is expected

TABLE IV. INDUSTRIAL GROWTH RATE IN PAKISTAN INDUSTRIAL

S.NO	List	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
1	Industrial sector growth rate	▲ 2.55%	▲ 0.75%	▲ 4.53%	▲ 5.18%	▲ 5.69%	▲ 4.55%	▲ 4.61%
2	Mining and Quarrying sector growth rate	▲ 5.16%	▲ 3.88%	▲ 1.40%	▲ 4.97%	▲ 6.19%	▼ -0.60%	▲ 7.80%
3	Manufacturing sector growth rate	▲ 2.08%	▲ 4.85%	▲ 5.65%	▲ 3.88%	▲ 3.69%	▲ 5.83%	▲ 5.43%
4	Large Scale Manufacturing growth rate	▲ 1.13%	▲ 4.46%	▲ 5.46%	▲ 3.28%	▲ 2.98%	▲ 5.64%	▲ 5.12%
5	Small Scale Manufacturing	▲ 8.35%	▲ 8.28%	▲ 8.29%	▲ 8.21%	▲ 8.19%	▲ 8.15%	▲ 8.17%

to grow more and more. Industrial sector of Pakistan accounts for around 18.17% of GDP in 2018 it was increased by of 5.80% as compared to the last year growth of 5.43% in 2017 when some of energy projects started generating energy[78]. Major sector in industrial sector of Pakistan is that of manufacturing which accounted for around 12.13% of Pakistan's GDP [79]. Industrial sector of Pakistan consists of cement industry, fertilizers, tobacco, food industry, steel, machinery, chemicals and medical instruments, primarily surgical [80] all these manufacturing industries works on energy supply. And it is expected that industrial sector will grow its production rate after the completion of all energy projects. Table IV shows the growth rate (where ▲ sign is for positive Increase ▼ is for negative Decrease) of different industrial sector of Pakistan where we can see a clear improvement in the growth rate after CPEC launched and its energy production started.

Pakistan is an agricultural country and its major population depends on this sector. Its contribution in GDP is 18.3%. This sector provides about 37.4% of employment opportunities to the people and is the major source of foreign exchange earnings for Pakistan [82]. CPEC energy projects are expected to rise this ratio to a high mark as energy shortage will soon be covered, which will help improve irrigation sector and other chemical and fertilizers industry will enhance its production that will further increase the agricultural production. As we see an incredible growth rate of 3.5% in agricultural sector during 2017-18. Table. V shows the overall growth rate in agricultural sector of Pakistan. There is almost a positive trend in production of all crops. All the major crops showed a positive trend in their production [83].

	growth rate							
6	Slaughtering sector growth rate	3.53%	3.63%	3.38%	3.34%	3.61%	3.55%	3.50%

Source.[81]https://en.wikipedia.org/wiki/Industry_of_Pakistanhttps://en.wikipedia.org/wiki/Economy_of_Pakistan#cite_note-7-79

TABLE V. GROWTH RATES IN AGRICULTURE SECTOR

Sector	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Growth rate	2.85%	7.02%	1.27%	3.42%	1.81%	3.50%	0.23%	1.96%	3.62%	2.68%	2.50%	2.13%	0.15%	2.18%	4.00%	0.58%	2.67%

Source. Main article [84]. Agriculture in Pakistanhttps://en.wikipedia.org/wiki/Agriculture_in_Pakistan

Data source. https://en.wikipedia.org/wiki/Economy_of_Pakistan#cite_note-7-81

All these sectors with their combined effect on the GDP have shown some positive response. As, we can see in the table.VI that shows the GDP growth of Pakistan.

TABLE VI. PAKISTAN'S GDP GROWTH RATE

DATE	GDP (Billions of US \$)
12/31/2013	231.2185672
12/31/2014	244.3608888
12/31/2015	270.5561317
12/31/2016	278.6546377
12/31/2017	304.5672532
12/31/2018	314.5675416
12/31/2019	278.221906

Source.[85]<https://www.macrotrends.net/countries/PAK/pakistan/manufacturing-output>, <http://datatopics.worldbank.org/world-development-indicators/>

To guarantee prosperity along with high yields per acre and high value-added products, modern agricultural measures and linking farmers with green farming is the required and most

TABLE VII. SHOWS THE GROWTH CHANGES INFORMATION ABOUT MINING AND QUARRYING SECTOR OF PAKISTAN

SECTOR NAME	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Mining	5.16%	3.88%	1.40%	4.97%	6.19%	-0.60%	7.80%

Source. [86] https://en.wikipedia.org/wiki/Industry_of_Pakistan

Pakistan has a lot of natural resources and industrial supportive minerals. The major contribution in energy sector is that of coal discovery which provides an alternative source of energy for manufacturing industries. Major contribution in this sector is the discovery of coal mines at Thar (Sindh), which has the capacity of over 175 billion tones [86].

CONCUSLION

The main purpose of present study is to explore the influence of CPEC's energy projects on the economic development of Pakistan. The study calls a halt that energy projects regarding CPEC contribute in solving all socio-

economic problems like poor and substandard transport system, low Foreign Direct Investment (FDI) and unemployment, health and education.

Based on our research findings, the following policy recommendations have been suggested for the Pakistani government. Being 70% of energy projects are coal-fired power generation plants so usage of advanced coal furnaces should be made certain to minimize the air pollution which can be a great threat in future.

1. Government of Pakistan is needed to renovate the old energy transmission infrastructure- to control energy losses and to utilize the new electric energy added by CPEC energy projects -in a proper and beneficent way.

2. Proper check and balance from government is required- to control corruption, push the work forward and to make CPEC plane happen as soon as possible- to minimize the risk from rival countries that feel unsecure from CPEC plane.

3. For the encouragement of FDI and exports- securities, financial supports- taxes redemptions and subsidies should be given to investors in order to appreciate their inflow-encourage local products and ensure investors with maximum return on their investment.

4. Government should encourage the industrial sector to produce more innovative electronic products- subsidize them initially to make people used to with technological changes- that will minimize the consumption of energy and maximize the efficiency in long run development

5. Technical education in Pakistan needs to be encouraged – technically rich and innovative brains are to be produced which can lead the country toward a prosperous and bright future.

Regardless of upbeats, some risks and challenges also cut the smooth operating way. Some major issues are like terror campaign in some provinces of Pakistan, security risks, un-fair allocation of funds, political clashes, poor infrastructure of local businesses, lack of business and trade awareness and technical labor force etc.

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