

China Pakistan Economic Corridor Energy Projects in Light of Sustainable Development

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Abstract- Energy sector of Pakistan has never been up to the demand of the country due to inappropriate energy management policies. The shortfall has been reaching to a nominal level of 4500 MW for more than 10 years. The economy of Pakistan has been dramatically affected and resulted in the shutdown of many industrial units. To manage this shortfall, electric supply companies had solely concerned the consumer end. Energy domain of Pakistan has confronted a rapid change by the mega-investment of more than 60 billion USD under the game-changing project of China-Pakistan Economic Corridor (CPEC). This project will boost the energy sector as half of the total capital of this project has been disbursed for the mitigation of shortfall and power crisis. The project has been started for the interests of both economies of both countries China and Pakistan. This research focused on the causes of the power crisis in Pakistan and how CPEC will boost the energy sector and how our environment will be affected by these energy projects. And policies have been discussed for efficient policymaking in generation with the lowest environmental impacts and contributing towards making this development more sustainable and acceptable.

Index Terms— China-Pakistan Economic Corridor, One belt and One road, Power crisis, energy policy Pakistan, environmental impacts of CPEC, sustainable development

I. INTRODUCTION

Energy is a lifeline for every country's economy. It is the most dynamic tool for socio-economic growth in a region. Pakistan is facing extreme energy shortages due to increasing the electricity demand. The energy sector of Pakistan is in the developing phase. Our electric supply companies always faced a lot of challenges in meeting the demand of the country. People are shifting towards their power generators to meet their needs. For the production of electricity, Pakistan spends 60% of its reserves on importing fossil fuel, which plays a crucial role in Pakistan's declining economy [1-3].

With the influence of China and its infrastructure, the government of Pakistan has made a great deal with chines to extend its energy projects. This will help stabilize the economy, and it can have a significant influence on the energy sectors.

A significant part of the CPEC is working to provide a great change in the energy sector, infrastructure, Gwadar port, and various other projects. In this paper, we are discussing the energy sector and exploring its aspects concerning its implementation in Pakistan [3-6].

According to the BOI, hydro, coal, solar and wind energy power plants are including in CPEC projects. Total Chinese investment is estimated at \$46 billion, of which about \$35 trillion was spent on oil. Due to CPEC's overwhelming energy value, the energy and economic corridor (PCEEC) is also known as the Pakistan-China project [7-10].

A large portion of CPEC expenditure (US\$ 33.79 billion) is committed to building electricity projects for 17045 MW generation in Pakistan with a 10,420 MW generation capacity prioritized. A good investment is expected to use existing energy infrastructure to resolve Pakistan's energy crisis [10-15]. The aim is to complete 14 power plants by 2020, while aggressively supporting the remaining 8 plants, although the completion date has yet to be decided. Mostly energy projects under CPEC are based on fuel combustion but with the passage of time energy projects under CPEC is shifting from non-renewable energy resources to renewable energy resources. The sources of generation of electricity under the CPEC is depicted in Fig. 1. Most of these ventures are based on Coal and Hydel technologies. CPEC also includes the urgent construction of the 878 km long transmission line from Matiari to Lahore to transfer energy from generating station to the consumer end. The main contribution of this research is to analyze the power generation projects under CPEC with their future environmental impacts and policymaking for making CPEC sustainable development [16-20].

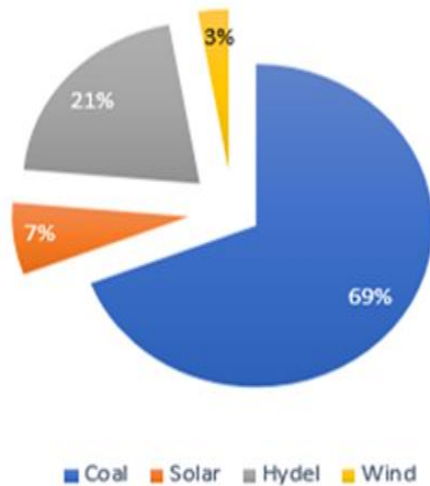


FIGURE 1. CPEC Projects [5]

II. METHODOLOGY

A. PROBLEM STATEMENT

Pakistan is facing a lot of problem due to energy crises. These energy crises are due to lack of energy station, Mismanagement in the energy sector and shortage of fuels. This causes enormous trade and business disruptions, dramatically rising inflation and unemployment, leading Pakistani people to misery and instability [21-25]. Pakistan relied too long on expensive oil energy, lagging behind cleaner, cheaper sources such as solar and wind power in its R&D. Oil and gas produce 80% of Pakistan's electricity, costing around \$9.4 billion. Production of electricity by using fossil fuels causes the increasing the per-unit cost of electricity, global warming as well as the emission of greenhouse gases. So, the solution of this problem is to development of new generating station that is based on renewable energy resources, Adoption of new technology for production of electricity, Mismanagement in the Energy sector and looking for a solution for sustainable energy in the CPEC projects.

B. AIM OF RESEARCH

This research aims to promote sustainable development. Following are the objectives of the research

- Analyzing power generation projects under CPEC with their future environmental impacts.
- Policymaking for making CPEC sustainable development.
- Directions and recommendations for future energy policy and planning.
- Finding the causes of power shortfall in Pakistan which can be taken into account in future.

C. CAUSES OF SHORTFALL AND MISMANAGEMENT IN ENERGY SECTOR OF PAKISTAN

It has been observed that Pakistan is facing short of 4000 to 4500 Mega Watts's energy [6, 26-31]. In hot summer when the load exceeds due to air conditioning systems and other variable loads, the shortfall rises to 7500 MW, this reasonable lack of

energy in the network causes problem and difficulties in every sector of Pakistan. The GDP (Gross Domestic Product) has been suffered by this energy issue and reduced noticeably. Many industries in this shortfall situation have been unable to manage their operations profitably and shifted their production plants to other countries where the environment is favourable. Some reasons behind shortfall have been discussed as follows.

- Un-development of new generating station
- Old Equipment's
- Un trained Staff
- Low Technical Standards and Poor Accountability
- Policy Issues
- Political Instability
- Security Concerns

To minimized the shortfall and emission of greenhouse gases, the Government of Pakistan has made a great deal with chines to install new energy projects and extend of existing energy projects in Pakistan under the CPEC.

D. EXPLORATORY AND CALCULATIVE APPROACH

The research study contains analysis and interpretation of data using different approaches and suggesting more beneficial policies of management. The methodology uses the exploratory and calculative approach for CPEC energy projects and deductive approach for the assessment of power sectors of Pakistan. The research is majorly divided into two portions, Part (a) involves the evaluation of CPEC energy projects in detail regarding their Environmental, Social and economic dimensions and, Part (b) includes the analysis of energy sector of Pakistan regarding power shortfall and suggesting more optimum management practices. The block diagram of the exploratory and calculative approach is shown in Fig. 2.

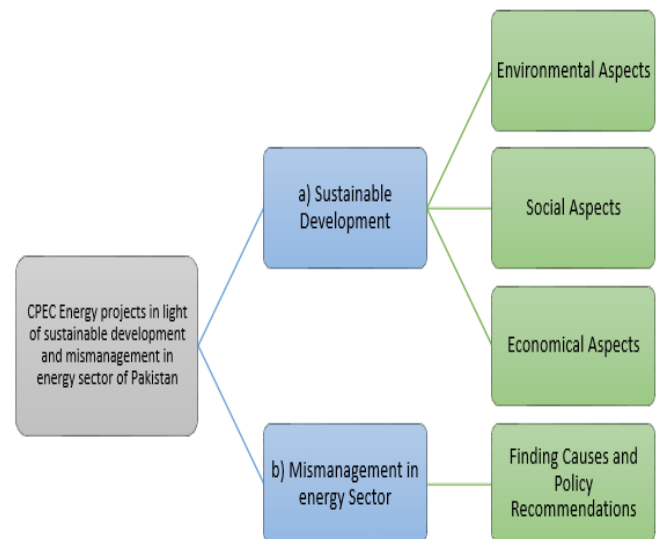


FIGURE 2. Block diagram of Exploratory and Calculative Approach

III. RESULTS AND DISCUSSION

A. CPEC ENERGY PROJECTS AND THEIR ENVIRONMENTAL ASPECTS

CPEC energy projects include hydro, solar, wind and coal power stations. In Punjab, there are total four energy projects which has been completed under CPEC, out of these four energy projects three of them are coal-based projects which is emitting emissions during their execution and operation, and only one energy project is Solar based which has almost zero emission during operation. Each coal project is of 1320MW, two of three coal projects has using imported coal and one has been relaying on Pakistan's local coal. Private Power Infrastructure Board (PPIB) is continuously monitoring the progress of power projects and trying to regulate the progress. These projects have been reduced burden on economy by providing electrical energy in the system on cheap rate. However, two out these projects have used imported coal from China but has used sophisticated technology of super critical Boilers for more efficient combustion and Electrostatic precipitators to reduce emissions.

70% of total energy generation under CPEC in all provinces of Pakistan is based on coal fired which caused by the greenhouse gases emission. So, to overcome these all environment issues the CPEC is moving towards clean energy production. There are four wind power projects under CPEC because of their ease of installation and emission free electrical energy. There are two projects under CPEC in Azad Kashmir both are Hydro power projects namely Karot and Kohala power stations. From the analysis it has been observed that due to global warming and ozone layer depletion CPEC and international trend is moving toward renewable and sustainable form of energy.

B. SOCIAL SURVEY ABOUT CPEC ENERGY PROJECTS IN LIGHT OF SUSTAINABLE DEVELOPMENT

The Survey of general public concluded the fears and opportunities in the minds of people regarding CPEC. Another advantage of that survey was that awareness of general public can easily be evaluated from it. People of the country are the stakeholders of every project in the country. The research and social survey that has been done is free from any kind of influence whether it's political, religious or cultural. The pure addition to knowledge is the piece, which is none biased. Aim of the activity is to strengthen understanding regarding China Pakistan Economic Corridor. The results obtained from social survey has been depicted in Figs. 3, 4, 5, and 6.

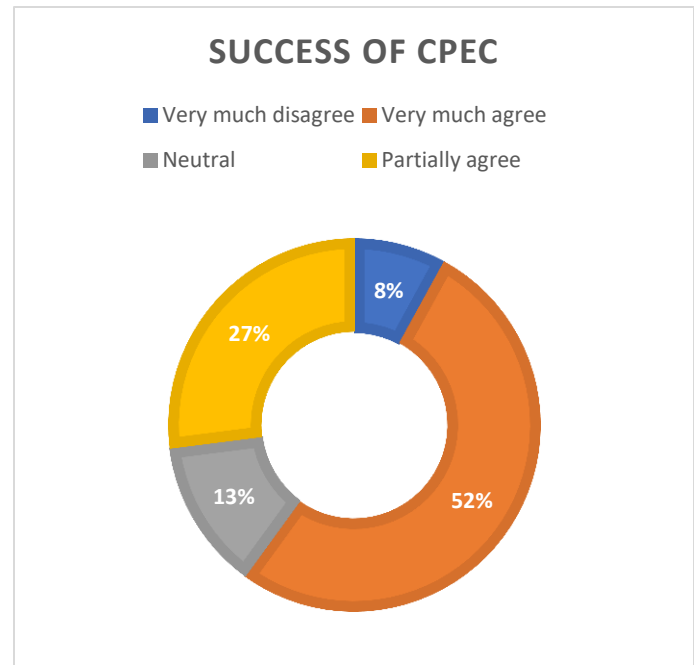


FIGURE 3. Social Survey Results about Success of CPEC

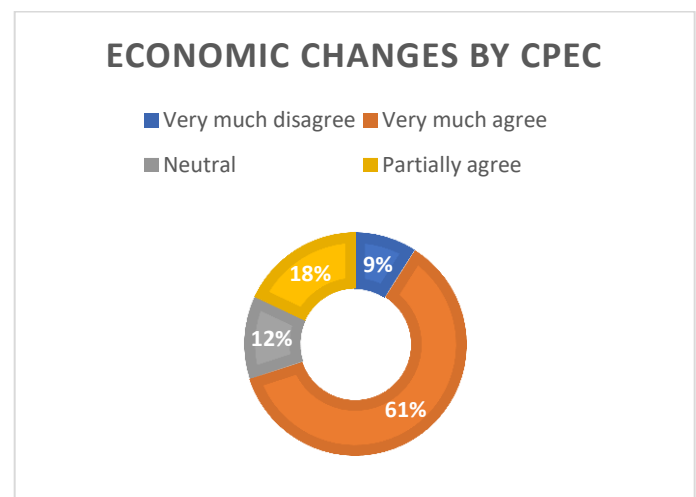


FIGURE 4. Social Survey Results of Economic Changes by CPEC

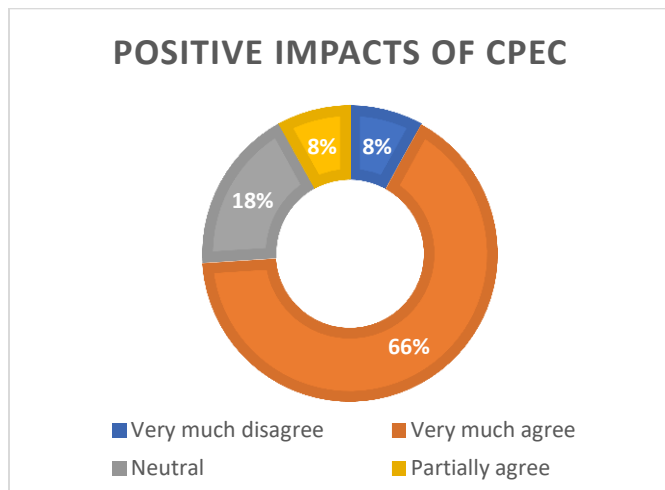


FIGURE 5. Positive Impact of CPEC

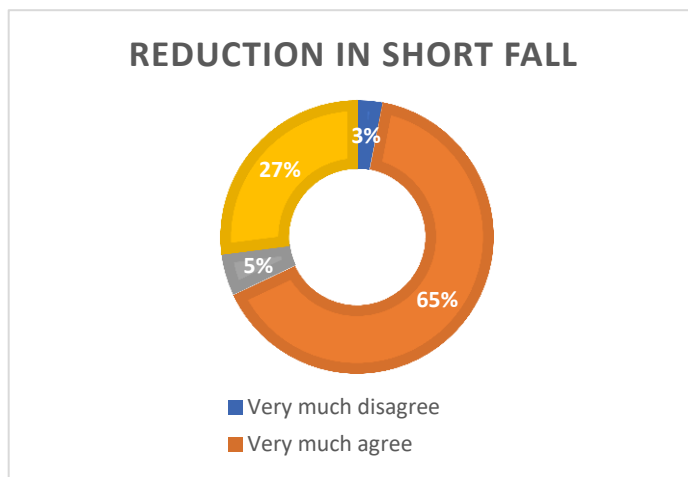


FIGURE 6. Reduction in Short-Fall under CPEC Projects

C. POLICY RECOMMENDATIONS

• VARIATION IN TARIFFS IN SHORT TIME

In Pakistan, everything changes with the arrival of the new Federal Government so as policies of government organizations. There were a lot of changes in tariff during the last few years which resulted in the form of fear in the investor's mind. Investors in the energy sector easily get scared by these ups and downs in the tariffs. Government need to stabilize the tariff of the energy sector for a long period to win the trust of investors. Significantly the renewable energy investors are much affected in the last few years, and the government should compensate for their problems and issues regarding investment. It will boost the energy sector as well as the overall economy of Pakistan.

• PRACTICE SUCCESSFUL ANALOGIES BY OTHER COUNTRIES

Many developing countries have been through this phase which Pakistan is facing and manages to resolve their issues. They planned to act and become successful. Policymakers should consider positive approach applied by other underdeveloped and developing countries.

Electrical power system of Iran is an excellent example for us; they were facing a lot of problem regarding power theft, so they introduced strong and strict anti-power theft laws. After the announcement of this law, power theft decreased drastically. They also implemented smart transmission and metering system, which proved very successful in the management of electric system. On the other side, if we see privatization of our institution, we can notice that organizations which were not making any progress under the government changed their stance after privatization.

• DEPEND ON AVAILABLE NATURAL RESOURCES

Pakistan have bulk of natural resources; these resources need to be explored more and utilized for generation purposes. One of the renowned researchers of United States Mr. Michael Kuglmen stated that Pakistan has huge coal and Gas reserves. There is a lot space in the field exploration of minerals. This space will remain free if we don't have modern sophisticated technology, we need technological upgradation. The government can take the initiative by having dealt with Chinese government and engineering companies for the up-gradation of our technology so we can help our geologists and mining engineers to explore the field more efficiently. If the exploration department becomes strong and technologically advanced, then it will be very useful to discover new minerals and precious reserves.

• EXTENDING PROVINCIAL RIGHTS AND RESPONSIBILITIES

According to laws in Pakistan, Provincial government can start energy project independently, but they need to consult the Federal government for the budget. We need to implement a system in which each province is solely responsible for its energy needs and can use their resources. They need to be permitted to finance the project from their provincial budget. This will give more flexibility to invest and build trust in investor. This will also reduce the tensions of the central government regarding the budget. Many projects in Pakistan ended due to budget issues. After implementing this Policy, the budget issues will be reduced. There are always a lot of clashes between the provincial and federal government on projects with huge investments which needs to be resolved by mutual policymaking. Sustainable policymaking department should be made which analyze the policies before implementation in light of sustainable development. As more as the policies are sustainable, their margin of success becomes high.

• REGULAR MAINTENANCE OF EQUIPMENT

Poor maintenance is one of the major issues in the transmission and distribution of electrical energy systems. The electrical

system in Pakistan is having a lot of losses in the form of communication and distribution; these losses are contributing towards overall system losses in a large percentage. Through proper operation and maintenance of electrical equipment, these losses can be reduced to a small amount, which will result in the overall improvement of the system. Maintenance should be planned regularly, and annual checks should be made. In our country, there is a trend that our management doesn't take scheduled procedures seriously until a huge fault occurs in the system. This behaviour of government caused a lot of damage to our organizations in the past. Strict policies should be made to ensure periodically in time

• ONLINE MANAGEMENT OF ELECTRICAL SYSTEM

All the world organizations which progressed in the last few years implemented the online database system for the development of the organization in a fast and easily approachable way. This way of overall Portfolio management of the power system will help to progress and monitor the system more efficiently. To increase our system's output, we need to improve the coordination and management, at the same time. The only solution which will enhance this coordination and help the government to see the bigger picture compactly and feasibly is through the use of Information technology. By the help of information technology, we can quickly gather information about losses in the system, the number of units consumed, total demand and contribution by each power plant. By this way of Portfolio management, the less efficient contributors of the system can be located and optimized in a better way.

• LONG TERM ENERGY GOALS DEVELOPMENT

Due to political influences on the energy system, our energy goals are developed temporarily to impress voters of the ruling party and to show instant progress in the energy sector. That is the reason that many projects just work for a little time, and after that, these projects are abandoned. Many projects are approved because of their short time of implementation and operation and their long-term issues are being ignored just for the sake of showing progress. Separate policy department without the political influence should be made

• INCREASE THE TREND OF DOMESTIC RENEWABLE ENERGY SYSTEMS

In developing energy economic policy, Domestic renewable power systems should be appreciated. We need to provide incentives to domestic consumers of electrical energy to increase their interest. A large amount of energy can be saved if only a few percent of our domestic load is reduced. This can only happen domestic users are appreciated to install on solar grid systems, which can fulfil their daily energy demand and can be able to contribute towards the national grid.

V. CONCLUSION

In this research work, energy projects under CPEC, and their effects w.r.t economics, environmental and social aspects have been discussed. Different energy policies are also recommended for sustainable energy management system in Pakistan. If these policies are implemented instead of traditional and cumbersome methods, CPEC energy projects can contribute a lot for mitigating energy crises in Pakistan. As a conclusion, it is stated that by the developing CEPC projects in Pakistan, the GDP of Pakistan has been boosting up and energy crises are going to mitigate rapidly. From this study, it can be concluded that the energy projects under CPEC are economically very beneficial for both countries, and they are sustainable.

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