IMPLICATIONS OF CPEC ENERGY PROJECTS FOR PAKISTAN'S POWER SECTOR AND POLICY

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CERTIFICATE

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SUPERVISOR'S DECLARATION

This is to certify that the MPhil dissertation submitted by Hamza Sadiq Khan titled "**Implications of CPEC Energy Projects for Pakistan's Power Sector and Policy"** was supervised by me and is submitted to meet the requirements of an MPhil degree.

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SCHOLAR'S DECLARATION

I hereby declare that the thesis submitted by me titled "**Implications of CPEC Energy Projects for Pakistan's Power Sector and Policy"** is based on my research work and has not been submitted to any other institution for any other degree.

Hamza Sadiq Khan

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List of Abbreviations

AEDB: Alternative Energy Development Board

ARE: Alternative and Renewable Energy

BRI: Belt and Road Initiative

CCI: Council of Common Interests

CPEC: China Pak Economic Corridor

CPI: Consumer Price Index

CPP: Capacity Payment Price

CPPA: Central Power Purchase Authority

CMEC: China Machinery Engineering Corporation

CTBCM: Competitive Trading Bilateral Contract Market Model

DISCOS: Distribution Companies

ECC: Economic Coordination Committee

EYB: Energy Yearbook

EPP: Energy Purchase Price

FDI: Foreign Direct Investment

FESCO: Faisalabad Electric Supply Company

G2G: Government to Government

GDP: Gross Domestic Product

GEPCO: Gujranwala Electric Power Company

GENCO: Generation Company

GWh: Gigawatt hours

GW: Gigawatts

HDIP: Hydrocarbon Development Institute of Pakistan

HESCO: Hyderabad Electric Supply Company

HVDC: High Voltage Direct Current

IEP: Integrated Energy Plan

IESCO: Islamabad Electric and Supply Corporation

IFI: International Financial Institution

IGCEP: Indicative Generation Capacity Expansion Plan

IPP: Independent Power Plants

IMF: International Monetary Fund

IRR: Internal Rate of Return

KESC: Karachi Electric Supply Corporation

KE: Karachi Electric

LESCO: Lahore Electric Supply Company

LOI: Letter of Intent

LOS: Letter of Support

MEPCO: Multan Electric Power Company

MOE: Ministry of Energy, Pakistan

MOWP: Ministry of Water and Power

MPNR: Ministry of Petroleum and Natural Resources

MWh: Megawatt hours

MW: Megawatts

NTDC: National Transmission and Despatch Company

NEPRA: National Electric and Power Regulatory Authority

OBOR: One Belt One Road

O&M: Operations and Maintenance

PTI: Pakistan Tehreek-i-Insaaf

PESCO: Peshawar Electric Supply Company

PSLM: Pakistan Social and Living Standards Measurement

PPA: Power Purchase Agreements

PML N: Pakistan Muslim League Nawaz

PPIB: Private Power and Infrastructure Board

QESCO: Quetta Electric Supply Company

RPP: Rental Power Plants

RFO: Residual Furnace Oil

ROE: Return on Equity

RLNG: Re-gasified Liquid Natural Gas

SEPCO: Sukkur Electric Power Company

SEMC: Sindh Engro Coal Mining Company

SOE: State-Owned Enterprises

SWOT: Strengths, Weaknesses, Opportunities, and Threats

T&D: Transmission and Distribution

WAPDA: Water and Power Development Authority

Abstract

China-Pak Economic Corridor (CPEC) is one of the most consequential economic programs in the history of Pakistan. Within CPEC, energy projects constitute the lion's share of investment. The study aims to analyze the impact of CPEC energy projects on Pakistan's power sector and policy since its inception in 2015. The study uses data provided from different public sources to examine the implications for the power sector. In addition, it provides historical context by recounting previous energy policies of the Government, their outcome, and impact on the power sector of Pakistan in the past. There has been no comprehensive study, to the author's knowledge, that has evaluated CPEC's role in the power sector to date and how it has changed the power sector landscape in Pakistan. The study also uses interviews with eight energy sector experts to determine what effects CPEC energy investments have had on the existing and future power policy of Pakistan. The study concludes that while CPEC has positively contributed to the power sector of Pakistan, it has also brought along a slate of new challenges for the Government that need to be addressed to further advance the sector's growth.

Chapter 1: Introduction

The rise of China in the global arena has had tremendous positive ramifications for the country itself and other nations. It has been estimated that more than 850 million people have been lifted out of poverty in China owing to its phenomenal GDP growth rate, averaging around 10% annually since the year 1978 (World Bank Data Indicators 2020). Shambaugh (2013) explains how China continues to pace towards a stronger role globally on all fronts, which includes the global economy in particular. In September 2013, Chinese President Xi Jinping announced one of the most ambitious economic programs by revealing its plan to build Silk Road Economic Belt and a 21st Century Maritime Silk Road, which is now referred to as the "Belt and Road Initiative" (BRI)[1]. Estimates indicate that the total costs of the BRI could be higher than $1 trillion by 2027 and involves 65 countries with the primary goal of increasing trade and connections between China and Europe, Asia, and the Middle East.

There are a total of six economic corridors under the overall BRI, as explained by Derudder and Kunaka (2018), which includes the China-Pakistan Economic Corridor (CPEC) that integrates the coastal regions of Pakistan with the Chinese border. Before September 2013, Chinese Premier Li Keqiang proposed a 1+4 cooperation framework strategy in May 2013, where energy, transport infrastructure, Gwadar port development, and industrial parks were included. As a follow-up, newly elected Prime Minister Nawaz Sharif visited China and signed the historic MOU on July 5, 2013[2]. It was not until April 20, 2015, that CPEC was officially announced during the visit of Chinese President Xi Jinping to Pakistan. Initially, 51 agreements and Memorandums of Understanding were signed that were valued at $46 billion. According to the Government of Pakistan's official website for CPEC, early harvest projects alone are worth estimated to be $46 billion. Whereas, adding additional long-term projects, it has been estimated that the total value is $62 billion and can rise beyond $100 billion in the future.

[1] Also known as the One Belt, One Road (OBOR).

The overall ambition of CPEC, with the exception of geopolitical goals, remained the connection of the Chinese land route with Pakistani ports at the south to develop Pakistan's economy by constructing and renovating its road, rail, and especially energy infrastructure. According to a jointly developed long-term plan by the Government of Pakistan, Ministry of Planning, Development, and Special Initiatives, and the People's Republic of China National Development and Reform Commission, CPEC's key cooperation areas consist of connectivity, energy, trade, agriculture and poverty, tourism and financial cooperation (Pakistan. Ministry of Planning, Development and Reform 2017). It is estimated that the value of CPEC investments and projects is above all Foreign Direct Investment (FDI) in Pakistan since 1970 and was valued to be 17% of Pakistan's GDP in 2015 (Deloitte 2016). Thus, there remains little dispute that CPEC will contribute and affect Pakistan's economy throughout its course of completion and in almost all key areas of the economy. In its Policy Reform Handbook for Trade Strategy in Pakistan, World Bank estimates that upon completion of infrastructure projects under CPEC, Pakistan can increase real income by up to 10.9 percent and GDP by as high as 13 percent.

To understand better the reasons for Pakistan's commitment to CPEC, it is essential to paint a broader picture of the economy. Anemic GDP growth, frequent power blackouts, high inflation, low foreign investment, and persistently high current account deficits rendered the country at a standstill. In comparison, regional competitors such as India and Bangladesh were fast-tracking ahead with record growth rates and development. CPEC provided Pakistan the opportunity to become a partner with a global player in trade along with uplifting its infrastructure, thus became Hobson's choice for policymakers. Prime Minister Imran Khan, in a speech at the World Economic Forum 2020, stated that the first phase of CPEC was to establish Pakistan's power generation capacity and connectivity, whereas phase two was focused on bringing agriculture technology, industrial growth, and railway infrastructure. Khan added later that Pakistan's energy remains 25 percent more expensive than Bangladesh and India, thus acknowledging that the power conundrum is not over and stating that it is the "biggest problem in Pakistan." [3]

A key reason, if not the primary reason, for Pakistan's drag on GDP growth remained its dilapidated and obsolete energy infrastructure. It was estimated that Pakistan was losing 2

[3] Abbasi (2020)

percent of its annual GDP due to frequent power outages[4]. The acute energy crisis spawned in 2008 and resulted in power outages (also known as "load-shedding" colloquially) for more than 12 hours a day, therefore, paralyzing all sectors of the economy (Kugelman 2013). On the announcement of CPEC, it was revealed that the power sector had taken up the largest share in the investment pie, and for good reasons. According to the National Transmission and Despatch Company (NTDC), Pakistan's energy deficit (the difference between energy generation capacity and peak demand) soared from 161Megawatts (MW) in 2006 to 4,396 MW in 2008. The catalyst for the immediate spike in deficit has often been attributed to the sudden increase in global oil prices, high growth in the consumption of electricity, inefficient government subsidies, and absent new power generation projects throughout the previous decade due to lack of planning.

It was estimated that $33.79 billion (Mirza et al. 2019) out of the initial announcement of $46 billion were earmarked for energy projects. These projects were estimated to add approximately 17,405MW to the national electricity grid. As explained by Abid and Ashfaq (2015), overcoming the energy crisis in Pakistan through CPEC was one of the foremost reasons for its massive popularity among policymakers and the general population. Chinese outward investment in the energy sector is not uncommon. Research by Du and Zhang (2018) states that earlier, Chinese overseas investment activities were concentrated in the energy and mining sectors globally. But now, the focus of China's overseas direct investment is shifting from natural resources to high technology- and consumption-oriented sectors.

Out of the six main objectives described, Afridi and Khalid (2016) state that one of China's motives for CPEC is to invest in the energy and mining sector of Pakistan. According to estimates, total actual committed investments in the energy sector in Pakistan as of November 2020, under CPEC, amount to around $22 billion[5] (this number is not to be confused with the overall number of $34 billion that is yet to be invested in the sector, as this only indicates what has been committed and what projects are under consideration). And since the announcement, 9 out of 17 priority power projects are commercially operational, which include three coal-fired plants, four wind farms, and one solar project (not completed, but 300MW operational) that

[4]Aziz, R. and Ahmad, M.B. (2015)
[5] Official Government Statistics available at www.cpec.gov.pk, energy projects are indicated by priority.

collectively have an estimated price tag of $9.3 billion, and an installed capacity of 5,920 MW (the MW figure does not include the mining and project in Thar). Nine other power projects remain under construction, including coal-fired power plants, hydropower projects, and transmission lines that, once completed, will have a total installed capacity of 4,000 MW[6].

Notwithstanding the large scale of CPEC energy-related investments in Pakistan, criticism of its efficacy, transparency, and ability to provide the country with an economic boost was rampant since its inception. Ali (2015) writes that issues concerning the transparency on CPEC projects resonated within political parties and the public since the announcement. Hussain (2016) writes that the widespread speculation that Pakistan would find itself in a debt trap because of CPEC would be banished only if facts are presented to the public domain. A wave of news regarding unsustainable borrowings in Sri Lanka and Malaysia in 2019 exacerbated suspicion on China's regional ambitions and, more importantly, the effects of CPEC on the public debt of Pakistan[7].

The impact of international news on Pakistan even resulted in a statement by Pakistan's adviser on commerce and industry, Abdul Razak Dawood, suggesting in an interview that the newly elected Government would review the merits of the CPEC and possibly even pause it for a year. Remarks made at a Belt and Road summit in Beijing in April 2019, the International Monetary Fund (IMF) Managing Director Christine Lagarde called for a BRI 2.0, which included transparency, open bidding, and competition. Lagarde further stated that "History has taught us that, if not managed carefully, infrastructure investments can lead to a problematic increase in debt."[8] The debate surrounding CPEC investments remain vibrant in the national and international press even in 2020.

On November 29, 2019, U.S. Ambassador and Assistant Secretary South and Central Asian Affairs Alice Wells raised suspicions about CPEC, based on the lack of transparency in awarding construction contracts and high cost of energy projects, which would, in turn, lead to debt

[6] Chinese and Pakistani government officials have frequently updated and altered CPEC projects. For example, initially Muzzaffargarh Coal project, Gaddani power park and Rahimyar Khan coal project were added to the early harvest projects but were later shelved due to feasibility issues.
[7] Smith (2018)
[8] Staff, "IMF's Lagarde says China's Belt and Road should only go where sustainable."

unsustainability[9]. Similar arguments were later reiterated in May 2020.[10] Hussain (2017) states that careful circumspection is required in six areas for a better implementation of CPEC, in which the foremost area included Pakistan's energy policy. As many energy projects achieve fruition, the ramifications on the energy sector have been considerable, and resultantly, energy policy has been required to be recalibrated.

It bears emphasizing that the word "energy" is a broad term and encompasses oil, gas, minerals, nuclear, and power etc. However, the study intentionally emphasizes the power sector only. The reason for choosing to restrict the scope of the study includes:

a- CPEC energy investments and projects in Pakistan are overwhelmingly focused on power generation.[11]

b- As most of the projects completed during the period of the study pertain to the power generation sector, ipso facto, the implications on the power sector will remain the most pronounced.

c- The study does discuss the implications of CPEC projects on the minerals sector (Thar mining) and energy resources broadly, but mainly because the overlapping of power generation and its resources are closely intertwined and inseparable without taking each other into context.

From an electricity deficient country, Pakistan has become a surplus country within five years, bringing a new slate of challenges for policymakers, which are discussed in Chapter 3. To date, while there remains considerable discussion on the merits and demerits of CPEC energy investments along with the potential and concomitant geopolitical and economic risks, there has been little or no record of analyzing the evolution and change in Pakistan's energy policy visa-a-vis the massive inflow of energy investments. This study intends to bridge the gap in the literature and attempts to provide a chronology of events in the energy policy domain, which were a direct result of CPEC energy projects and investments.

[9] Staff, "IMF's Lagarde says China's Belt and Road should only go where sustainable."
Corridor."
[10]Siddiqui, "Alice Wells' remarks another doomed attempt to defame Sino-Pak relations: Chinese embassy."
[11] With the exception of mining of Thar Coal reserves, all projects are power sector related.

1.1 Research Objectives

1- To study Pakistan's energy policies post-CPEC and analyze and compare the challenges that the Government faced then and now when five years have passed.
2- To provide a detailed analysis of what challenges CPEC projects brought and how the Government can better utilize Chinese investment in the power sector.
3- To propose policy changes in the energy sector to help identify any impediments to growth in the energy sector.

1.2 Research Questions

In line with the above discussion, the study aims to answer two central questions regarding CPEC's investment in Pakistan's energy sector:

1- How has Pakistan's energy sector changed since the inception of CPEC?
2- How has Pakistan's energy policy changed since CPEC? What policy lessons has the Government of Pakistan drawn from CPEC energy projects?

1.3 Significance of the Study

Pakistan has successfully managed to bridge its energy generation gap within the past five years due to both CPEC and non-CPEC power projects. As a result, load-shedding has been significantly reduced, which, in turn, has improved the livelihood of millions of people. However, Pakistan's power sector remains frail and riddled with problems. It behooves policymakers to evaluate the impact of CPEC investments to date, which constitute sizable energy-related projects. Recent reports have suggested that despite rising generation and improving the power mix, CPEC energy investments have brought along a new slate of challenges, including high debt and equity repatriations, significant government exposure to guarantees in take-or-pay contracts, and rising circular debt.

In light of the ongoing discussions on the pros and cons of CPEC energy investments, along with accompanying economic risks, there has been little or no record of analyzing the evolution and change in Pakistan's energy policy visa-a-vis the massive construction of CPEC projects. This study intends to bridge the gap in the literature and attempts to provide a chronology of events in the energy policy domain, which were a direct result of CPEC energy projects and investments.

The study is composed of two parts. The first part seeks to establish the changes in the energy sector as a result of CPEC energy investments, and the second part attempts to identify policy evolution in response to the after-effects of CPEC in the energy sector. While there remains considerable discussion on the merits and demerits of CPEC energy projects, along with the potential and concomitant geopolitical and economic risks, there has been little or no record of analyzing the evolution and change in Pakistan's energy sector and policy visa-a-vis the massive inflow of energy investments. This study is the first of its kind to attempt in identifying energy sector changes as a direct result of CPEC energy investments and documents the ongoing policy changes in the power sector as a result

The study aims to review what the literature has so far analyzed on CPEC vis-à-vis Pakistan's energy sector and policy in Chapter 2. In Chapter 2, the study also maps the entire power structure of Pakistan and discusses historical policies. Chapter 3 describes the research methodology and explains how it remains suitable for the research questions. Chapter 4 then analyzes and discusses how CPEC contributed to shaping Pakistan's energy policy and what course of actions are still required to reap its full potential. Chapter 4 also uses data to explore the dimensions and contributions of CPEC to the power sector of Pakistan and uses primary semi-structured interviews to deduce how government policy has been shaped. Chapter 5 provides a conclusion of the study along with the research findings and policy suggestions.

Chapter 2: Review of Literature

The literature review has been distributed in four sections. Section 2.1 briefly reviews Pakistan's energy policies before the CPEC announcement. Section 2.2 describes the existing energy sector structure and institutional setup in Pakistan. Section 2.3 explores research studies that have analyzed Pakistan's power policy with respect to CPEC. Lastly, Section 2.4 identifies the gaps in the existing literature studying CPEC and changes in the power sector of Pakistan.

2.1 A Review of Major National Power Policies prior to CPEC in Pakistan

The objective of this section is to familiarize the reader with Pakistan's historical energy policies and summarize their outcomes and shortcomings. Adopting a good energy policy is extremely vital for countries to promote economic growth, improve the well-being and welfare of their citizens. According to the World Energy Trilemma Index (2020), Pakistan ranks at 93 out of 108 countries in the world[12] for its energy policy and sector. The index used in the report provides an independent and objective rating of a country's energy policy and performance using three core indicators, namely energy security, energy equity, and environmental sustainability. Energy security indulges in energy diversification indicators and system strength, energy equity deals with indicators related to the price of energy, access to electricity, and affordability, and lastly, sustainability deals with efficiency and carbon indicators.

Good energy policies require careful assumptions, meticulous forecasting, and reliable demand analysis. In developing countries like Pakistan, they become ever more important given weak macroeconomic fundamentals. Therefore, a weak policy could potentially derail and suppress growth if they are not carefully drafted or implemented. The Government of Pakistan has developed many energy policies in the past that have achieved mixed results. Energy and power policies have long-term implications because power plants last for decades and, thus, any agreements can have far-reaching consequences for the economy.

[12] The report has been published for the past 10 years. Pakistan is also a member of the World Energy Council, which publishes the report.

It is discussed in Section 2.2 that prior to Pakistan's energy sector reforms in the '90s, Water and Power Development Authority (WAPDA) remained the dominant body that regulated, managed, and controlled the entire chain of the power sector. Various studies were carried out during this period, which resulted in the construction of large hydropower projects. However, there was not a single formal national energy policy prior to the 1990s (Mirjat et al. 2017). For this review, we begin with Pakistan's first formal national power policy released in 1994.

1994 Power Policy

The 1994 power policy remains one of the most controversial and consequential energy policies of Pakistan. The Policy was introduced to attract private sector investors to bridge the increasing gap between supply and demand and increase access to electricity in Pakistan. It was considered well ahead of its time by attracting private investors as a foundation of its national policy compared to other less developed countries in the mid-1990s. The policy was implemented under the World Bank's supervision and guidance under its "Private Sector Energy Development Plan" or PSEDP I and II[13]. This was Pakistan's first-ever attempt at a national level energy policy that introduced and welcomed the intake of Independent Power Producers (IPP), which, to this day, remain a large chunk of the power generation sector. According to the policy, the total installed capacity in Pakistan at that time was 10,800MW, whereas the shortage was estimated at 2000MW (Pakistan. Ministry of Energy, Private Power and Infrastructure Board 1994). Salient features of the policy included:

- Exemption to investors from corporate tax, customs duties, income taxes and other import surcharges.
- 6.5 cents per Kilo watt-hour (Kwh) levelized tariff for the first ten years (premium 0.25 cents for projects above 100MW)[14].
- Investors would be able to choose fuel, site/location, and technology.
- Indexation of inflation, foreign exchange risks, and inflation (domestic and US inflation) among other operation and maintenance (O&M) costs.

[13] Fraser (2005)

[14] The average bulk tariff was later revised downwards to 6.5 cents due to the abolishment of foreign exchange risk insurance by the government of Pakistan.

Main Outcomes of 1994 Policy:

- A net total of $3 billion flowed from abroad and was invested in the power generation sector.
- 16 IPPs were established by PPIB under this policy, which brought in a total of 6031MW of power into the system that was mainly Residual Furnace Oil (RFO) of 3200MW, and the remaining were gas-based power projects.
- Pakistan's energy mix shifted from hydel-based to thermal in a short time period (within 2 to 3 years), and, as a result, power shortages were eliminated.

Criticisms:

- According to Bacon (2019)[15] , insufficient attention was given to the affordability of private power in Pakistan. WAPDA's average tariff was 4.5 cents per Kwh in comparison to the policy's suggested 6.5 cents, which rose to 8.6 cents after the inclusion of 24.2 percent losses in the sector. Moreover, the returns on equity of 25 percent after-tax were excessive.
- The power demand was projected higher than what was added to the grid, resulting in excessive power being contracted.
- The institutional structure remained weak to support such a system of tariffs and investments, given the high losses of WAPDA and the KESC.
- Costs of the projects were considered higher than international projects of the same size with competitive bidding.
- High returns on equity and costs resulted in high capacity payments and debt repatriations, rendering the power system more expensive and unsustainable for the Government given sovereign guarantees.
- The power sector was made highly dependent on oil prices, leading to further dependency on a single fuel source. This would impact Pakistan's current account balances as well as its ability to keep the power sector affordable for consumers.
- The process was not considered transparent and subject to political interference and influence. Thus, allegations of corruption surfaced in 1997. The allegations of corruption

[15] The report marked both PSEDP I and II projects "Unsatisfactory".

and attempts to renegotiate contracts with IPPs led to the erosion of investor confidence in Pakistan.

1995 Hydropower Policy

After the apparent success of the 1994 policy in attracting private investment in thermal power plants, the Government announced a hydel power generation policy in 1995 (Pakistan. Ministry of Energy, Private Power and Infrastructure Board 1995). It was considered an extension of the 1994 policy, just for hydel power projects (Valasai et al. 2017). The objective of the Government was to diversify from the thermal generation plants and attract cheaper hydel sources for the grid. The salient features of the policy include:

- Offering the same fiscal incentives as with the 1994 Power Policy.
- A levelized tariff of 5.57 cents per kWh for under 20MW projects and 6 cents for projects between 21MW to 300MW and all above were to be assessed on a case to case basis.
- Given the nature of hydropower resources, selected and preferred sites were offered to investors instead of giving an open option as in the 1994 policy.
- The power to issue a Letter of Intent (LOIs) and Letter of Support (LOS) was delegated to the provincial governments.
- Provinces were allowed to manage investments for projects up to 50MW.

Main outcomes of the 1995 policy:

The project attracted only one hydel project during its course. The New Bong Escape Hydropower Project was originally conceived as a 45 MW run-of-the-river hydropower project. Later the project was renewed, and it became an 84MW capacity project.

Criticisms:

It was considered that the failure of the 1995 policy was due to the ambiguity in the process of site allocations and the content of feasibility studies. Moreover, investors remained more focused on quicker and easier thermal power plants instead of the long-term and complicated hydel projects (Kessides 2013).

1998 Power Policy

Since the success of the 1994 power policy and in the midst of legal battles against corruption and malpractices between the Government and IPP's, the Government introduced the 1998 power policy (Pakistan. Ministry of Energy, Private Power and Infrastructure Board 1998) to introduce a competitive power market and develop an autonomous regulator of the power sector. The policy was considered essentially an amendment and improvement to the 1994 power policy. The new policy was designed to attract more investment in the coal and hydel sector of Pakistan, therefore, diversifying the already RFO and gas-based generation sector. Also, the goal of the policy was to eventually privatize DISCOs and thermal government-owned generation companies or also known as GENCOs. The salient features of the policy were:

- Tariffs would be based on minimum levelized tariffs through international competitive bidding instead of the prior upfront tariff regime of the 1994 power policy. Tariffs would also be in PKR instead of USD.
- Feasibility studies would be carried out prior to the bidding process. The Government would prepare the studies.
- Tariffs would be based on a capacity price and energy price.
- The policy also provided protection against political risks.

Main Outcomes of the 1998 power policy:

The Government was under tremendous international pressure due to nuclear tests, and the political situation was not feasible as well. No project was built under this power policy. However, on a better note, National Electric Power Regulatory Authority (NEPRA) was constituted and made functional (Qudrat-Ullah 2015).

Criticisms:

- Not sufficient tax incentives were offered in comparison to the 1994 power policy.
- No IPPs came forward for investment in Pakistan under this policy.
- The Government was already involved in legal disputes with prior IPP's over tariffs and corruption charges. Thus investor confidence had been shattered.

2002 Power Policy

The construction of more than required power projects under the 1994 power policy and concomitant slow pickup of demand due to low GDP growth in the late 90's due to political instability led to a surplus of power generation in the early 2000s and resulted in high capacity payments and financial problems in the energy sector. According to Bacon (2019), Pakistan's generation mix was the most expensive in the region. The Government introduced the 2002 Power Policy to meet energy demands from indigenous sources from 2005 onwards (Pakistan. Ministry of Energy, Private Power and Infrastructure Board 2002). Also, the policy focused on targeting private, public-private, and public investments in the sector. It bears emphasis that the policy was substantially amended in 2006 in the Economic Coordination Committee (ECC) meetings. Some important features of the 2002 policy included:

- Shifting the burden and responsibility of fuel supply (guaranteed payments) from the Government to the IPPs.
- Tax incentives, such as income tax, turnover tax, and withholding tax on imports, were introduced again, similar to the 1994 policy.
- The policy initially did not offer similar tax incentives for duel fuel or oil-based power plants but later revised the decision in 2006 in ECC meetings.
- The Government indexed the foreign component of O&M costs to the US Consumer Price Index (CPI).
- In 2007, the Government secured the capital costs, costs during construction, foreign exchange debt of IPP's to any exchange rate fluctuations.
- The Return on Equity (ROE) was also allowed to be paid in US dollars.
- The Government also revised the policy to allow thermal (oil and gas only) to be formally approved on the international competitive bidding process.

Main Outcomes of the 2002 policy:

The 2002 policy resulted in 3,183MW of capacity added to the generation sector of Pakistan. They were a total of 14 projects which comprised of 7 gas-fired, 6 RFO, and only one private hydro power project (Uddin et al. 2019).

Criticisms:

- The policy exacerbated the already thermal skewed energy mix, i.e., more projects were made based on RFO and diesel-based power generation instead of focusing on coal or hydel power sources.
- The policy tied O&M, debt, and ROE to US dollars, which under depreciation has led to further increase in capacity charges and unsustainability of the power sector finances in Pakistan.
- All IPPs set under this policy earned exorbitant profits and the investment payback period was between 1-4 years. The internal rate of return (IRR) was estimated at 15 percent in US dollar terms.

2006 Policy for Development of Renewable Energy for Power Generation

The 2006 Renewable Energy Policy was Pakistan's first attempt to harness indigenous renewable energy in Pakistan. The policy primarily focused on promoting wind, solar and small hydel power projects. For this policy, the Government had employed the services of its recently mandated Alternative Energy and Development Board (AEDB). The policy included the short-term, medium-term, and long-term targets and targeted an overall 9700MW of capacity addition into the grid by 2030 (Pakistan. Ministry of Energy, Alternative Energy Development Board 2006). Some important features of the policy were:

- Wind-Risk (risk if the wind does not blow to power the wind turbines) was placed with the purchaser or Central Power Purchase Authority (CPPA).
- The policy included both feed-in tariffs and cost-plus tariffs to encourage private sector development.
- There were fixed capacity payments to be paid to the power generators even if the Government did not require power.
- Tax incentives were offered, such as exemption from income tax, repatriation of equity and dividends, and allowance to raise funds locally and internationally.
- Carbon credits could be claimed by IPPs.
- Mandatory purchase of renewable energy projects power generation.

Main Outcomes of the 2006 policy:

A total of 24 wind projects with a total capacity of 1,233MW were added to the system because of this policy. In addition, seven solar power projects of 480MW were added under this policy. Analysts were quick to point out that while the policy remained essential to diversify and indigenize energy resources, several shortcomings remained, as mentioned below (Mirjat et al. 2017).

Criticisms:

- Initial feed-in tariffs for RE projects were more expensive than other regional countries.
- More coordination was required by provinces and the AEDB to allow further projects to be constructed.
- Assuming the wind risk by the Government has placed a burden on capacity payments to power producers.
- Local industry was not incentivized, and, therefore, all equipment was to be imported.
- Lack of transmission infrastructure to support the intermittency of renewable energy into the grid. The policy did not incorporate the limitations of grid infrastructure.
- Difficult for renewable energy to compete against highly subsidized fossil fuel-based power plants.
- Unrealistic targets set, which to date have not been met.

2010-2012 National Energy Policy

In the backdrop of high fuel prices[16] and the already fuel/thermal intense power sector, the Government of Pakistan struggled to make import payments, distribute electricity due to dilapidated infrastructure, and raise electricity tariffs. As a result, the entire electricity structure and its financials became unsustainable, and hours of power outages followed. The Government announced a National Energy Policy in 2010, after holding a 3-day energy summit in Islamabad, declaring an end to power outages and increasing supply as well[17]. The policy primarily focused on taking demand-side measures.

[16] Brent prices rose above $120 in 2011

[17] Faiz (2013) and ADB (2019)

The salient features of the policy included

- Banning late wedding nights and closure of markets early.
- Short-term fix by introducing Rental Power Plants (RPPs).
- Reduced supply of electricity to KESC and rehabilitating the GENCOs.

Main Outcomes of the National Power Policy:

The policy had barely closed the gap between supply and demand and was mocked by media for addressing issues only superficially[18]. Later, the Government announced an Annual Plan 2010-2011. The Plan gave details on the means to close the gap, where it would add short-term 420 MW of rental plants, 1,241 MW of IPPs, 298 MW of hydel projects, 44MW of wind projects, and 116 MW from KESC (K electric now). According to details submitted to the Supreme Court of Pakistan, RPPs contributed on average 118MW between March 2011 and February 2012, which was estimated to be less than 1 percent of the total installed capacity in the country.

Criticisms:

- The Rental Power Plants (RPPs) drew substantial criticism and were subjected to the decision of the Supreme Court that it was laced in corruption[19].
- The RPPs were highly expensive and RFO and diesel-based, which again exacerbated the power crisis.
- No large projects were licensed during this tenure.
- Demand-side measures failed to mitigate power outages owing to the mammoth size of the difference between supply and demand of electricity.
- The Government failed to view the entire power sector under a long-term lens and could not adequately resolve them in a coordinative manner. No licenses were

2013 National Energy Policy

In view of the massive failure of the 2010 energy policy, which included its attempts to suppress demand and bring in Rental Power Plants (RPPs), the newly elected government of Pakistan

[18] Kugleman (2013)

[19] The Supreme Court had on March 30, 2012 scrapped all deals made by the government with RPPs set up since 2006 by declaring them illegal, non-transparent and invalid.

Muslim League Nawaz (PML-N) hurriedly pushed a new "National Energy Policy" for approval at the Council of Common Interests (CCI). The National Energy Policy was Pakistan's first holistic policy that covered the entire chain of the power sector and presented a roadmap for its resolution (Pakistan. Ministry of Energy, Power Division 2013). The power system's gap had increased as high as 5,500MW and showed no signs of abatement. As a result, power outages were estimated to last between 12-16 hours a day. The country was facing mass protests on a daily basis due to the lack of power as well as unaffordability. Despite being hastily designed, the policy remains a document that comprehensively covered and identified almost all the weak spots of the power sector. The policy addresses issues pertaining to the entire chain of the electricity sector, i.e., generation, distribution, and price issues. The following are some of the important features of the policy:

- The policy acknowledged the challenges set forth by years of negligence and lack of investment in the energy sector, such as the high supply-demand gap, expensive electricity due to thermal dominance in the energy mix, a weak transmission & distribution (T&D) sector, high theft, and lack of access to rural areas.
- The policy set out nine ambitious goals for the Government to achieve, which included increasing the supply of power, conservation measures, the use of indigenous sources, improving the T&D network, minimize financial losses and pilferage, and improve coordination in government departments.
- Along with setting up nine goals, the Government also set forth five targets to achieve by 2017, namely to plug the electricity gap to 0, reduce the cost of generation from 12 cents to 10 cents, reduce T&D losses from 23-25 percent to approximately 16 percent, increase collections from 85 percent to 95 percent, and to reduce decision-making process time (without setting up a timeline).
- Some of the notable strategies to meet the above goals were set out as retiring all circular debt, fast-tracking wind and hydel based projects, phasing out subsidies, converting expensive RFO and diesel-based plants into gas or coal, diversion of gas to the power sector, privatizing DISCOs and GENCOs, and installing smart meters to reduce theft.

Main outcomes of the 2013 Policy:

The National Energy Policy 2013 led to the formation of the 2015 Power Generation Policy, which, in turn, resulted in the inflow of investment of CPEC power projects in Pakistan (Irfan 2019).

Criticisms:

- The 2013 policy envisioned eliminating power outages by 2017. In reality, as discussed later, the power gap only closed in 2019.
- Despite the policy being sensitive to the price of energy generation, the cost of power increased.
- Transmission and Distribution renovation lacked emphasis throughout policy period.
- Financial constraints, such as circular debt and bill low recovery, remained.
- The policy to convert existing RFO and diesel-based generation plants into coal and gas never reached fruition.
- Failure to phase out or rationalize energy subsidies.
- Lack of coordination between government departments remains.

2015 Power Generation Policy

Following the 2013 National Energy Plan, the Government announced the Power Generation Policy in April 2015 to formally attract private investment to bridge the expanding supply and demand gap in the power generation sector (Pakistan. Ministry of Energy, Private Power and Infrastructure Board 2015). The new generation policy was a follow-up to the 2002 power policy and added many new features. The primary implementer of the policy was to be the Private Power and Infrastructure Board (PPIB) along with relevant provincial bodies. The policy was the first ever to welcome public investment projects and public-private partnership-based power projects. Salient features of the policy included:

- Fiscal incentives remained similar to the 2002 power generation policy.
- Private, public, and government-to-government G2G projects were included in the scope of the policy.
- Exchange rate risk was similar to the 2002 policy as well, where any exchange rate adjustments were catered for foreign debt payments.

- The policy ensured that there would be a payment of 50 percent of Capacity Charges in case an IPP is unable to procure fuel for the plant due to payment delays by NTDC.
- There was only a 5 percent customs duty for the importation of plant machinery.
- Laws of England were allowed for foreign lenders when signing Implementation Agreements (IA) and Power Purchase Agreements (PPA).
- NEPRA offered tariff incentives, such as a USD equity Internal Rate of Return (IRR) of 20 percent.

Main Outcomes of the 2015 Power Policy:

The policy attracted Re-Gasified Liquid Natural Gas (RLNG), hydel, imported indigenous coal-based power plants under CPEC and non-CPEC. To date, four CPEC coal-based projects have already achieved commercial operations with a total capacity of 4,620MW and are valued at $6.7 billion. In addition, three RLNG powered plants were established, in which two were owned by the Federal Government and one by the Punjab Government. The total addition in the capacity by these RLNG plants was 3,633MW. They are several hydel, coal, and RLNG power plants that are still in the pipeline (State of Industry Report 2020).

Criticisms:

- According to NEPRA and NTDC, power generation capacity is now in excess of estimated demand. Thus, implying an oversupply, as witnessed in the early 2000s, a direct result of the 1994 power policy.
- As a result of contracting power more than demand, Capacity Charges are increasing at unsustainable levels and can potentially render the entire power sector financially unviable.
- While the policy helped in diversifying the power mix, it did not focus on indigenous resources, such as Thar coal, in comparison to imported coal and RLNG. As a result, external payments did not subside.

2019 Alternative and Renewable Energy Policy (ARE)

The ARE 2019 policy was Pakistan's second-ever energy policy that focused on renewable energy resources (Pakistan. Ministry of Energy, Alternative Energy Development Board 2019).

The ARE 2019 policy's primary focus, as indicated by the document, is to protect the environment, least-cost generation, auction-based tariff determinations, and development of skills locally, and technology transfer. The scope of the ARE 2019 is much broader than the scope of the Renewable Energy Policy of 2006, i.e., including directly energy to waste, tidal wave, biogas and biomass, hydrogen, geothermal, storage, and hybrid technologies. Following are some of the important features of the policy document:

- The policy sets an ambitious target by stating that it will bring 20 percent renewable energy capacity to the system by 2025 and 30 percent by 2030.
- The document explicitly states that it will conduct auctions for RE procurement annually in lieu of the earlier upfront or cost-plus mechanisms of tariffs stated in the RE 2006 policy.
- The policy will conduct all procurement of RE volumes according to demand set by NTDC and the Indicative Generation Capacity Expansion Plan (IGCEP). The Government sets provisions for G2G contracts separately in this policy that may not have to follow the set guidelines of auctions or the IGCEP. It also gives the same waivers to new technologies on a cost-plus tariff method subject to AEDB approval, which will be unsolicited proposals[20].
- To promote local indigenization, all exemptions given to import products that can be manufactured locally will be discontinued, plant machinery for the assembly of RE technology will be exempted, and all tax anomalies will be removed.
- Domestic skill development will be conducted by the establishment of an Institute of Renewable Energy Technologies under the AEDB.
- Provinces are given a more important role whereby they would be able to establish projects where the offtake is not the Federal Government, or the interconnection is not given by the NTDC. The provinces can develop their own policies for projects.

[20] An unsolicited proposal (USP) is a proposal made by a private party to undertake a public-private partnership (PPP) project, submitted at the initiative of the private firm, rather than in response to a request from the government.

- Fiscal incentives include exemption from corporate income tax, import duties, repatriation of profits and dividends, protection from expropriation, and international dispute resolution.

Main Outcomes of the 2019 Renewable Energy Policy:

Twelve wind power projects achieved financial closure under the 2019 ARE policy with a total capacity of 610MW.

Criticisms:

- It is widely perceived that the targets set forth by the ARE 2019 policy are over-ambitious. The targets also set forth generation capacity (power) instead of the more realistic and reflective approach in targeting energy, that is, in gigawatt-hours, which is the actual energy produced.
- Given the current circular debt problems and dispute of wind power projects with the Federal Government over forced power "curtailments", the policy may scare off any potential investors in the future.
- Due to the inherent intermittency nature of renewable energy projects, grid stability and infrastructure would be integral to its success. Given the current weak conditions of the system, it seems challenging for NTDC to establish this in such a short time.

2.2 Institutional Structure of Pakistan's Power Sector

Pakistan's energy structure has experienced major changes during the past three decades. Prior to the 1990s, two State-Owned Companies (SOEs), namely the Water and Power Development Authority (WAPDA) and Karachi Electric Supply Company (KESC)[21] had a complete monopoly of running the entire power sector of Pakistan in their domains. According to Khan (2014), two major reforms had taken place to alter their monopolistic control. First, the Government created a regulatory authority called the National Electric and Power Regulatory Authority (NEPRA) in

[21] WAPDA controlled the power sector of the entire country except for Karachi and its adjoining areas, which were managed by KESC.

1998, and second, structural reforms were carried out where unbundling of managerial and operational functions was carried out at WAPDA.

The unbundling was mainly implemented to achieve better efficiency and governance by separating the functions of Generation, Distribution, and Transmission in the entire country Bacon (2019). WAPDA was split into two entities in 1999, where WAPDA itself remained to oversee only hydroelectric power generation, and Pakistan Electric and Power Company (PEPCO)[22] was made responsible for managing nine distribution companies, four government-owned generation companies (GENCOs), and NTDC. It bears emphasis that the reforms were carried out to create an enabling environment for private investment to flow in the power sector of Pakistan[23]. To understand the entire structure of the power sector better, we summarize a few important players operating in Pakistan and provide a graphical illustration.

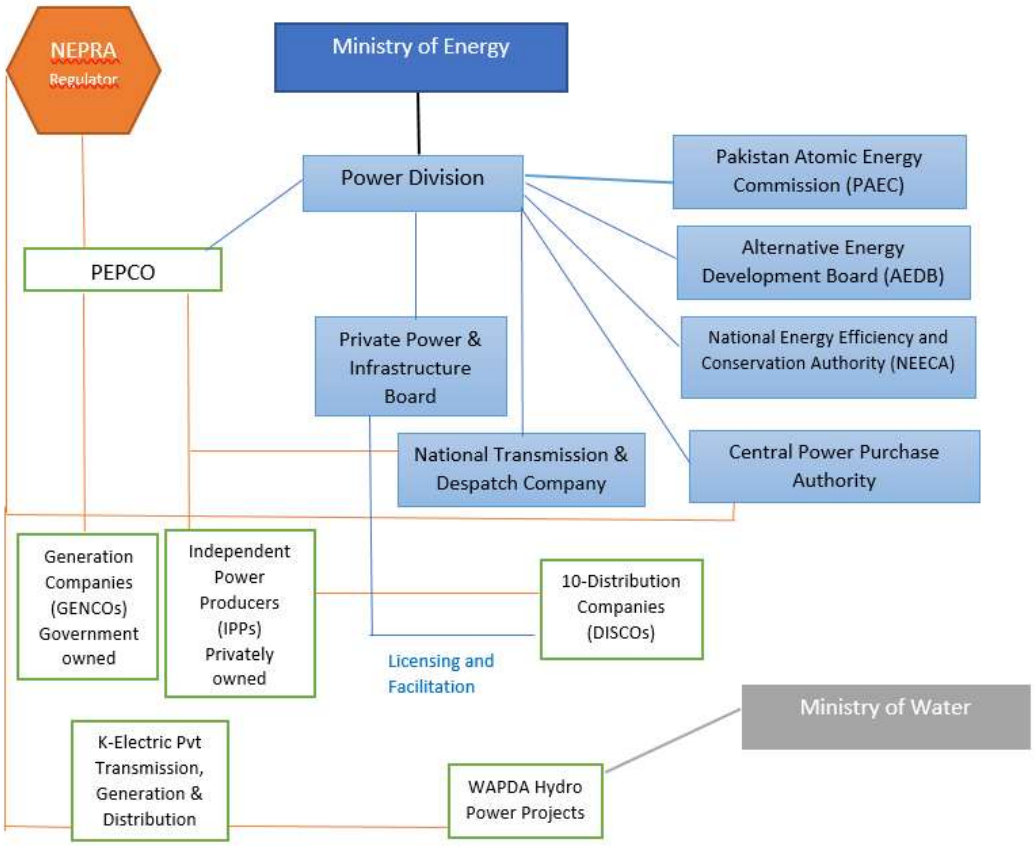
Ministry of Energy-Power Division

In a step towards more consolidation of the entire energy sector, streamlining functions and coherence in policy, the Government of Pakistan, in 2017, established the Ministry of Energy by merging the Ministry of Petroleum and Natural Resources and Ministry of Water and Power. A separate Ministry of Water was established that took control over WAPDA and water-related affairs. Pakistan's primary responsibility for energy policy remains with the Ministry of Energy, which, in turn, is bifurcated into two divisions, namely Power Division and Petroleum Division. The Ministry of Energy, Power Division comprises a technical and an administrative division, where the technical division is charged with devising and formalizing Pakistan power sector policies under the guidance of the Federal Minister of Energy.

[22] PEPCO was dissolved in 2010. The current government is considering reviving PEPCO.

[23] The Word bank and Asian Development Bank (ADB) were the main financers and designers of the reform projects carried out in the 90s. According to a World Bank Review report, the projects implemented in the 1990's were given an Unsatisfactory rating.

Figure 2.0: Structure of Pakistan's Power Sector



Source: Author's illustration using reports by NEPRA, ADB, and World Bank.

National Electric and Power Regulatory Authority (NEPRA)

NEPRA was created under the NEPRA Act 1997. The authority's main function was to regulate the entire chain of the power sector, which includes the Generation, Transmission, and Distribution network of Pakistan, issue licenses for all activities of generation, transmission, and distribution, and, most importantly, set their tariffs. NEPRA also has the authority to impose fines, ensure implementation of contracts, and protect consumers from any unfair practices from the sector.

Private Power and Infrastructure Board (PPIB)

PPIB was established in 1994, during the same period as the 1994 National Power Policy. It remains one of the most important and consequential institutions in the power sector of Pakistan. Its primary function remained to attract private sector investment in Pakistan. Other functions of

PPIB include acting as a facilitator to private investors, approving licenses, being the lead negotiator on behalf of the Government, providing guarantees, and negotiating power and fuel contracts, among many other duties. The establishment of PPIB provided the Power Division with technical expertise to deal with Independent Power Producers (IPPs). More importantly, PPIB remains an integral part of the power structure as it also facilitates and recommends the Government of its power policies. PPIB's role was further increased in 2015, where it was charged to facilitate Public owned power plants to be established under the IPP model in Pakistan.

Central Power Purchase Agency (CPPA):

The Central Power Purchase Agency (CPPA) was created as a company to take over functions related to market operator and market developer from NTDC that were originally planned in the power sector reforms of the '90s. The market currently operates under a single–buyer market for power. The operationalization of CPPA began in 2015. CPPA's core function includes power procurement from power producers and sell to DISCOs (primarily acting as a financial intermediary). It is also a settlement agency where all finance-related matters between the DISCOs and power producers also occur. On the policy front, CPPA is also responsible for developing a competitive power market as envisaged by the Federal Government under different policies.

Alternative Energy Development Board (AEDB)

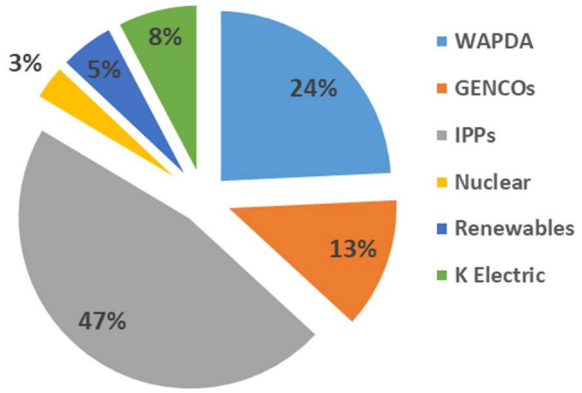
The Alternative Energy Development Board (AEDB) was created in 2003 for primarily supporting investment in solar, wind, and small hydro in Pakistan. The AEDB was also given charge of developing renewable energy policies for the Ministry of Energy, implement the policies and facilitate the development of these projects. The mandate of AEDB also includes the promotion of bagasse/biomass energy projects as well.

Power Generation Structure:

Pakistan's power generation setup can be mainly distributed in four types of generation companies, which are 1) Independent Power Producers (IPPs), 2) Government-owned Generation Companies (GENCOs), 3) Nuclear Power Plants, and 4) WAPDA owned Large

Hydropower projects[24]. PPIB has issued and assisted in the setup of 40 IPPs, with a total generation capacity of 17,551MW, over the course of its history, which were developed on a private sector model. In addition, the AEDB has helped establish 24 Wind power projects (1,235MW) and 6 Solar energy projects of 430MW. They are a total of four generation companies that are owned by the Government, which include Jamshoro Power Company (GENCO-I), Central Power Generation Company (GENCO-II), Northern Power Generation Company (GENCO-III), and Lakhra Power Generation Company (GENCO-IV). The total capacity of all GENCOs is 5,762MW. Pakistan currently has five nuclear power stations, with one based in Karachi, while the remaining at Chashma. The total capacity of the nuclear power stations is 1,318MW. WAPDA has 9,387MW of large hydropower projects under its charge, which include Tarbela Dam, Mangala Dam, Ghazi Barotha hydropower projects, and Neelum Jhelum power plants, among others.

Figure 2.1: Installed Capacity as Per Ownership and Type (2019-2020)



Source: NEPRA State of Industry report 2020 and Energy Yearbook 2020

Transmission and Distribution Network:

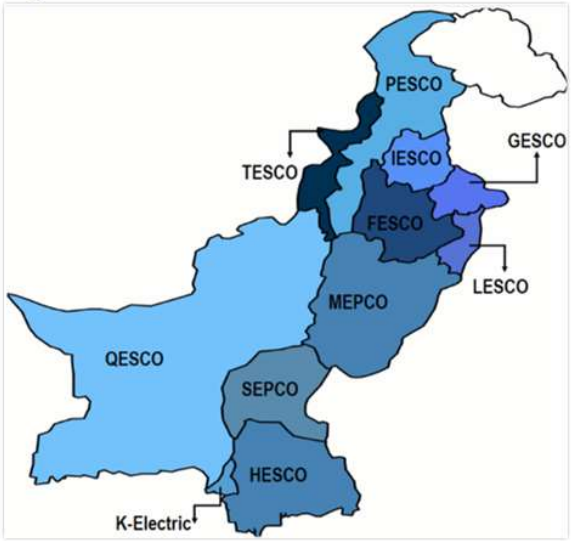
Pakistan's current electricity transmission network for high voltage 500KV and 220KV is all controlled by a single company called the National Transmission and Despatch Company (NTDC)[25]. As mentioned in the above brief history, NTDC was unbundled in the late-90s from WAPDA. NTDC functions as a system operator and primary dispatcher of electricity from power generation companies to distribution companies on an economic merit order. More importantly, NTDC is responsible for power system planning of the entire country, which includes the development of medium-term and long term load forecast and indicative generation capacity

[24] National Transmission and Distribution Company (NTDC)
[25] This doesn't include areas in Karachi and under K-Electric.

expansion plan, preparation of transmission development plan, and the development of transmission investment plan.

The distribution sector (DISCOs) is responsible for managing and maintain all power lines from 132KV and below. They are a total of 10 DISCOs, which are geographically distributed, as depicted in Figure 2.2**.** Pakistan's distribution system is marred with high losses and low recoveries due to bad governance, weak law and order, and poor infrastructure.

Figure 2.2: Distribution Division in Pakistan



Source: NTDC

2.3 Pakistan's Power Policy and CPEC

It has been tabulated that $33.79 billion (Mirza et al. 2019) out of the initial announcement of $46 billion were earmarked for energy projects. These projects are estimated to add approximately 17,405MW to the national electricity grid. Abid and Ashfaq (2015) explain that overcoming the energy crisis in Pakistan by means of CPEC was one of the foremost reasons for its massive popularity among policymakers and the general population. Chinese outward investment in the energy sector is not uncommon. Research by Du and Zhang (2018) states that earlier, Chinese overseas investment activities were concentrated in the energy and mining sectors globally. But now, the focus of China's overseas direct investment is shifting from natural resources to high technology- and consumption-oriented sectors.

Kamran et al. (2019) examine Pakistan's power structure and find that the energy mix has shifted from hydropower intensive to thermal intensive since the 1994 energy policy. The study also conducts a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis of the power sector of Pakistan and finds that while there is tremendous potential in the renewable sector to

grow, lack of a strong grid infrastructure, political instability, and power theft remain central bottlenecks. The authors advise that under a CPEC agreement, the Government should offer the Chinese incentives to shift more power towards indigenous fuels and renewable energy instead of imported coal and thermal power plants. In reality, the authors do not take into account the hydel projects that have already initiated under CPEC, and Thar coal, which, in turn, are expected to tilt the balance towards indigenous resources.

Iqbal et al. (2018) analyze Pakistan's energy policies since 1994, stating that this was the first time there was a consolidated and formal energy policy to attract foreign investment. They use the 5 E's approach to evaluate and analyze energy policies since 1994 and deduce that the demand and supply gap of power supply kept increasing over a 25-year span. The authors also briefly address whether CPEC energy projects provide a solution to the power crisis and caution that while there are plenty of efforts to increase generation, the Government will have to address the distribution sector, where losses hover around 20-25 percent. The research was carried out in 2018. Therefore, it was only possible to analyze the impact CPEC has had for three years. However, most of the coal and renewable projects have come online post-2017, therefore, missing out on key projects under CPEC.

Qudrat-Ullah (2015) also examined the energy policy of Pakistan through the lens of socio-economic and environmental effects. The author also came to a similar conclusion that the energy policies of Pakistan failed to address the primary goal of achieving a balance in supply and demand of electricity production, and to make matters worse, also brought on severe environmental repercussion as well.

S. Malik et al. (2019) use a framework that primarily assesses the energy sector and energy security of Pakistan that is based on Availability, Affordability, Applicability, and Acceptability (4A approach). The study analyzes energy data from 2011 to 2017 only and finds that as Pakistan turned to imported fuels to generate electricity, energy security indicators deteriorated. The study acknowledges massive investments in the energy sector from 2014 onwards but also cautions about the results. The study predicts that imported fuel energy is expected to double by 2025 and, therefore, poses a serious challenge to policymakers in the near future as import bills increase and render the current account more at risk. The study suggests that the Government

take remedial policy measures to encourage indigenous fuel power generation to improve energy security and provide a sustainable and greener future in the sector. The analysis provides a useful tool for policymakers to evaluate past policy mistakes. However, the study does not delve into specific CPEC generation plants and their associated costs to compare their cost efficiency with other power plants.

Iqbal et al. (2019) present a review of literature on CPEC and its impact on Pakistan's electric power crisis. The study is based on a meta-analytic review of 17 studies completed from 2015 to 2018. The authors conclude that CPEC significantly reduces the energy crisis but also highlights that inadequate planning, a dilapidated electricity distribution system, and an unsustainable energy mix would create problems. The study briefly dwells on different power policies prior to CPEC and their weaknesses but does not elaborate in detail what policy weakness or strengths have resulted in the aforementioned problems.

Uddin Ahmad et al. (2019) conduct a meta-analytic review of 18 papers relevant to CPEC energy projects. The evidence indicates that CPEC augmented energy security in Pakistan. However, it comes along with five worrying factors as well, which comprise economic burden, security threat, project completion delays, lack of project feasibility studies, and inter-provincial conflict. The study uses Spearman's correlation to find key terms in the studies. The authors use papers published between 2014 and 2018 only. More importantly, the study states that policymakers have failed to take into account the aspect of loan investments that accompany CPEC power projects, existing circular debt, and other questions that could potentially exacerbate as a result of growing foreign investments. They add that no consideration has been given to renew Pakistan's energy policy, which was last updated in 2013.

Similarly, Herberg (2017) states that while CPEC holds potential to resolve Pakistan's energy shortages and displace old furnace oil based power plants, it will not be able to solve the broader energy crisis that are deep rooted outside of power generation. The study also emphasizes how numerous policymakers are concerned about Pakistan's ability to repay CPEC related debts. While the study provides a discourse on CPEC and its ramifications for Pakistan's energy future, it lacks specificity and detailed analysis that uses data and actual generation numbers that have been released.

Valasai et al. (2017) review Pakistan's energy problems, discuss the policy history, and make recommendations. The paper further adds that energy projects are being constructed under the independent power producers (IPPs) model and will be financed by the Export-Import Bank of China with interest rates ranging from 5 to 6 percent. More importantly, the study states that the Government will be obligated to purchase electricity at set tariffs. This rings true under the current predicament that the Government is facing, which has resulted in the renegotiation of power contracts with CPEC and non-CPEC projects because "Take or Pay" contracts have become unbearable in the long term. Valasai et al. (2017) recommend that restructuring, settling the circular debt, conservation efforts, and a sensible mix of energy are key steps that the Government must take going forward to improve the sector. The study, however, does not discriminate between CPEC and non-CPEC power projects.

Mirjat et al. (2017) provide a review of the entire energy sector of Pakistan and its power policies historically. The study concludes that due to a lack of Integrated Energy Planning (IEP), the country has been unable to develop its indigenous natural resource and rational energy policies. The study uses a qualitative methodology to assess the strengths and weaknesses of the different policies that the Government introduced in the past. Also, given that new data has

The study goes further by analyzing five energy modeling tools that can be used for adoption in Pakistan for coherence in the entire sector. Irfan (2019) uses SWOT analysis for evaluating the most recent "National Power Policy" that was revealed in 2013. The authors find that while the strengths include the massive potential for renewable energy and indigenous resources, the risks include high costs, high distribution losses, and inconsistency in energy policies. The methodology is useful in analyzing a single government policy and identifying its pitfalls but lacks information on how the policy has fared in the years following its implementation, including no mention of how CPEC and RLNG based power projects that followed have yielded the required goals of the policy.

Nasim and Fatima (2020) estimate and compare the cost of electricity generation from oil and gas power plants (commissioned between 2010-2014) with coal-based power generation plants

(all coal power-based plants constructed in Pakistan since 2017 are under CPEC). The study finds that coal plants established under CPEC are cheaper than oil and gas-based power plants. The authors assume the load factor of the plants at 85 percent. The study also finds that when taking into account the carbon emissions of these coal plants, by using median CO2 costs of 34 countries, the differential reduces. The study is unique in its method by its comparison of CPEC and non-CPEC plants but is also limited in that it only takes into account the data from June 2017, when only the Sahiwal Coal power plant was commissioned.

Raza et al. (2018) use data from the World Bank and the official website of CPEC to study the relationship between energy and growth. They underscore the importance of energy projects of CPEC and state that there is a strong correlation between electric power consumption, labor force, and price ratio with GDP. These results indicate that CPEC will likely add to employment because of higher electricity consumption. However, the study overall does not differentiate which projects they have taken into account specifically, as many energy projects are non-CPEC. Divorcing CPEC and non-CPEC energy projects would be essential to estimate the impact and contribution of CPEC on Pakistan's energy sector.

Prior to CPEC, Kessides (2013) use discourse analysis to evaluate issues in the energy sector that had debilitated the economy of Pakistan. The study shows how Pakistan's energy policies in the past failed to encourage cheap and indigenous energy sources over the previous three decades, which therefore led to this "Chaos in Power". The study underlines the lack of a policy framework, governance, decentralization, and weak regulation that had contributed to the crisis. The author also points out the lack of use of coal reserves and remained utilized only 0.2 percent of the country's power generation capacity.

2.4 Gaps and Issues Identified from Literature

The existing literature on the power sector and CPEC, with specific reference to Pakistan, reveals the following gaps and issues:

1- Power policies of Pakistan since 1994 reveal how the Government aims to resolve one problem and faces another as a consequence. This manifests in a weak policy design that focuses on only short-term goals instead of long-term planning. For instance, while the 1994 policy achieved its aim to increase generation, it resulted in high energy costs and focused singularly on thermal imported fuel plants mostly. Subsequently, the Government realizing its mistake, issued a hydel-focused policy in 1995 and then turned back to investors in the late 90s due to legal disputes. This "ad hocism", inconsistency and bad planning continued throughout the decade of 2000s as well.

2- Most studies use power sector data until 2018, whereas most CPEC power sector projects were commissioned after 2018, and data of their energy generation was shared in the following years. The data used till 2018 is quite short for making any strong analysis on the results of CPEC projects. Data use prior to 2018 would also result in an analysis that would miss out on many of the critically important CPEC projects, which include wind power projects and domestic coal-based generation power plants. Therefore, the results could be misleading.

3- Almost all studies with reference to Pakistan's power sector do not discriminate between CPEC and non-CPEC projects. Moreover, generation plant-wise analysis is absent. Only one study uses the plant-wise generation data, which uses data up till June 2017. There has been a significant change in the power sector and its challenges since then.

4- While the studies provide strengths and weaknesses of different power and energy policies of Pakistan, they lack a comprehensive discourse on how CPEC has changed the landscape of the power sector and policy with the empirical investigation and actual numbers of generation. The challenges are laid out by the previous studies, but descriptive analysis of previous power policies and context remains weak. Also, as these studies use data that miss out on key CPEC projects, policy prescriptions may have become obsolete. New challenges and the rapid development of the sector in the previous three years behooves new analysis and context.

Chapter 3: Methodology and Data

In view of the breadth, flexibility, and types of information used, the study uses document analysis as its primary methodology for analysis. Bowen (2009) writes that "Document analysis is a systematic procedure for reviewing or evaluating documents—both printed and electronic (computer-based and Internet-transmitted) material. Like other analytical methods in qualitative research, document analysis requires that data be examined and interpreted in order to elicit meaning, gain understanding, and develop empirical knowledge"[26]. The documents for this methodology and analysis include charts, meeting notes, newspaper clippings, press releases, institutional reports, quotes, interviews, and various other public and private records.

Document analysis also provides a means to record and track changes due to a specific event. A researcher can use documents and compare differences in how a specific event changed circumstances over time due to its implementation, which appropriately suits the study at hand, that compares Pakistan's power market structure and policy pre and post CPEC inception. It is pivotal for this study to have a careful context of previous/historical energy policies that have shaped the discourse of the current energy policy of the Government. Using document analysis greatly benefits the aim of the study, which analyzes Pakistan's energy sector and policy in view of its historical challenges and CPEC's inception. To draw a relationship of the challenges, Pakistan was facing during the early 2010s in its energy sector and the role and utility of CPEC energy investments require careful analysis and details that would become difficult to explain and recount using only quantitative methods. A discussion on Pakistan's energy sector involves more than ten organizations that play a key role in the determination of the energy policy. The complexity of combining information, collecting and corroborating data provided by many organizations and key players requires exhaustive coverage and contextualization, which are the advantages of using document analysis within the qualitative methodology framework.

The study of public policy requires examining government actions, policymakers, and stakeholders, which is a dynamic process that always changes over time. Moreover, due to the

[26] Bowen (2009, 27)

complex interplay of many government institutions, which also results in a particular policy formation, document analysis is better suited for our analysis in lieu of using quantitative methods. Another key benefit of using this qualitative methodology and document analysis is the time limitation factor. Because CPEC was signed in April 2015, significant and large projects only begun operations in mid-2017, leaving barely two and a half years of data patterns to analyze. This, in turn, means that we do not have enough data points to carry out any meaningful quantitative analysis. In addition, using document analysis allows us to analyze studies in a specific context to Pakistan's energy woes. They are many analyses and reports that have been conducted on the overall impact of CPEC on growth, but only limited analysis has been carried specifically on the energy aspects of CPEC. Thus, gleaning information specific to the scope of the study is easier in document analysis compared to a specific quantitative approach. In light of the research questions, document analysis provides a comprehensive approach that can take the historical context (part 1 of the research question) to the evolution and then taking forward the lessons that can be learned (part 2 of the research question).

Bowen (2009) writes that document analysis help produce an outline of problems and questions that can be figured by using other methodologies, which add to the data, increase credibility, and validate findings. The benefit of using document analysis for this study is that it can be used combined with other qualitative research methods (Patton, 2002). Because the study is aided by semi-structured interviews from eight power sector experts (essentially to build our case to address the second part of the second research question, i.e., deriving the policy lessons from CPEC projects), using this methodology would provide the flexibility and accuracy for arriving at specific conclusions that confirm the authenticity of the information used from documents. They are essentially three types of interviews used to approach answers to qualitative questions and studies, namely structured, semi-structured, and unstructured (Longhurst 2003).

The purpose of semi-structured interviews is primarily to ascertain the interviewees' response and opinions to an incident that is relevant to the research subject. Semi-structured interviews are employed when there is sufficient factual and objective information about a particular topic, but subjective knowledge and information are lacking (Merton & Kendall,1946). Using semi-structured interviews allows us to give interviewees space and provide elaborate policy angles

regarding CPEC subjectively, as different aspects of the energy sector are closely interconnected. In contrast, a structured interview would bound interviewees to remain within the domain of the question and fail to grasp the context of the answer and background. Because energy policy is a complex topic and is intertwined to many areas of public policy, the use of semi-structured interviews had greater logic and provided more insight and breadth.

Semi-structured interviews are widely conceived as one of the most effective and suitable ways of collecting information and data (Kvale and Brinkmann 2009). In the case of this study, we have identified data and interpreted it for analyzing changes in the energy sector but lack content regarding the energy policy impact. Specifically, to answer part two of the research question, i.e., CPEC's impact on Pakistan's energy policy, we use interviews with energy sector experts and public officeholders and arrive at thematic areas of interest. The interviews allow us to build and analyze the narrative on how CPEC has shaped Pakistan's energy policy and continues to do so, which would be difficult with quantitative methods. The study aims to explore the "how and why" aspect of CPEC's impact on the energy sector and policy, which is better adapted to qualitative research and semi-structured interviews than quantitative methods. While semi-structured interviews do not aim to provide numeric and specific factual data, they are extremely useful when analyzing topics that are yet to be researched and are of subjective nature.
During the semi-structured interviews, steps were taken for proper conduct and avoid biases as proposed by Patton (2002). Some of the steps included asking one question at a time and allowing the respondent to answer until finished, keep neutrality when discussing pros and cons, and eliciting no emotional response or reaction, and lastly, making sure the interview does not astray to irrelevant areas.

Our main method of organizing interviews was face-to-face conversations on the topic at the respective offices of respondents or meeting at a neutral spot that was private and comfortable. The selection of interviewees was based on a simple two-step procedure. The first step involved shortlisting candidates that were experts in energy policy in Pakistan. Initially, there was a list of 20 personal contacts who were involved in the energy sector and had expertise in working on CPEC energy-related projects directly and indirectly. The second step involved approaching 20 contacts that were prepared to answer willingly on this topic. Out of all the government officers

approached, only three government officials agreed to discuss the condition of anonymity, whereas five private sector contacts had some reservations but generally remained open without the condition of anonymity. It bears to note that out of the five private sector respondents, three had prior working experience with the government and held senior policy positions during their tenures. The list of eight respondents ensured the representation of both; private and public sector opinion on the state of CPEC and its contribution to Pakistan's energy and power sector.

As given in Annexure B, the structure of questions did not strictly follow the given numeric order; rather, questions followed after introductions informally. Answers, at times, came before the actual question was posed. Hand-written notes were made and then manually analyzed to form common themes of discussion. The average time taken to conduct a single interview varied from 30 minutes to one hour. At times, follow-up questions and clarifications were sought after interviews to draw conclusions and avoid mistakes in notes. Because there is limited research, to the best of the author's knowledge, on CPEC energy projects' impact on Pakistan's energy policy, semi-structured interviews provided significant insight and an extensive range of opinions. Using interviews allowed general and recurring themes to be structured descriptively and more efficiently.

To analyze the first part of the second research question, the study uses data mostly sourced from public institutions. Data on CPEC projects is gleaned from the official CPEC website (cpec.gov.pk), press reports, and information from NEPRA documents during tariff determinations and licenses. Data on the power and energy sector is taken from NTDC, Alternative Energy Development Board (AEDB), CPPA's power purchase data and annual reports, NEPRA's State of Industry Report, PPIB, and the Energy Yearbook of Pakistan (EYB) published by the Hydrocarbon Development Institute of Pakistan (HDIP). Most data and public reports have been made available on the respective websites of government institutions. Data specific to CPEC projects, including their actual generation costs and capacity payments, have been made available in NEPRA's State of Industry Report 2020. Previous years' data on capacity payments – power plant wise-data has not been made public, limiting a time series analysis. The study uses generation data in terms of a kilowatt-hour (Kwh) generated by all power generation companies and total dependable capacity (what can potentially be generated at

maximum levels) that includes CPEC and non-CPEC projects from NTDC's Power Market Survey. The estimated number of peak demand projections and available generation capacity numbers have been used from NTDC's power market Survey and NEPRA's public reports. Information on Pakistan's previous power policies and their shortcomings have been collected from various reports by International Financial Institutions (IFI's), consultant monitoring and evaluation reports, and research policy notes.

Chapter 4: Analysis and Discussion

This chapter is divided into three main parts. Part one explains the ongoing debate on CPEC overall and its criticisms. The first part also lays out how energy projects are a large part of the criticisms within CPEC and therefore require specific attention. Part two delves into CPEC energy projects in detail and the respective energy policy since its inception. This part also analyzes, using data, the impact these projects have had on the energy sector of Pakistan from 2015 to 2020. Finally, part three explains how the Government's energy policy has changed as a result of these CPEC energy investments and critically analyzes these policy decisions. Part three uses primary semi-structured interviews with eight experts to build on the argument on how Pakistan's energy policy has changed to date and will require new policy measures.

4.1 The Debate on CPEC

CPEC has been embroiled in controversy, both internationally and domestically, since its public announcement in April 2015. The location, route, type, and magnitude of investments have led to many contrarian opinions of the benefits of these projects, attracting domestic criticism from the Pakistani political community and policymakers[27]. Given the scale of CPEC investments in Pakistan, criticism of its efficacy, transparency, and ability to provide the country with economic prosperity is common. Ali (2015) writes that issues concerning the transparency of CPEC projects resonated within political parties and the public since its announcement. Hussain (2016) writes that the widespread speculation that Pakistan would find itself in a debt trap because of CPEC would be banished only if facts are presented to the public domain.

A wave of news regarding unsustainable borrowings in Sri Lanka and Malaysia in 2019 stoked suspicion on China's regional ambitions and, more importantly, the effects of CPEC on the public debt of Pakistan[28], even though the evidence did not support this. Kratz et al. (2019)[29] compiled instances where Chinese external debt was renegotiated with sovereign countries. They found 40 instances of debt renegotiations in 24 countries since 2007. The research focuses only

[27] Raza, “CPEC could become another East India Company.”
[28] Smith (2018)
[29] Kratz et al. (2019)

on loans that involve government guarantees and not project term renegotiations[30]. The paper finds that asset seizures are very uncommon occurrences, in which practically only two cases were found, i.e., Sri Lanka and Tajikistan. The impact of international news on Pakistan even resulted in a statement by Pakistan's adviser on commerce and industry, Abdul Razak Dawood, suggesting in an interview that the newly-elected government of Pakistan Tehreek-e-Insaf (PTI) would review the merits of the CPEC and possibly even pause it for a year[31].

Similarly, remarks made at a Belt and Road summit in Beijing in April 2019 by the International Monetary Fund (IMF) Managing Director Christine Lagarde called for a BRI 2.0 which includes transparency, open bidding, and competition. Lagarde further stated that "History has taught us that, if not managed carefully, infrastructure investments can lead to a problematic increase in debt"[32]. On November 29, 2019, the U.S. Ambassador and Assistant Secretary South and Central Asian Affairs Alice Wells raised suspicions about CPEC based on lack of transparency in awarding construction contracts and high cost of energy projects, which would result in debt unsustainability. Similar arguments by Wells were reiterated in May 2020. CPEC's projection and criticism have remained inconsistent in Pakistan over the years. Haider and Waqar (2019) analyze the projection of CPEC in the print media of Pakistan and conclude that both Government and media contribute to creating an atmosphere of uncertainty and confusion. The authors elaborate on how the narrative on CPEC's contribution to the economy has moved from positive to negative over the years and remains inconsistent throughout the period owing to mixed public signals.

Even though debt sustainability remains out of the scope of this paper, but it bears some thought and focus on understanding how energy is a significant part of the debate. The narrative that CPEC was initiated to distress Pakistan's debt sustainability purposefully remains unfounded. Downs (2019) specifically concludes that although CPEC power projects would add to Pakistan's sovereign debt, there seems to be no deliberate attempt or strategy to damage Pakistan. Moreover, given the relationship between Pakistan and China, the success of CPEC, not failure

[30] Project terms like the recent revision in the East Coast Railway project with Malaysia.
[31]The remarks were later rescinded and clarified
[32]Staff, "IMF's Lagarde says China's Belt and Road should only go where sustainable."

and unsustainability, would serve Chinese interests better. The author also highlights the fact that other international investors (Oracle (British), Almirqab Capital (Qatar-based), International Finance Corporation (IFC,) and the World Bank) would not have heavily invested in CPEC power projects had they deemed these projects unsustainable. However, there are other geopolitical reasons as well for their investment. A much widely cited study, Hurley et al. (2019), identifies Pakistan as one of eight countries that may suffer debt distress due to Chinese investment. The authors find that Pakistan remains one of eight countries in the high-risk category due to BRI projects. The study, however, does not take into account the difference between domestic and external debt. Moreover, the study only attempts to gauge the risk factor in terms of debt sustainability and does not delve into the details of country-specific dynamics such as Pakistan, which direly needed investment in its energy infrastructure in 2013.

Therefore, criticism and debate on CPEC have often, directly and indirectly, revolved around its flagship investment goal to build energy infrastructure projects. Upon completion of five years since CPEC was announced and significant size of energy projects achieved fruition, it behooves policymakers and researchers to analyze the ramifications for Pakistan's energy sector carefully.

4.2 CPEC's Contribution to Pakistan's Power Sector

To better understand the reasons for Pakistan's commitment to CPEC, it is essential to paint a broader picture of the economy and energy sector prior to 2015. Anemic GDP growth, frequent power blackouts, high inflation, low foreign investment, and persistently high current account deficits rendered the country at a standstill and in a second IMF program (2013) since 2008. Due to weak macroeconomic fundamentals and loss of investor confidence, little interest was shown for investment in Pakistan's energy infrastructure. Power outages most frequently occurred during peak demand hours, i.e., when consumers needed electricity the most. In the case of Pakistan, it was during sweltering temperatures in June that could, on average, remain above 40 degrees Celsius. As a result, mass protests, plundering, and civil unrest remained common in areas where power outages lasted throughout the day[33]. In addition to the common man's predicaments, business costs soared owing to the use of alternative power solutions, which

[33] Hassan, "Pakistanis protest against increasing power cuts during Ramadan."

included running gas and diesel-based generators and battery-powered backups. These alternative systems made matters worse in the crisis, which included adding to technical losses to the already feeble and dilapidated grid[34].

During 2007-2008, the rise of global oil prices above $100 per barrel worsened the power and current account balance crisis. Given Pakistan's high dependence on thermal power plants (mainly RFO and gas-based), the increase in oil prices led power costs to rise meteorically, resulting in high energy subsidies[35], which, in turn, worsened the fiscal balance. The root of the unfavorable generation mix has been traced back to bad power policies throughout the 90s and the 2000s (discussed in Section 2.1) and lack of panning, which had primarily attracted investment in oil and gas-based thermal power plants only and not indigenous fuel sources. The closure of factories and businesses due to lack of power and rising costs became an important factor in the change of the Government after the 2013 elections. According to Bacon (2019), Pakistan's generation mix was the most expensive in the region. Poor policy decisions made in the 1990s by building RFO-based power plants became too expensive from 2007 onwards when fuel prices rose above $100 per barrel. According to NEPRA, the RFO-based plants generated one-third of Pakistan's total energy generated, at 17 cents per Kwh (compared to the 12 cents average at that time).

The shortfall and incapacity to generate sufficient electricity are traced back to the failure to invest in the energy sector overall as the country grew over the years. Prior to 2015, a key reason, if not the primary reason, for drag on Pakistan’s GDP growth remained its dilapidated and obsolete energy infrastructure and generation capability. It was estimated that Pakistan was losing 2 percent of its annual GDP due to frequent power outages[36]. The acute energy crisis, which had spawned in 2006 and resulted in power outages later (also known as "load-shedding" colloquially) for more than 12 hours a day, paralyzed all sectors of the economy (Kugelman 2013). Due to the lack of investment in the energy sector, the country added only 655MW in five

[34] Kazmi, et al. (2019).
[35] The Government pays a subsidy to maintain uniform tariff across the country, called the Tariff Differential Subsidy (TDS). This subsidy is used as a mechanism to keep tariffs below actual costs of generation to shield the public from price increases.
[36] Aziz, R. and Ahmad, M.B., 2015. Pakistan’s power crisis. Special report. United States Institute of Peace.

years, from FY05 to FY09, during which GDP grew at 4.8 percent on average annually. Thus, the power demand far outpaced the available generation capacity in the country. Pakistan's GDP per capita more than doubled between 2000 and 2011, from $534 to $1,164, the power generation capacity only increased from 14,444MW to 18,892MW during the same period[37].

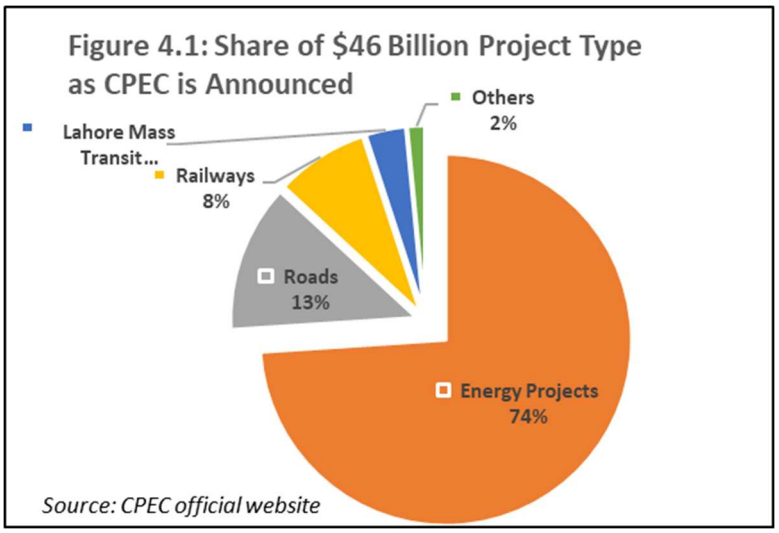
In addition to high costs and lack of diversification, the power sector was marred with serious governance issues, which, to this day, remains one of the primary contributing factors to the consistent increase in circular debt[38], financially choking the entire energy chain. As discussed in Chapter 2, rapid reforms carried out in unbundling WAPDA's functions into different DISCO's in the late 1990s failed to yield desired outcomes in creating an effective distribution system. Moreover, plans to privatize, and before privatization, enable DISCOs to operate as corporate bodies never materialized. It is estimated that, on average, 10 percent of billed electricity is lost due to non-payments, 20 percent is lost owing to T&D losses (such as theft). In addition, numerous regulatory and Government subsidies have disallowed the recovery of even the costs incurred in generating electricity, thus contributing significantly to the buildup of the circular debt. According to the National Energy Policy 2013, the actual cost of generating a single unit of electricity cost 15.6 cents per Kwh in comparison to the actual average tariff of 12 cents.

The newly elected Government of PML-N in May 2013 was widely perceived as a government given a direct mandate to eliminate the power crisis by the people. The Government made no delay in revealing the "National Energy Policy" in 2013, which did a fairly good job in delineating all the problems faced by the sector (see Chapter 2 for further details). The 2013 policy was primarily a roadmap developed to address and resolve the power crisis, in which the foremost problem was the "yawning supply-demand gap". Figure 4.3 clearly shows that the gap had to be bridged on a war footing.

[37] World Development Indicators, World Bank

[38] To understand the definition and reasons for Circular debt buildup and background please see: The Causes and Impacts of Power Sector Circular Debt in Pakistan, 2013.

Along with addressing the crisis by initiating government-owned RLNG based power plants, the Government was also desperate to attract foreign investment in the sector[39]. The newly elected Prime Minister Nawaz Sharif began the Government with an official visit to China to court and secured large infrastructure projects and confront the power crisis. It was not until April 20, 2015, that CPEC was officially announced during Chinese President Xi Jinping's visit to Pakistan. It was announced that 51 agreements and Memorandums of Understanding were signed that were valued at $46 billion. According to the Government of Pakistan's official website for CPEC, early harvest projects alone are worth $46 billion. If additional long-term projects are added, it has been estimated that the total value is $62 billion and can possibly rise beyond $100 billion in the future[40]. As depicted in Figure 4.3, a significant chunk of CPEC's investment portfolio is focused on energy projects. Out of the total $46 billion committed, it was estimated that $33.8 billion were to be siphoned to energy-related projects.



[39] https://world.time.com/2013/06/25/pakistans-biggest-challenge-is-not-the-taliban-its-electricity/
[40] Changes in the initial MoU's have been made since 2015.

Table 4: List of CPEC Energy Projects and Status as on Decemeber 2020

	Name	MW	Fuel	Cost in USD Billion	Status
1	Sahiwal Power Plant	1320	Imported Coal	1.91	Operational Since May 2017
2	Port Qasim Power	1320	Imported Coal	1.91	Operational Since Nov 2017
3	Hubco Coal	1320	Imported Coal	1.91	Operational Since Aug 2019
4	Engro Thar	660	Local Coal	1.00	Operational Since July 2019
5	Shanghai Electric	1320	Local Coal	1.91	Expected COD Feb 2023
6	Hubco Thar Coal	330	Local Coal	0.50	Expected COD Mar 2021
7	Thal Nova Coal	330	Local Coal	0.50	Expected COD Mar 2021
8	Gawadar Coal	300	Imported Coal	0.54	Expected COD Dec 2022
9	Thar Oracle	1320	Local Coal	1.64	Expected COD Jun 2023
10	Karto Hydro	720	Hydel	1.70	Expected COD Dec 2021
11	Suki Kinari	870	Hydel	1.70	Expected COD 2026
12	Kohala Hydro*	1100	Hydel	2.36	Expected COD Dec 2022
13	Azad Pattan*	701	Hydel	1.65	Expected COD Sep 2026
14	Phandar hydro	80	Hydel	NA	Under Review
15	Gilgit KIU	100	Hydel	NA	Under Review
16	Quaid e Azam Solar	1000	Solar	0.15	Only 100MW operational since Jul 2015
17	Hydro China	49.5	Wind	0.11	Operational since Apr 2017
18	UEP Wind	99	Wind	0.24	Operational since Apr 2017
19	Sachal Wind	49.5	Wind	0.13	Operational since Apr 2018
20	Three Gorges (2nd)	49.5	Wind	0.11	Operational since Jun 2018
21	Three Gorges (3rd)	49.5	Wind	0.11	Operational since Jul 2018
22	Cacho*	50	Wind	NA	LOI Stage
23	Western Energy*	50	Wind	NA	LOI Stage
24	Matiari-Lahore line	NA	Transmission	1.66	Expected COD Mar 2021
25	Block 2 Thar	NA	Mining	0.63	Operational since Jun 2018

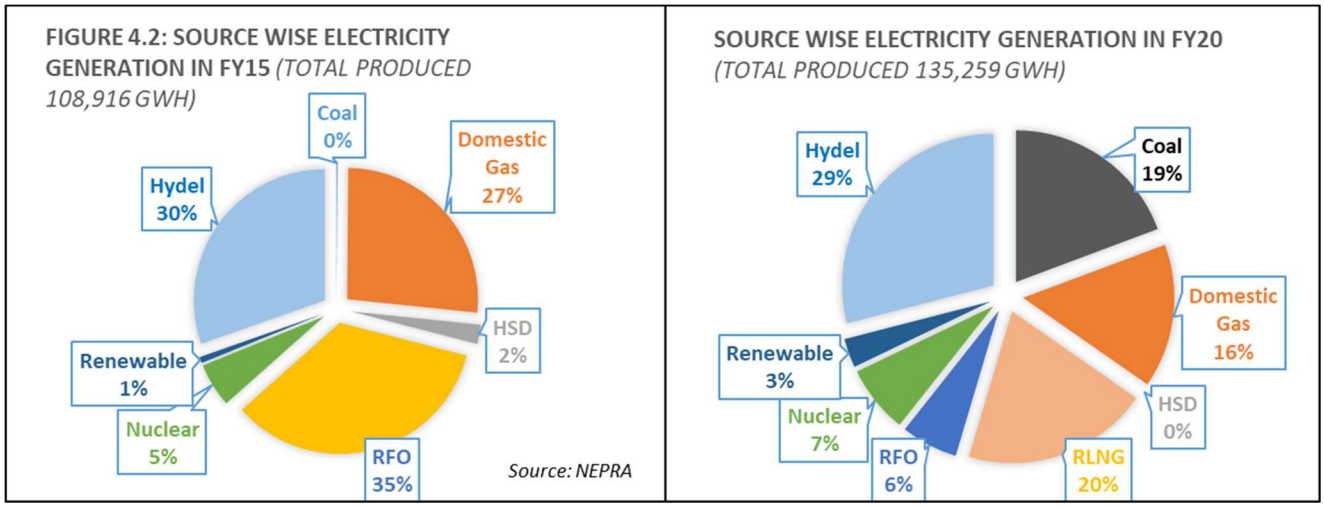
* Not Priority Projects, Only Actively Promoted
Source: Cpec.gov.pk

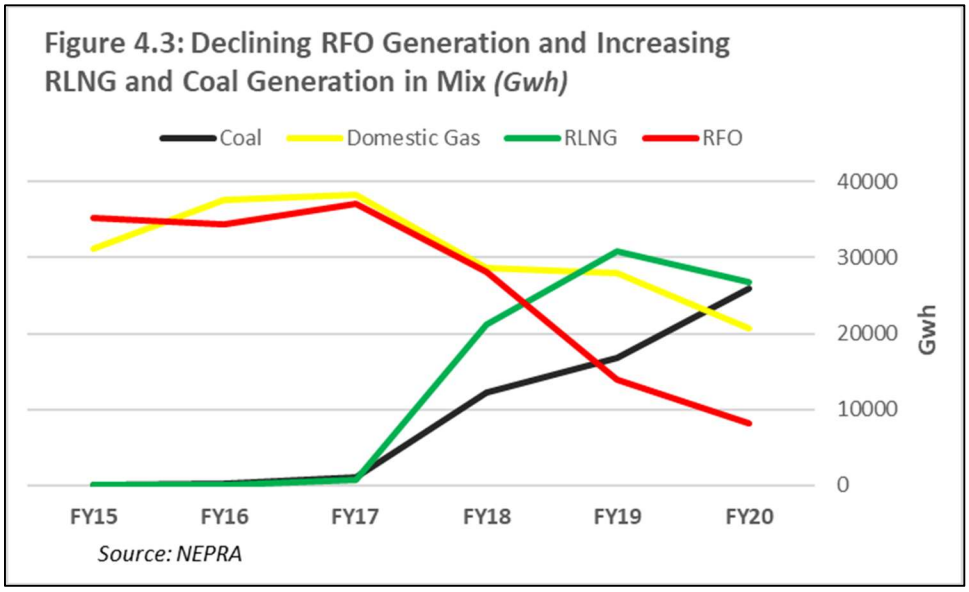
Six areas that summarize the impact of CPEC energy investments on Pakistan's energy sector:

a- Diversification in the energy generation mix of Pakistan (displacing RFO)

Within CPEC power projects, coal power projects have the lion's share in the MoUs, with 62 percent in terms of MWs added. According to public information available on the official CPEC website, coal projects added the most MWs capacity added, i.e., 8,220 MWs out of the total announced CPEC energy generation projects of 13,188 MWs. Prior to 2015, coal had less than one percent share in the total electricity generation mix. Therefore, the addition of coal power plants was seen as a positive initiative to diversify the much-needed power mix and also use

untapped indigenous coal reserves to save foreign exchange outflows, albeit local coal is currently used to generate 660 only MWs but is planned to be expanded. In comparison to 2015, the energy mix (source-wise) has become much more diverse because of coal and RLNG-based power plants. The increase in RLNG and coal has displaced the more expensive and inefficient RFO based power plants. Pakistan's total electricity generation has increased from 108,916 Gwh to 135,259 Gwh due to CPEC and non-CPEC power plants.



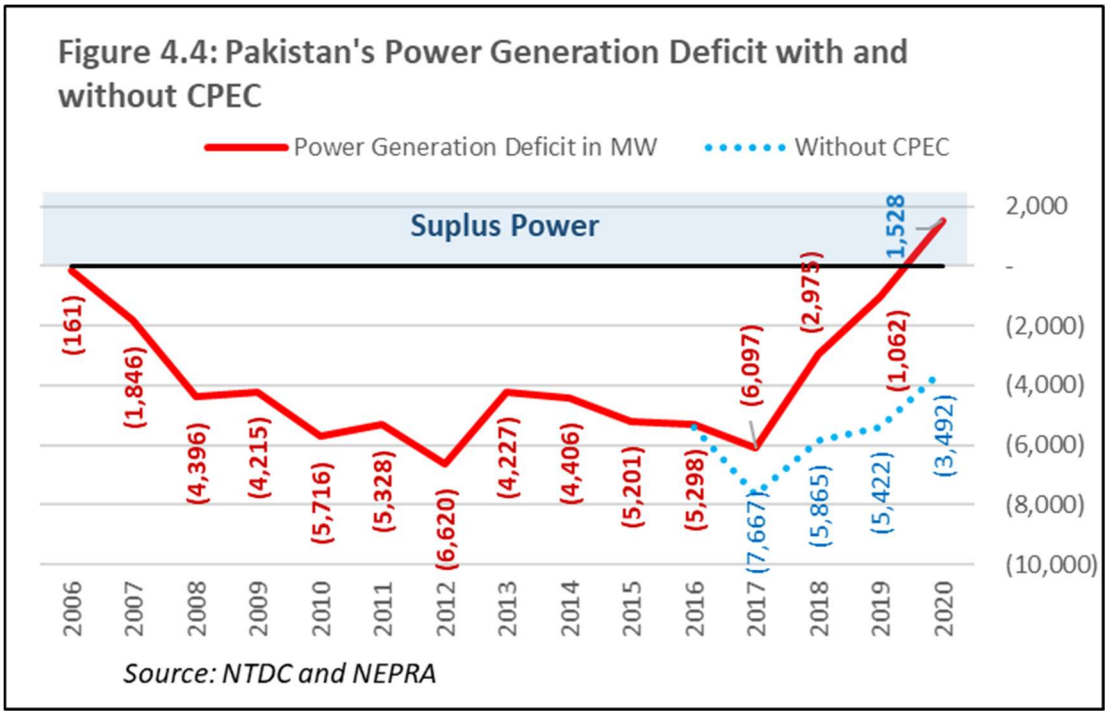


b- Contribution in bridging the supply-demand gap in electricity.

According to the National Transmission and Despatch Company (NTDC), Pakistan's energy deficit[41] soared from 161 MWs in 2006 to above 6,000 MWs in 2012 and 2017. Increasing demand stemmed from GDP growth. Furthermore, the lack of investment in generation plants led to a worsening gap. Pakistan added only 655 MWs between FY05 and FY09, during which GDP grew at 4.8 percent on average annually. Thus, the demand for power far outpaced the available generation capacity in the country. As CPEC power plants began to operationalize, the gap gradually reduced. Using data from NEPRA and NTDC, we show how if CPEC projects had not been operationalized during these years, the gap would have increased above 7,500 MWs in 2017 in comparison to the actual 6,000 MWs gap in the same year.

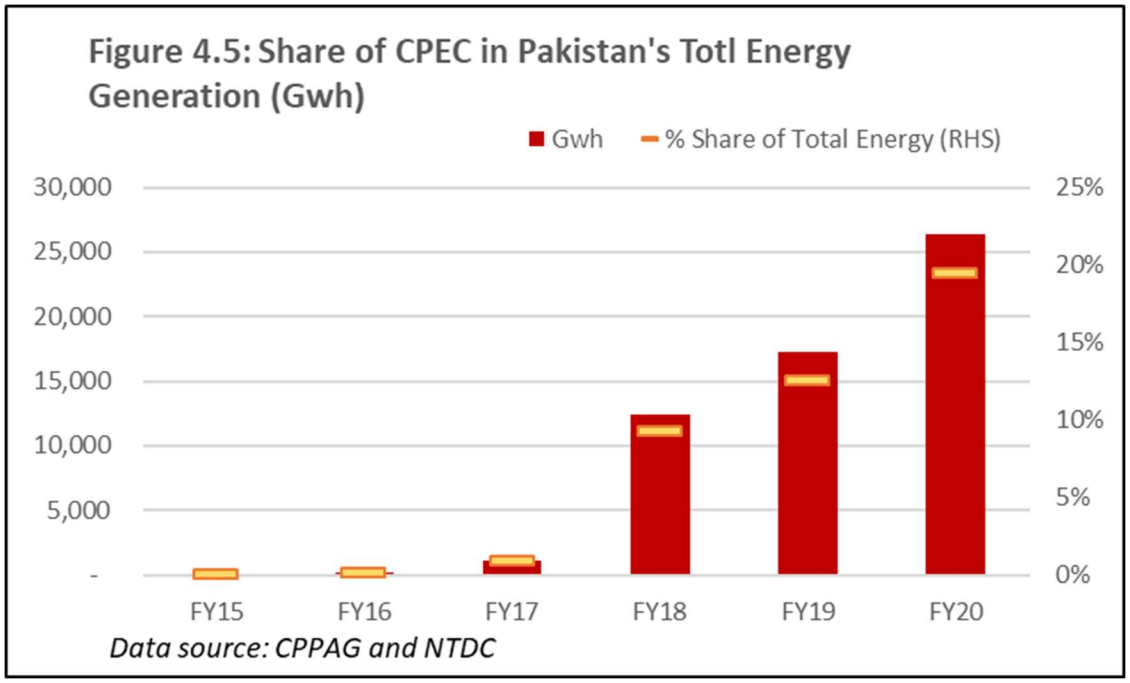
The commissioning of non-CPEC projects, such as Bhikki and Haveli Bahadur Shah, both RLNG power plants, in March and May 2017 also substantially contributed to the slowdown of the gap in 2018. The power deficit turned to a surplus only in 2020 as the CPEC, and non-CPEC projects started commercial operations, as depicted in figure 4.4. Therefore, CPEC power projects played an integral role in bridging Pakistan's huge generation gap and helped achieve stability in electricity generation. It is estimated that from 2015 to 2020, a total of 5,020 MWs of capacity has been added under the umbrella of CPEC in Pakistan.

[41] According to NEPRA's State of Industry Report, the "Generation Capability is the maximum Generation Capability of any day recorded during the year and Demand is the Maximum Demand of any day recorded during the year."s



To further substantiate CPEC's integral role, figure 4.5 shows how the amount of Gwh these energy projects have generated since 2015 as a share of the total energy generation in the country. The trend shows that as CPEC energy projects are achieving commercial operations, their share in the energy mix is also becoming significant. The total share of energy produced in FY20 is 19 percent, where all CPEC projects combined produced 26,337 Gwh.[42]

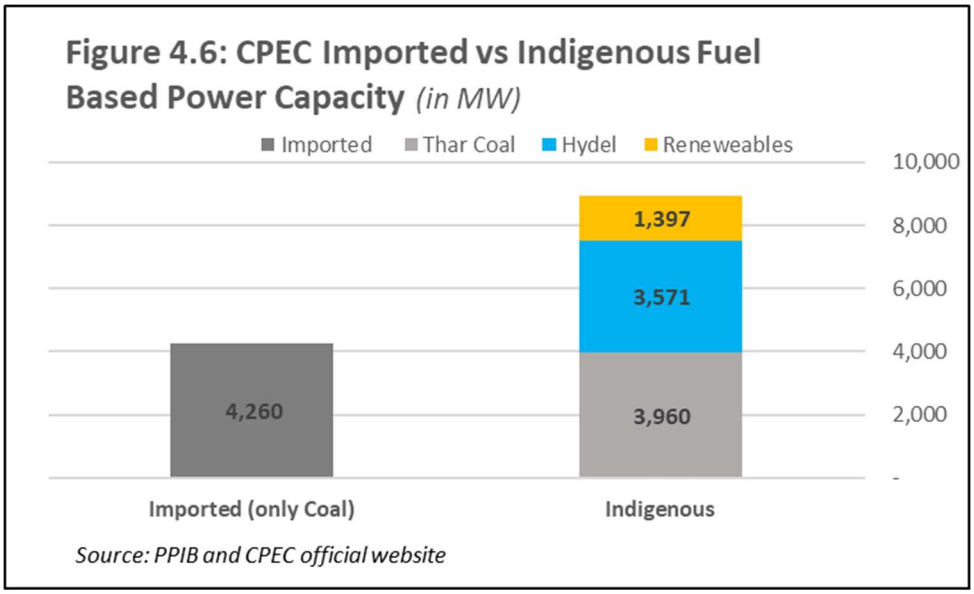
[42] According to Chaudhry et al (2020) it is estimated that 17,000MW of capacity is to be further added by 2025. Their study indicates that Pakistan's surplus will continue to remain well ahead of 2025 unless demand picks up substantially.



c- Using Indigenous Resources for Power Generation.

Prior to CPEC, it was evident that Pakistan's energy mix was highly dependent on imported based RFO and HSD. The Government stated explicitly in its National Energy Policy 2013 and Power Generation Policy 2015 that indigenous fuel-based technology would be encouraged and promoted. Currently, there is only one operational CPEC project based on indigenous coal (Engro Thar Coal of 660 MWs), but it is planned that 3,960 MWs of Thar coal-based projects are to be operational by 2023. In addition, 3,571 MWs of hydel projects based in KP and GB are expected to be operational by 2026, which are expected to generate cheap power and provide electricity in less accessible areas.

Pakistan had never mined coal out of the 175 billion tons estimated reserves at Thar. The inception of CPEC has brought out the exploration and mining of two Thar blocks for the exclusive purpose of generating power. The development and mining of Thar Block 2, producing 3.8 million tonnes of coal, is already operational and is completed in partnership with China Machinery Engineering Corporation (CMEC) and a local partner Sindh Engro Coal Mining Company (SECMC). It is estimated that 68 percent or 8,928 MWs of all CPEC energy projects announced up till 2020 are based on indigenous fuel, per figure 4.6.

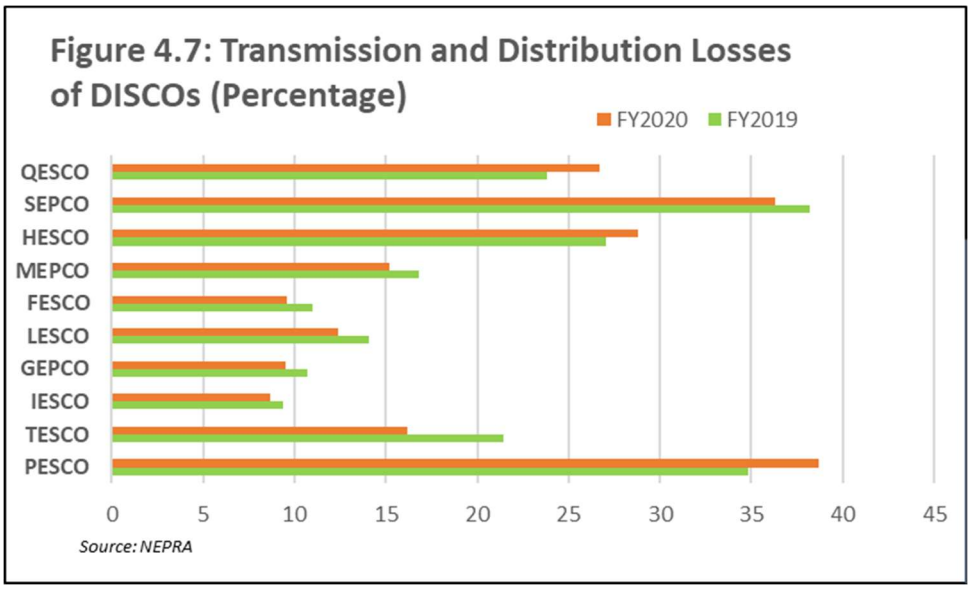


d- Contribution of CPEC in Pakistan's Grid Infrastructure

Acknowledging Pakistan's massive generation gap, CPEC remained generation intensive and focused on plugging the country's gap in supply and demand of power. With the exception of one project, Pakistan's first-ever 660 kV HVDC Transmission Line, no other CPEC projects were on the Transmission and Distribution system. Matiari to Lahore's 878 transmission line project's primary role is to provide 4,000 MWs of power from the established and under-construction coal power projects in Sindh (Thar) all the way to central Punjab (Lahore). The project is under construction and is expected to be completed by March 2021, syncing time to transfer power from the upcoming Hubco and Thalnova Thar coal-based projects. One of the primary shortcomings of CPEC is that it has not addressed the dilapidated distribution sector of the energy chain.

While plugging the generation gap remained vital owing to mass protests and suppressed GDP growth, the capacity to transfer this electricity in a sustainable way remains a challenge. According to NEPRA, the average Transmission and Distribution Losses of DISCOs' have hovered around 20 percent throughout the country. Moreover, data suggests that no progress has been made in improving collections or upgrading the network, as Figure 4.7 suggests. These high

losses add to the circular debt as DISCOs are unable to recover these losses from consumers and, therefore, are unable to pay CPPA, which, in turn, is short of liquidity to pay the generation companies.



e- How have CPEC projects Fared in Terms of Prices?

Like any other private power plant, CPEC power plants also adhere to NEPRA rules and tariffs, and, thus, the consumers bear costs for electricity generation in terms of their contribution to the national tariff. Now that 10 CPEC projects are already up and running, it is time to analyze these costs compared to other similar projects for comparative analysis. Nasim and Fatima (2020) analyzed these costs by comparing the average tariff of coal generation plants under CPEC with oil- and gas-powered plants established between 2010 and 2014. The study used data up till June 2017. It chose to use data from NEPRA to analyze the long-run tariffs and adjusting the variable parts of the tariff over time. The study found that NEPRA approved tariffs for CPEC coal power plants were Rs 2.52 per kWh less than gas and oil-powered plants[43].

[43] The study also analyzes prices assuming a plant load factor of 85%, which results in a lower cost difference between CPEC Coal and other oil and gas powered plants i.e. Rs1.44 per Kwh. These numbers do not include carbon costs associated with these coal power plants.

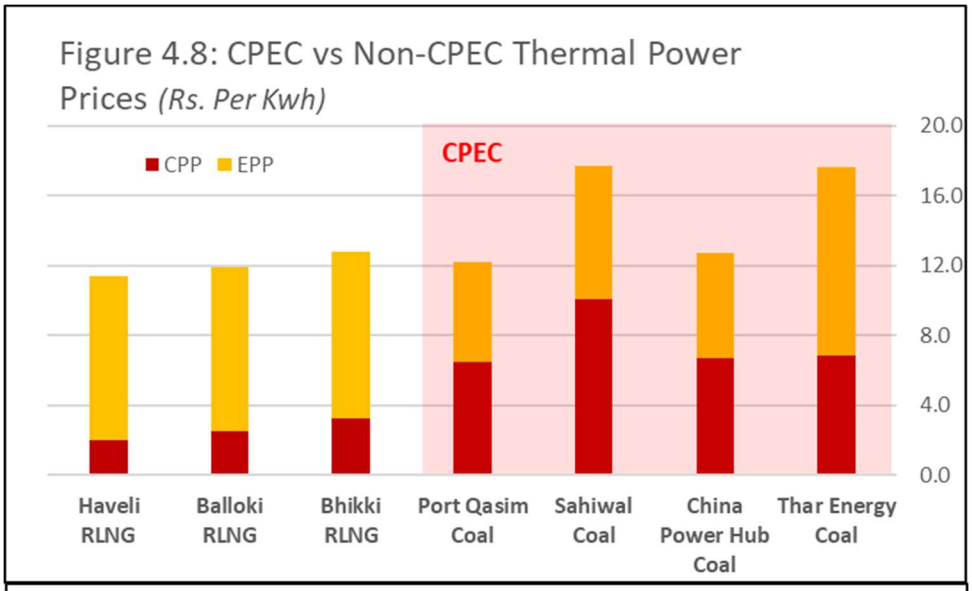
Instead of using NEPRA determined tariffs in tariff petitions, the present study uses the latest data of NEPRA from their State of Industry Report (2020). Before delving into the specifics, it is important to know in brief what comprises a tariff. A tariff essentially comprises two parts, namely Energy Purchase Price (EPP) and Capacity Payment Price (CPP). EPP mainly includes variable operating costs of a power plant, such as fuel costs and variable operations and maintenance costs. On the other hand, Capacity Price Payments (CPP) includes all fixed costs of a power plant, which contain fixed operation and maintenance costs, debt repayments, returns on equity, and the cost of construction, among other things. Adding up these two parts constitutes a full tariff of a power plant, which is then passed on to the consumers after adding additional transmission and distribution costs.

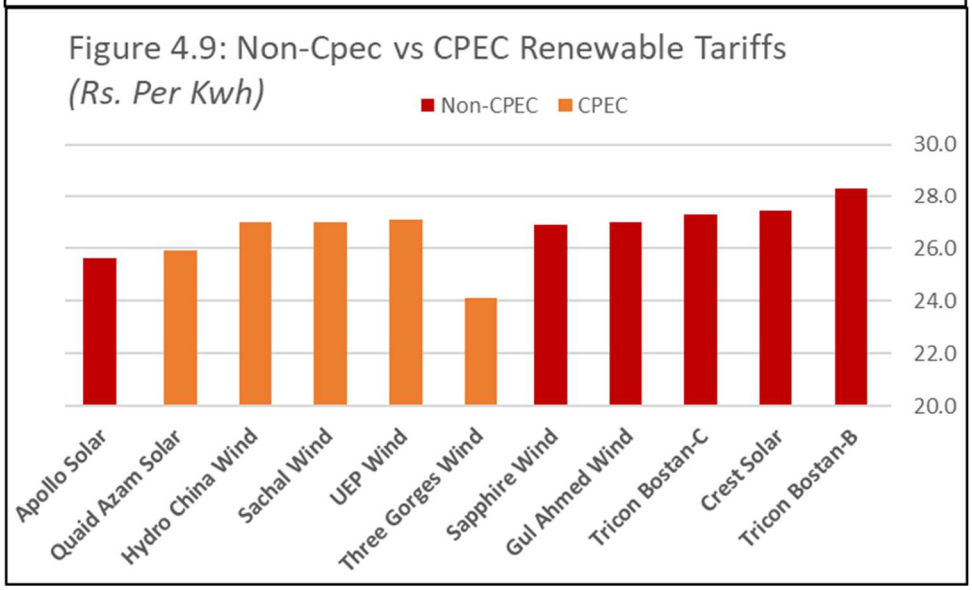
Our methodology differs from Nasim and Fatima (2020) in three ways. Firstly, we do not assume 85 percent load capacity. Instead, we use actual NEPRA numbers that show what has actually been produced by these power plants and what has actually been billed[44]. Secondly, for comparison purposes, we use the latest RLNG power plants for comparing with coal plants, and also include a sample of non-CPEC wind power plants (the same year of COD) and two different solar power plants to compare with the single CPEC solar power plant. Thirdly, we use data for the entire fiscal year 2020 in comparison to their use of data of only June 2017. Results indicated in Figure 4.8 show that, based on actual data of electricity generation receipts by NEPRA, CPEC costs per Kwh are on average Rs. three per kWh higher than the new RLNG-based power plants in Punjab. On the renewable energy side, CPEC projects are as competitive as other non-CPEC renewable energy projects. An important caveat to this basic analysis remains that several variables that can change in the course of time may result in different numbers, such as RLNG prices have been at their lowest due to the onset of COVID-19 in March 2020. If RLNG prices increase, prices of CPEC coal projects may become more competitive[45]. More importantly, as Figure 4.9 shows, CPP for CPEC projects is much higher due to higher costs of construction and

[44] This Method has its pros and cons. Pros include the fact that because NTDC never fully utilizes a power plant at its full capacity, we should use actual billed numbers. A con would be the exact opposite, that actual costs do not reflect the plant's actual efficiency and potential. But for this study's purpose, it would be a brief method to gain a general idea.

[45] It also bears emphasis that the average utilization factor of RLNG plants was recorded at 56 percent in comparison to CPEC coal projects average of 60 percent. Which means that despite being used at a lower capacity than CPEC coal projects, power generated using LNG as a fuel remains cheaper.

debt repayments compared to RLNG projects, which have almost half the CPP costs in comparison. The results are different from Nasim and Fatima (2020), where they found that CPEC coal projects were cheaper than oil and gas power plants. The reason for the difference can be due to the fact that the oil and gas power plants used in their analysis were commissioned between 2010-14 and remained less efficient than the new RLNG power plants.





Source: Data has taken from NEPRA tariff determinations on capacity payments and tariff petitions by Generations companies.

Chaudhry et al. (2020) state that the UK and Spain have a capacity component less than 10% of the total tariff, whereas they range between 10-20% in the U.S., showing that CPEC projects capacity costs are much above than developed countries.

f- Technology Transfer and Human Resource Development

The construction and development of large coal power plants for the first time in Pakistan's history has been a landmark achievement within the umbrella of CPEC. Mining for domestic Thar coal on a large scale has brought skill and expertise within the local population. The partnership of CPEC with a local company (Engro) has substantially brought human resource and technical expertise into Pakistan from China. Moreover, Super Critical Coal powered plants[46] (imported coal-based) are state of the art coal technology, which are the first of their kind in Pakistan. In addition, the construction of the Matiari-Lahore High Voltage Direct Current (HVDC) transmission line has done the same for the National Transmission and Distribution Company (NTDC), which is deeply involved in the first-ever HVDC line in the country. CPEC's investment in the power sector has directly built human resources and brought in new technology in Pakistan.

[46] All imported coal CPEC power projects are based on Super Critical Coal Technology.

Table 4.1: Summary of CPEC Energy Investment Impact on the Power Sector of Pakistan

	Prior to CPEC	Post CPEC
Energy Generation Mix	Power generation mix was significantly biased towards RFO, Hydel and domestic gas.	CPEC is expected to contribute in hydel in future and has already succesfully added domestic and imported coal as a large generation component thus diversifying the mix and increasing Energy security in Pakistan.
Power Deficit	Supply demand gap in electricty peaked up to 6,000MW in 2012 and 2017.	As of June 2020, Pakistan's power deficit has converted in to a 1,528MW surplus.
Indigenous Power	Pakistan's power sector was heavily skewed towards RFO and HSD based power plants (imported fuel)	CPEC investment in Pakistan is more tilted towards hydel, domestic coal and Renewables than imported Coal.
Grid Infrastructure	Transmission and Distribution sector remains in extermely poor condition. Higher power breakdowns and theft add on to the problems of generation.	Lack of investment in distribution sector has caused problems like circular debt to persist. CPEC has invested only in one HVDC transmission line.
Power Prices	Electricity Prices are considered one of the most expensive in region on account of using Fuel oil for power generation.	Cost of eletricity remain high on account of higher debt and equity payments (Capacity). CPEC projects are costlier in terms of per Kwh than other similar sized new thermal plants, but remain cheaper than RFO based plants.
Technology Transfer and HR development	Obsolete and inefficient technology used in Power and T&D Sector.	First time Super Critical Coal technology and HVDC transmission lines introduced. Training of local NTDC and power sector HR conducted.

4.3 Impact of CPEC Energy Investments on Pakistan's Power Policy

Hussain (2017) states that careful circumspection is required in six areas for a better implementation of CPEC, in which the foremost area included Pakistan's energy policy. As many energy projects achieve fruition, the ramifications for the energy sector have been considerable, and, resultantly, the energy policy has been required to be recalibrated. This section attempts to answer the questions on how CPEC influenced Pakistan's power policy. Before we move on, it is important to define the parameters of an energy or power policy. According to Section 14A of the NEPRA Act of 1997, "The Federal Government shall, from time to time, with the approval of the Council of Common Interests, prepare and prescribe a national electricity policy for the development of the power markets". According to the Government's recently released ARE 2019 policy, it interprets Section 14A as not confined to a

single Policy Document as “the National Policy”, rather it insinuates that the national policy is an amalgamation of many policies. Without delving into the legal interpretation of the Government’s power policy, the study simplifies the definition of power policy as any decision taken by the Federal Government that would have implications for the power sector. The decision could be an ECC notification or even a clause within a specific Power Purchase Agreement (PPA) that has ramifications for many or even a single power plant, the Transmission, and Distribution Sector, or any matter pertaining to the pricing/costs.

The section uses primary interviews with eight energy sector specialists to analyze common themes of their opinions and summarizes the results accordingly. The energy sector specialists are mainly lawyers, chartered accountants, engineers, implementers, and policymakers in the Government.

List of Interviewees:

1- Senior Policymaker at PPIB
2- Lawyer and Consultant, Senior ex-Government Power Sector Expert
3- Lawyer and Energy Consultant with Asian Development Bank (ADB) and World Bank
4- Chartered Accountant and Consultant to Power Sector IPP’s
5- Senior Government Officer at Government of Punjab, Energy Department
6- Engineer and Policymaker at PPIB
7- Senior Advisor to NEPRA
8- Ex-Senior Advisor to NEPRA

The list of questions is attached in Annexure B. The common themes, along with the summary of findings of these in-depth interviews, are aforementioned.

4.3.1 CPEC’s Influence on Coal Tariffs

As discussed above, CPEC’s primary investment in the energy sector of Pakistan has brought coal technology and power plants to Pakistan. A major concern for Pakistan’s power sector pre-2015 was the lack of any foreign investment at all in the energy sector from 2005 onwards.

According to a senior officer at PPIB, who worked directly on the Power Generation policy 2015, the Government requested NEPRA to revise its coal tariffs in 2014[47] with the primary intention of attracting Chinese investment under CPEC. Initially, NEPRA set coal upfront tariffs with ROE set at 17 percent in September 2013. However, upon the Government's insistence that no foreign country and/or private developer is able to invest under the given ROEs, NEPRA increased the ROE to 29.5 percent for coal power projects[48]. Therefore, the direct result of CPEC in the sector was the increase in ROE to attract Chinese inward investments in the coal sector of Pakistan even before the official initiation of CPEC. The resultant high coal ROEs have been subject to controversy and widely believed to be the highest offered to any power plant in the history of Pakistan.

4.3.2 Allowance of G2G Projects without Any Competition

A lawyer and a power consultant stated that a direct result of CPEC projects was that the Government allowed government-to-government projects in the Power Generation Policy of 2015. These projects, including CPEC power projects, had been included under bilateral contracts between the Government of Pakistan and any foreign country. The projects were applicable to NEPRA-determined upfront tariffs but would not go through any competitive bidding process. The Lawyer elaborates that the direct result of this clause was that power projects under CPEC were developed at high costs than international benchmarks due to the absence of any competitive bidding along with a general lack of transparency of these projects. According to the respondent, the fact that the ADB-sponsored coal project at Jamshoro, Sindh, attracted a price tag of $900 million in competitive bidding, a similar-sized CPEC project cost $1.9 billion is staggering.

4.3.3 Fuel and Hydrological Risk Guarantees

[47] For NEPRA upfront Coal tariffs in 2013 see: https://nepra.org.pk/tariff/Tariff/Upfront/Notification%20upfront%20Tariff%20imported-local%20coal.PDF

[48] To see the governments petition to change coal tariffs in 2014 and NEPRA's decision see: https://nepra.org.pk/tariff/Tariff/Upfront/Decision%20of%20the%20AUthority%20Upfront%20Coal.PDF

A lawyer and a former government power expert explained that due to CPEC, the Government took on substantial risks on its books in the power generation policy of 2015 to attract the establishment of power projects. The GOP included in the Power Purchase Agreements (PPAs) of CPEC projects that in case of delays in payments that render the procurement of fuel for power generation not possible for the power generator, the GOP would still be liable to pay Capacity Payments (CPPs). The PPA also provides the right to cease generation, to the power company, in case of non-payments that lead to a lack of fuel purchase ability. The Lawyer added that this clause was added solely due to the risks associated with the rising circular debt problems and liquidity issues that followed throughout the chain of the power sector. In addition, to attract hydel projects foreign investment in Pakistan, the Power Generation Policy of 2015 included a clause whereby the power purchaser (in this case, the CPPA) would bear the risks of water availability to these hydel projects. This specific clause renders the GOP at high risks due to the unknown effects that climate change may have on water flows on the specific hydel projects that are under construction. In case water flows are impeded to these hydropower projects due to unforeseen circumstances, CPPA would remain liable to pay Capacity charges to the hydel project as usual established under this policy.

Disagreeing with the argument presented by the lawyer, the senior PPIB officer stated that the hydrological risk and fuel guarantees were already a complaint that IPPs had registered with PPIB prior to CPEC. Thus, this change in policy was not a direct consequence of CPEC but rather something that PPIB had considered prior to CPEC.

4.3.4 Supplemental Agreement with CPEC Power Projects

All respondents agreed with the fact that CPEC projects were given an extra advantage over other non-CPEC IPP's in the government's power policy. The fact that a separate supplemental agreement existed that included the inclusion of an additional Sinosure fee in the cost tariff and an escrow account that would shield CPEC power projects from the effects of circular debt was a substantial policy advantage. Respondent 4, a Chartered Accountant, stated that the additional Sinosure fees had raised the cost of some projects by an extra $20 million. However, a senior Punjab Government officer disagreed with the unfair advantage argument and stated that the

macroeconomic conditions in 2015 did not attract any investment from any country in the world, and thus, there were substantial country risks that China was undertaking. The country risk profile of Pakistan meant that the government had to provide additional guarantees and incentives for investment inflows.

4.3.5 Banning Imported Fuel Based Power Projects

An ex-senior advisor to NEPRA and a senior PPIB official stated that the Government, by approval from the Economic Coordination Committee (ECC), has already decided that no further power projects are to be given approval that are based on imported fuels, which include imported RLNG and Coal. The decision was made in July 2016 and resulted in two already in approved projects, Lucky Electric Coal Project and Siddiqsons Energy Coal Project, which was based on imported coal, forced to be converted to local coal instead of imported coal. The government made this decision in view of the bulging capacity payments issue and worsening current account balance, which in turn resulted in the third IMF program since 2008.

4.3.6 Power Sector Report and Renegotiations with IPP's

A senior advisor to NEPRA emphasized the significance of a government-ordered power sector report on the ills and wrongdoings of the past power policies and IPP's in March 2020. The report concluded that Power Purchase Agreements (PPA) with IPPs would need to be renegotiated and converted from Take of Pay to Take and Pay contracts. The committee reported excess payments to IPPs under 2002, 2006, and 2015 power policies and advised the government to conduct a forensic audit of all power plants if the IPPs do not opt for Take and Pay contracts. In addition, it advised the government to remove dollar-based returns to IPPs into PKR based. NEPRA advisor stated that this report enabled the government to identify the power sector's problems more clearly and was forward-looking in providing the right solutions. The advisor further stated that the primary driver of this report remained that because CPEC projects were becoming a burden on the balance of payments in terms of profit and debt repatriation, it jolted the government to rethink the overall sector and conduct an analysis. Respondents 4 and 5 disagreed with the notion that CPEC was the driver of this report and stated that this was a

problem that the Government had already faced in the late 90's as well. According to the latest reports, the government and the IPP's are still in the process of signing new PPAs, which are expected to result in significant savings to consumers and the government.

4.3.7 Focus on Distribution Sector and Establishing a Power Market

A common theme across the interviewees was the unanimous consent of introducing wide and bold reforms in the distribution sector. Respondents uniformly stated that CPEC had failed to invest or address "the elephant in the room", which remained a poorly governed and dilapidated distribution sector. However, they also agreed that since the generation gap had been met, the DISCOs were now in the spotlight. The interference of politics in appointing board members and managers at DISCOS was raised by the Chartered Accountant, Senior Punjab Government official, and Advisor to NEPRA, and was stated as a prime example that unless there was privatization across the board, this would always remain in the same state. Respondents 1, 2, and 3 were, however, skeptical of privatization, citing K-Electric's example of bad governance as a case in point. In addition, all respondents but Respondent 4 and 3 remained positive about the prospects of a Competitive Trading Bilateral Contract Market Model (CTBCM). The respondents stated that due to the operationalization of CPEC power projects and surplus energy, CTBCM had become a realistic proposition and urgency. Respondents 3 and 4 stated that CTBCM had been in the cards since the 1990s and had little to do with CPEC. They said that before reaching CTBCM, the government would need to take many other steps before its successful implementation. Respondents 4, 5, and 7 stated that the Government's only way out of the "Take or Pay" obligations in CPEC and non-CPEC projects were the introduction of a CTBCM. The government's recent round of negotiations with IPPs and the MOU includes the agreement that all contracts would be converted from Take or Pay to Take and Pay upon the introduction of CTBCM.

Chapter 5: Conclusion and Policy Suggestions

A kilowatt generated is better than no kilowatt generated at all. Pakistan's power crisis, which peaked in 2012, resulted in debilitating power outages and suppressed GDP growth. There is little doubt and disagreement within policy circles that CPEC provided a framework, plan, and substantial investment in Pakistan when no other country was willing to under high country risks of the time. The study finds, with data support, that CPEC allowed Pakistan mainly to bridge the demand and supply gap, diversify the energy mix by displacing expensive fuel, and contributed to technology transfer and human resource development. Contrary to popular belief that CPEC has contributed to the burden of imported resources in power generation, CPEC projects are significantly more tilted towards indigenous resources. Hydel, renewable energy, and Thar coal projects are more than twice the size of imported projects.

The study uses a different approach to measure the tariff comparison between CPEC and non-CPEC power plants. It finds that CPEC power projects have been more expensive to consumers when compared to the new thermal RLNG power plants established in 2017. However, they remain substantially cheaper than oil-based old power plants. Cognizant of the fact that 10 CPEC energy projects have already achieved commercial operations, it was imperative and timely to analyze the costs of these projects to consumers. The study also finds that fixed capacity costs (mainly due to the higher price of construction) are mainly to blame for the high price to consumers.

The study also finds, with the help of interviews with eight leading energy sector specialists, that the Government undertook several policy changes to attract CPEC power projects into Pakistan. The key policy changes in the power sector include raising incentives to attract coal power, allowing blanket cover from competition to G2G projects such as CPEC, more government guarantees, and higher allowance of costs such as insurance fees. In addition, due to surplus power generation capacity created, the government has now changed policy to ban imported fuel projects and is now in talks with IPPs to change the debt terms and de-link dollar returns to some generation plants (negotiations with CPEC projects are due). The resultant surplus in power has uniquely provided an opportunity to introduce changes in power policy with respect to

establishing a power market. The study finds that there is a disagreement amongst experts on the efficacy of introducing a power market absent distribution reforms. This could potentially be an avenue for further research.

In sum, the government has undertaken several commendable remedial policy measures in response to the challenges posed by CPEC power projects, which include banning imported fuel-based power plants, eliminating indexation of dollar-based returns, and renegotiation of Power Purchase Agreements (PPAs) with IPPs. It bears emphasis that CPEC's imported and local coal power plants are costing the government up 30 percent dollar-based returns, which are unsustainable and exorbitant. The government needs to rationalize these rates of returns as well. However, there are caveats to taking these measures, which most importantly include loss of investor confidence in the government's policy and, therefore, lack of investment in the sector in the future. The government can learn important lessons from the renegotiations in the late 1990s that had negatively affected power investment in the following decade. The risk of renegotiating with CPEC power plants could also potentially jeopardize future CPEC projects that have already been committed. Thus, the government will have to tread cautiously.

CPEC has brought about a visible solution for the common man in terms of Pakistan's energy supply but has failed to address long-standing structural issues in the governance of the power sector that remains more challenging than building "brick and mortar" generation plants. The study finds that Pakistan's power policies have remained "generation centric" and have disregarded or ignored the weaknesses of the distribution sector altogether. The lack of emphasis on the distribution side of the power sector is manifested in the continuing rise of circular debt at a faster pace than before. The distribution sector can best be described as a "leaky bucket" where no matter how much generation you pump in, it will end up a third less due to losses, inefficiencies, and theft. Reforming DISCOs, which are overstaffed, unionized, badly governed, and bear losses of billions of rupees every year remains one of the biggest challenges in the power sector. Since KESC's privatization in 2005, every government has planned and committed to the IMF to privatize DISCOs but has been unsuccessful.

Policymakers should introduce novel measures that do not include the standard privatization solution only for tackling the sector. Restructuring and corporatization of distribution companies is being discussed in policy circles, but no implementation or timelines have been released to date. Long-term planning and policies is the need of the hour. The study finds that Power policies of the past have addressed immediate needs to the power sector but lack institutional reforms, especially those that address planning for energy for the future.

Based on these results, the government must recognize the urgent need for an "Integrated Energy Planning" model that consistently measures and integrates the entire economy and a power policy that maintains a balanced approach with respect to generation and distribution. Power policy must move to competitive bidding instead of encouraging G2G (we have witnessed that in RE but not thermal power plants). The government should immediately halt all power generation plants that have yet not achieved financial close, as any additional capacity could make matters worse in terms of circular debt and rising CPP. Resources from CPEC should be reoriented to the distribution sector, where it is much needed. It has taken four years to realize the costs of CPEC and its concomitant challenges to the power sector. A proper planning framework could have avoided the many crises of the past and those to come in the future.

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Annexure A

Power Policies by the GOP:

1994 Power Policy

1995 Hydroelectric Policy

1998 Power Policy

2002 Power Policy

2006 Renewable Energy Policy

2013 National Energy Policy

2015 Power Generation Policy (PPIB)

2019 Alternative and Renewable Energy Policy

Chronology of Significant Events in Pakistan's Power Sector:

1- KESC Established in 1913 as a private entity to oversee Karachi's power network
2- 1952 Government takes control of KESC.
3- WAPDA established in 1958.
4- Major reforms begin with the unbundling of WAPDA in 1990's.
5- PPIB established in 1994.
6- Pakistan's first ever national power policy revealed in 1994.
7- NEPRA established in 1997.
8- PEPCO created in 1998 to manage DISCOs and Government owned companies (GENCOs).
9- KESC was privatized in 2005 (first ever vertically integrated company in power sector)
10- PEPCO dissolved in October 2010.
11- Government creates AEDB in 2003 and sets target to achieve 10% Renewable energy by 2015.
12- CPEC announced in 2015.
13- CPPA is incorporated and takes over NTDC's function of market operator and managing payments systems in 2015.

14- Pakistan’s first ever Coal powered plant reaches commercial operations date in October 2017.

15- Ministry of Water and Power merged with Ministry of Petroleum and Natural Resources to Ministry of Energy. Ministry of Water is separately created to manage all water related matters.

16- Pakistan’s first ever Indigenous Coal Power plant reached commercial operations in March 2019.

Annexure B:

Questions for Interview with Energy Experts:

1- How do you see CPEC in terms of its contribution to Pakistan's Energy sector?

2- Do you think CPEC has shaped or changed the discourse on public/energy policy in Pakistan?

3- If yes, can you explain the sticking points that you believe are the most important?

4- Do you think CPEC singlehandedly ended load shedding/power outages in Pakistan?

5- Can you specify what benefits CPEC brought to the energy sector in Pakistan?

6- Can you specify the challenges that CPEC energy projects have posed to the energy sector of Pakistan?

7- What kind of decisions do you think the government needs to take under its Energy Policy to tackle the challenges posed by CPEC Energy projects? Can you explain briefly:

8- What are the problems with the current Energy Policy, i.e. Power Generation Policy 2015?

9- How do think CPEC has changed the government's energy policy since 2015?

10- Do you think the government is on the right track in view of its current energy policy outlook?