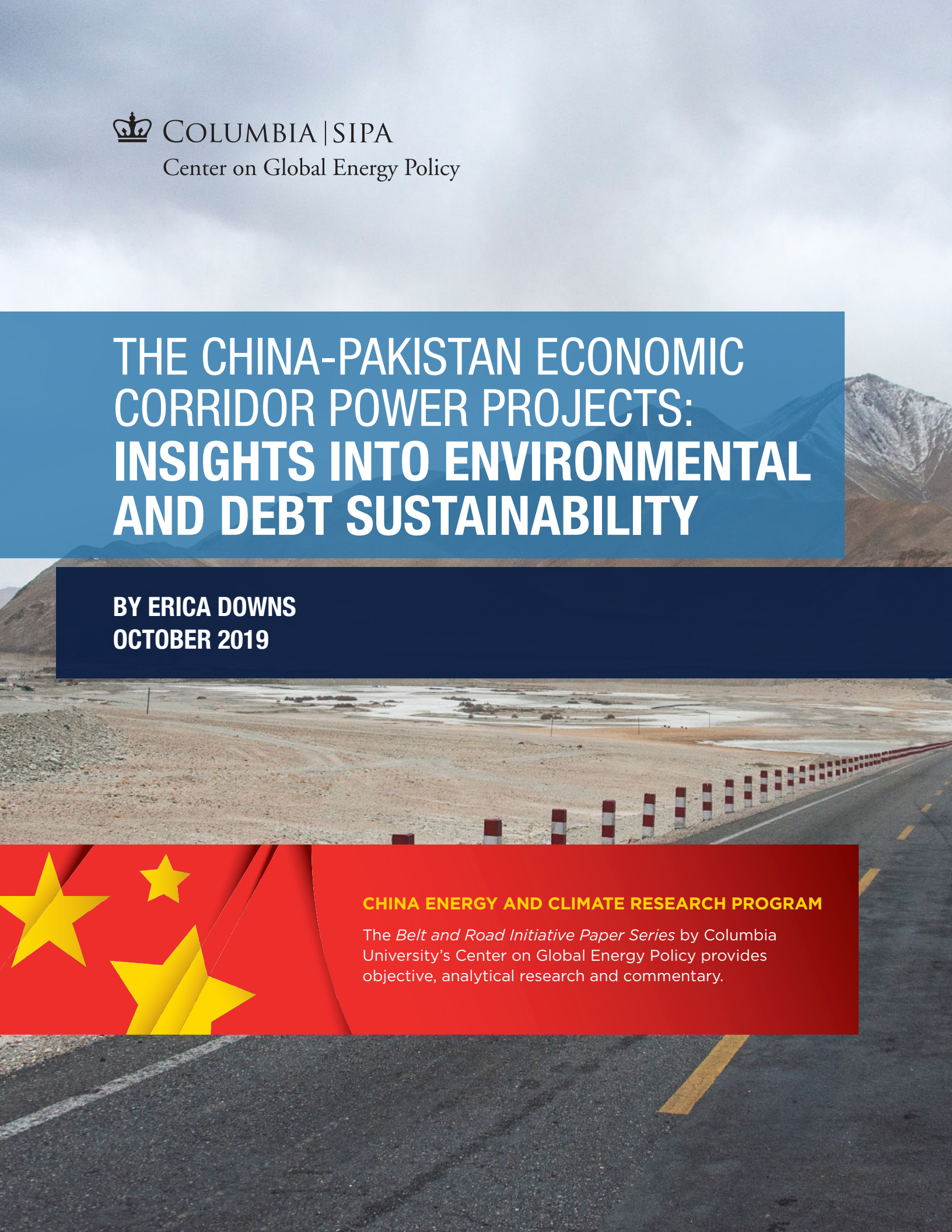

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THE CHINA-PAKISTAN ECONOMIC CORRIDOR POWER PROJECTS: **INSIGHTS INTO ENVIRONMENTAL AND DEBT SUSTAINABILITY**

BY ERICA DOWNS
OCTOBER 2019

CHINA ENERGY AND CLIMATE RESEARCH PROGRAM

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FOREWORD

The Center on Global Energy Policy's Belt and Road Initiative Paper Series

The Belt and Road Initiative (BRI) is the largest infrastructure initiative ever. From geopolitics to markets to the natural environment, across much of the globe, its impacts are far-reaching. The Center on Global Energy Policy's Belt and Road Initiative Paper Series offers research and commentary on the BRI and its implications around the world. It covers a range of energy-related topics and offers different points of view.

In this paper, CGEP Fellow Erica Downs examines the China-Pakistan Economic Corridor (CPEC), focusing on the financing and construction of coal-fired power plants by Chinese state-owned entities. The paper explores two topics that have been raised more broadly about the BRI: environmental and debt sustainability.

We welcome submissions for this series. (Please send proposed topics and outlines to energypolicy@columbia.edu.) Our guiding principle will be to inform readers with objective, research-based analysis. We hope to contribute to constructive global dialogue on these important topics in the months and years to come.

Davd Sandalow
Inaugural Fellow and Director, China Program Center on Global Energy Policy
Columbia University

EXECUTIVE SUMMARY

Pakistan is increasing its use of coal to generate electricity at a time when many other countries are reducing coal use in order to cut greenhouse gas emissions or pollution. China is helping Pakistan expand its coal-fired generation capacity through the financing and construction of coal power plants as part of the China-Pakistan Economic Corridor (CPEC). CPEC is a component of Chinese president Xi Jinping's Belt and Road Initiative (BRI), which aims to forge greater global connectivity in part through infrastructure development. Nearly 75 percent of the generation capacity of CPEC power plants is coal-fired. Pakistan's National Electric Power Regulatory Authority (NEPRA) expects that CPEC coal power plants will be largely responsible for the projected increase in the country's coal-fired generation capacity from 3 percent as of June 30, 2017 (fewer than six months after the first CPEC coal plant began commercial operation), to 20 percent in 2025.

As part of its series on the Belt and Road Initiative, Columbia University's Center on Global Energy Policy initiated research into the CPEC power sector projects, which account for the majority of the cost of CPEC projects. This paper examines two of the key concerns critics have about the BRI: environmental sustainability and debt sustainability. Concerns about environmental sustainability center on the ways in which an expansion of the amount of electricity generated globally by fossil fuels, especially coal, will increase greenhouse gas emissions, making it more difficult if not impossible to meet the emissions targets in the Paris Agreement. Concerns about debt sustainability focus on whether China's lending in support of infrastructure projects will lead to problematic increases in debt, with some analysts maintaining that Beijing is intentionally seeking to push countries into debt distress in an attempt to gain control over strategic assets or decision-making in borrowing countries.

The main findings of this study are threefold.

- First, the heavy focus on coal in the new generation capacity added by the CPEC power projects stems from both "pull" factors from Pakistan and "push" factors from China:
  - The CPEC coal power projects reflect Pakistan's long-standing goal of diversifying its generation mix away from fuel oil toward domestic coal in an attempt to decrease generation costs and conserve foreign exchange. They also reflect the perception of the administration of former prime minister Nawaz Sharif, whose pledge to end power outages helped his party win the 2013 election, that coal was the best option to bring on a large amount of new capacity in the short term. Although Pakistan has vast renewable energy potential, solar and wind power were considered too expensive and difficult to integrate into electric grids.
  - Meanwhile, Chinese companies had several reasons to sell coal power plants to Pakistan, including exporting rather than warehousing excess power generation equipment, financial incentives provided by Beijing and Islamabad, and the ability to execute projects fast enough to help Sharif eradicate the blackouts hurting Pakistan's economy before he stood for reelection in 2018.

- Second, there is a mismatch between the dominance of coal in the CPEC power generation mix and Beijing's recent emphasis on green development as an important feature of the BRI. This gap between Beijing's rhetoric and the reality on the ground can be explained in large part by Pakistan's preference for building coal-fired generation capacity. Ultimately, it is up to the host country to decide the composition of its electricity mix. The Chinese government has a long-standing reluctance to interfere in decisions of this type. Moreover, China regards some of the CPEC coal power plants as environmentally friendly because they use relatively modern technologies and are expected to emit fewer greenhouse gas emissions than the fuel oil plants Pakistan is replacing.
- Third, there is a risk that the CPEC power projects will add to Pakistan's sovereign debt burden, but multiple factors indicate that any increase in sovereign debt from these projects is unlikely to be the result of a deliberate strategy on the part of China. Although the debt financing arrangements for CPEC power sector projects primarily involve loans from Chinese banks to project companies wholly or partly owned by Chinese firms, these projects may increase Pakistan's debt because of sovereign guarantees issued by Islamabad to support CPEC power projects and the liquidity crisis in Pakistan's power sector known as circular debt. That said, several aspects of the China-Pakistan relationship and the large stake that China's government and companies have in the success of CPEC indicate that Chinese interests are better served by sustainable CPEC projects than unsustainable ones.

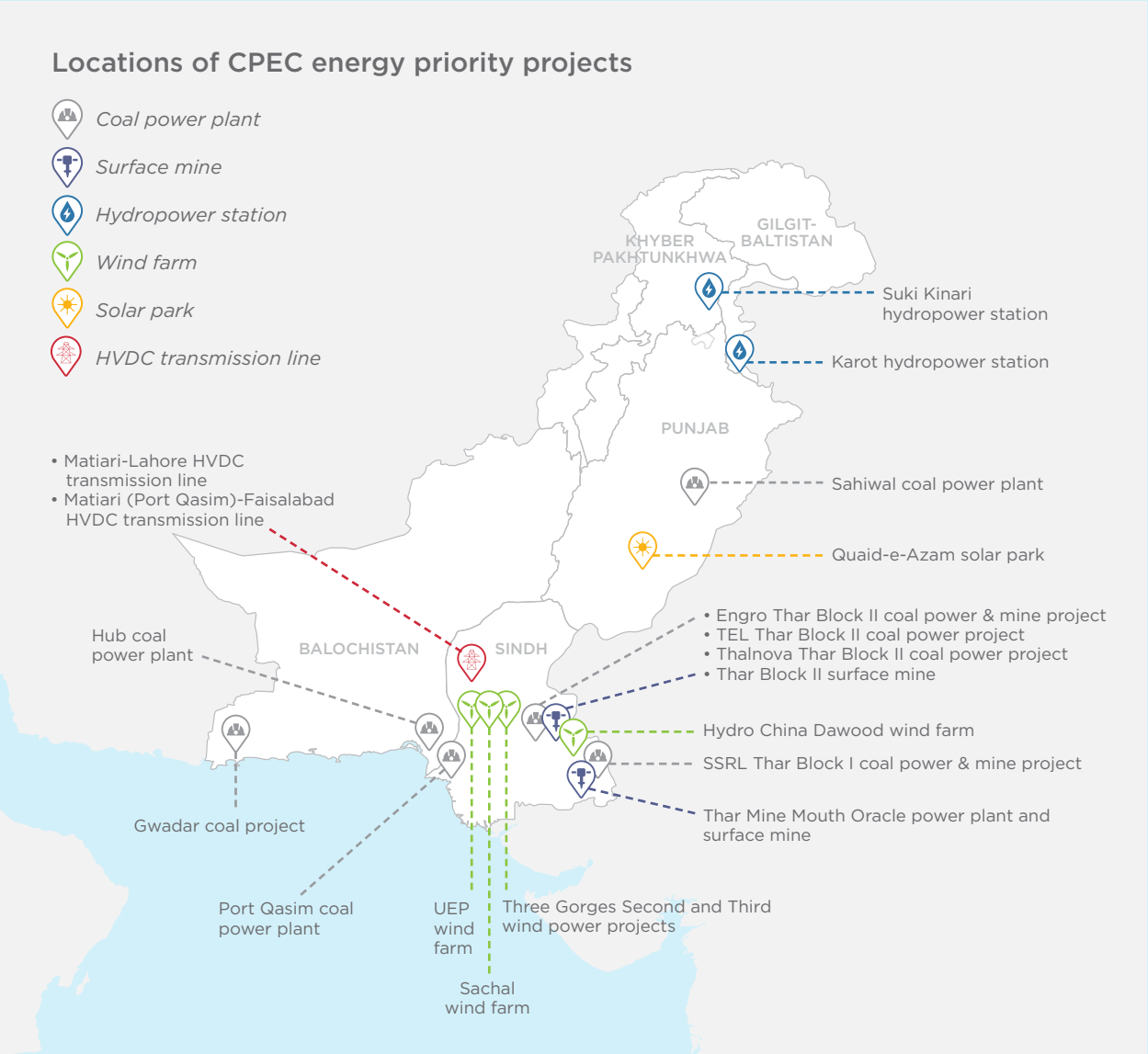
INTRODUCTION

In May 2013, Chinese premier Li Keqiang proposed that China and Pakistan focus on developing "priority projects in connectivity, energy development and power generation" and an economic corridor linking the two countries.[1] China and Pakistan formally launched the China-Pakistan Economic Corridor (CPEC) nearly two years later when President Xi Jinping visited Islamabad in April 2015.[2] CPEC is a collection of energy and transport projects, some of which will connect western China to the Arabian Sea.[3] The Chinese Embassy in Pakistan reported that as of the end of 2018, 22 CPEC projects worth US$18.9 billion had been initiated or completed.[4] Although $18.9 billion is far below the $62 billion often cited as the value of the CPEC project portfolio, it is nonetheless a considerable amount of foreign capital for Pakistan.[5]

The Chinese government has regarded CPEC as the bellwether of President Xi Jinping's Belt and Road Initiative (BRI), which he unveiled in 2013.[6] Once described by Xi as a "project of the century," the BRI aims to forge greater global connectivity, including through the construction of infrastructure, notably in emerging economies.[7] The initial importance of CPEC as the leading edge of the BRI is reflected in the oft quoted remark made by China's foreign minister Wang Yi in 2015: "if 'One Belt, One Road,' is like a sweet symphony involving and benefitting every country, then the construction of the China-Pakistan Economic Corridor is the sweet symphony of the melody's first movement."[8]

Power sector projects are a large component of CPEC. Generation and transmission projects account for 7 of the 11 CPEC projects completed and 6 of the 11 CPEC projects under construction at the end of 2018.[9] In addition, the 15 power sector projects that comprise the CPEC energy priority projects—those initially scheduled for completion by 2020 and the subject of this study—represent 55 percent of the value of all the projects on the government of Pakistan's CPEC website with an estimated cost listed ($20.9 billion out of $38.6 billion).[10] This focus on power projects reflects the determination of former Pakistani prime minister Nawaz Sharif to honor his campaign promise, which helped his party win the 2013 elections, to end Pakistan's chronic electricity shortages.

Three-quarters of the new generation capacity to be added by the CPEC power sector projects is from coal-fired power plants. If all these plants are constructed, they will be a major driver in Pakistan's increasing reliance on coal for electricity. Indeed, the government of Pakistan expects the CPEC power plants to contribute to an expansion of coal's share in Pakistan's power generation mix from 3 percent on June 30, 2017, to 20 percent on June 30, 2025.[11] This push to produce more electricity from coal stands in contrast to the move away from coal for power generation in other countries in recent years.[12]



An investigation into the projects being developed by Chinese firms in Pakistan's power sector in the more than four years since the launch of CPEC provides an opportunity to draw some initial conclusions about two issues that lie at the heart of criticisms of the BRI—environmental sustainability and debt sustainability. On the former, there are concerns that BRI infrastructure, especially coal power plants, will negatively impact the environment in a variety of ways, including by harming the global climate and polluting air and water. On the latter, there are concerns that BRI infrastructure projects may result in problematic increases in debt, with some critics worried that China is intentionally seeking to push borrowing countries into debt distress to gain strategic leverage over them.[13]

The key questions addressed by this study include the following:

- Why is the power generation capacity being developed under CPEC so heavily skewed toward coal?
- What accounts for the disconnect between Beijing's emphasis on green development as a feature of the BRI and the coal-fired power plants being constructed with Chinese finance in Pakistan?
- Is China deliberately using the CPEC power projects to push Pakistan into debt distress?

The answers to these questions are based on a variety of English and Chinese sources including Chinese and Pakistani government documents, media reports, industry publications, corporate documents, public statements made by officials and power company executives, and interviews with experts on the economies and energy sectors of China and Pakistan.

The main findings of this study are threefold. First, the fact that almost three-quarters of the new generation capacity to be added by the CPEC "early harvest" power projects is from coal power plants is the result of both a "pull" from Pakistan and a "push" from China. Second, the disconnect between the dominance of coal in the CPEC power generation mix and Beijing's emphasis on green development as an important feature of the BRI is largely due to Pakistan's long-standing preference for producing more electricity from coal. Third, although the CPEC power projects may increase Pakistan's debt burden because of sovereign guarantees and the liquidity crisis in Pakistan's power sector known as "circular debt," multiple factors indicate it is unlikely that Beijing is purposely seeking to trap Pakistan in a debt crisis in a bid to gain assets and influence in Pakistan.

This study has three sections. Part one introduces the CPEC power projects and explains why the new generation capacity they are adding is heavily skewed toward coal. Part two details why there is a gap between the focus of CPEC power projects on coal-fired generation and Beijing's aspiration to build a greener BRI. Part three discusses what China's involvement in Pakistan's power sector tells us about concerns that Beijing intentionally seeks to increase the debt burdens of borrowing countries.

PART 1: THE CPEC POWER SECTOR PROJECTS

The CPEC power sector projects, which are for the production and transmission of electricity, are rooted in Pakistan's need for additional power generation capacity. Since the mid-2000s, Pakistan's electricity demand during peak hours has exceeded its maximum generation capability (see table 1). In Pakistan's fiscal year ending on June 30, 2012, the shortfall reached 6,758 megawatts (MW), roughly the equivalent of 12 medium-sized coal-fired power plants.[15] Electricity outages lasted 10 hours a day in cities and as many as 22 hours a day in rural areas.[16]

Table 1: Pakistan's power deficit during peak hours

Fiscal year ending June 30	Installed capacity (MW)	Maximum generation capability (MW)	Demand during peak hours (MW)	Deficit (MW)
2006	19,550	15,168	15,223	-55
2007	19,681	15,575	17,487	-1,912
2008	20,232	14,707	19,281	-4,754
2009	20,566	16,040	20,314	-4,274
2010	21,614	15,144	21,029	-5,885
2011	23,342	15,430	21,086	-5,656
2012	23,342	15,896	22,654	-6,758
2013	23,725	16,846	21,605	-4,759
2014	23,702	18,771	23,505	-4,734
2015	24,961	19,132	24,757	-5,625
2016	25,374	20,121	25,754	-5,625
2017	28,399	22,148	28,476	-2,969

Source: National Electric Power Regulatory Authority, State of the Industry Report 2017*, 149, 183, https://www.nepra.org.pk/Publications/State%20of%20Industry%20Reports/State%20of%20industry%20report%202017.pdf and International Renewable Energy Agency, Renewables Readiness Assessment Pakistan, April 2018, 7, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Apr/IRENA_RRA_Pakistan_2018.pdf*

Pakistan's electricity crisis originated in the mid-1990s when the government decided that private sector investment was the key to developing the new generation capacity required to meet growing demand for electricity due to limited public sector resources. In 1994 Islamabad released a power policy that offered generous incentives to private investors, including an attractive up-front tariff, a premium for all generation projects above 100 MW commissioned by the end of 1997, exemptions from corporate income tax and import

taxes and duties, and perhaps most consequently, the choice of fuel for the project. These incentives were very successful in quickly securing private sector investment, resulting in roughly 4,000 MW of new generation capacity.[18]

The bulk of this investment was in power plants that ran on imported fuel oil, in part because the low oil prices of the 1990s made fuel oil an inexpensive option.[19] These projects contributed to a substantial transformation of Pakistan's power generation mix. Hydropower's share of installed generation capacity fell from around 67 percent in 1985 to 27 percent in 2017, while oil's share was 26 percent in 2017.[20] The dramatic increase in oil prices in the 2000s (reaching a high of $147 per barrel in 2008) caused Pakistan's power generation costs to skyrocket.

Pakistan's reliance on fuel oil for power generation has contributed to the liquidity crisis in the country's power sector known as circular debt, which in turn contributes to the country's frequent power outages. The term refers to the fact that entities in the power sector generally do not have enough money to pay each other for long periods of time.[21] The sole buyer of all grid-connected electricity produced in Pakistan is the government-owned Central Power Purchasing Agency (CPPA). CPPA buys the electricity from the generation companies and sells it to the distribution companies, which sell it to consumers.[22] However, the distribution companies are often unable to pay CPPA in full due to factors including the failure of the government to compensate them in a timely manner for below-market tariffs, customers being unwilling or unable to pay their bills in full, theft, technical losses, and distribution losses. As a result, the CPPA lacks the funds it needs to pay the generation companies, which in turn do not have enough money to pay the fuel suppliers.[23] The fuel suppliers, in turn, cut off supplies in response to nonpayment, forcing generators to shut down for extended periods of time and contributing to electricity shortages. For example, in Pakistan's fiscal year 2014, circular debt resulted in the idling of 5 gigawatts (GW) of generation capacity, which was almost 22 percent of the total installed capacity.[24]

Pakistan's power shortages have taken a toll on its economy. The World Bank estimates that blackouts have reduced the country's GDP by 2 percent per annum in recent years.[25] Pakistan's textile industry, a major source of export revenue, has been hard hit. Media reports have documented the woes of companies in Faisalabad, Pakistan's cloth capital, where power outages had forced hundreds of units to close and left tens of thousands of workers jobless as of 2011.[26]

Pakistanis took to the streets in the early 2010s (and beyond) to protest the electricity shortages. Rioters enraged about the government's inability to provide electricity during hot summer weather stormed the house of a politician, torched police vans, and looted shops.[27] Doctors and nurses picketed outside hospitals, where power outages contributed to a lack of clean water and canceled operations.[28]

Sharif tapped into this discontent in his successful bid to become prime minister for the third time in 2013. He blamed the previous government for the country's plunge into darkness and the resulting harm to Pakistan's economy, arguing that "it [would] be difficult to identify another example of collective national failure of policies and governance of this magnitude."[29] Campaigning under the slogan "Bright Pakistan," he vowed to end the

power shortages within two years if elected.[30] His manifesto for the 2013 election outlines a series of measures to resolve the energy crisis and boost economic growth, including the development of at least 5,000 MW of new coal power plants and an investment of $20 billion to generate 10,000 MW of electricity in the next five years.[31]

After his victory, Sharif wasted little time in letting China know that Pakistan's power sector was open to Chinese firms for more business. When China's premier Li Keqiang visited Pakistan less than two weeks after the general election in May 2013, Sharif requested that China build another nuclear power plant for Pakistan.[32] Premier Li was receptive to Sharif's overture, proposing that China and Pakistan not only cooperate in the development of power generation projects but also the construction of a bilateral economic corridor.[33] Li's remarks appear to have emboldened Sharif. When he visited China on his first overseas trip as premier in July 2013, he lobbied executives at the Export-Import Bank of China, China Development Bank, and China Investment Corporation, China's sovereign wealth fund, telling them that there were great opportunities for the development of coal-fired power plants and hydropower plants in Pakistan.[34]

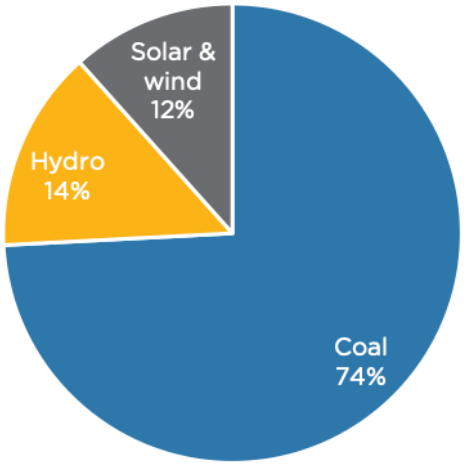
These visits laid the groundwork for the prioritization of power generation in CPEC. 13 of the 15 projects on the list of CPEC-Energy Priority Projects initially scheduled for completion by 2020 (the dates for some projects have slipped) are power generation projects; the others are transmission lines (see table 2). The total amounts of generation capacity and investment for the current CPEC energy priority projects essentially match the numbers in Sharif's manifesto. The combined capacity of the CPEC energy priority projects is 11,190 MW (compared to 10,000 MW in the manifesto), and the total estimated cost of the projects is at least $20.9 billion (compared to the $20 billion in the manifesto), with the costs of two projects still to be determined. Moreover, the CPEC power projects align with Sharif's call for generating more electricity from coal. Nearly three-quarters of this new capacity is from coal-fired power plants; the remaining 25 percent is a mix of hydro, wind, and solar power (see figure 1).

Table 2: CPEC energy priority projects

	Project	Fuel	Capacity (MW)	Estimated cost (US$ million)	Commercial operation date
1	Port Qasim coal power plant	Imported coal	1,320	1,912.2	April 2018
2	Suki Kinari hydropower station	Hydro	870	1,707	December 2022
3	Sahiwal coal power plant	Imported coal	1,320	1,912.2	October 2017
4	Engro Thar Block II coal power and mine project	Domestic coal	660	995.4	July 2019
	TEL Thar Block II coal power project	Domestic coal	330	497.7	July 2019
	Thalnova Thar Block II coal power project	Domestic coal	330	497.7	July 2019
	Thar Block II surface mine			1,470	December 2018
5	Hydro China Dawood wind farm	Wind	50	112.65	April 2017
6	Gwadar coal power project	Imported coal	300	Not yet determined	Not yet determined
7	Quaid-e-Azam solar park	Solar	1000	1,302	August 2016 (300 MW)
8	UEP wind farm	Wind	100	250	June 2017
9	Sachal wind farm	Wind	50	134	April 2017
10	SSRL Thar Block I coal power and mine project	Domestic coal	1,320	1,912.2	Expected 2018/2019
11	Karot hydropower station	Hydro	720	1,698	December 2021
12	Three Gorges second and third wind power projects	Wind	100	150	June and July 2018
13	Hub coal power plant	Imported coal	1,320	1,912.2	February 2019 (660 MW)
14	Matiari-Lahore HVDC transmission line			1,658	March 2021
	Matiari (Port Qasim)-Faisalabad HVDC transmission line			1,500	2018/2019
15	Thar Mine Mouth Oracle power plant and surface mine	Domestic coal	1,400	Not yet determined	Not yet determined

Source: CPEC Secretariat, "CPEC-Energy Priority Projects," China Pakistan Economic Corridor, accessed June 27, 2019, http://cpec.gov.pk/energy.

FIgure 1: Generation capacity of CPEC power plants by fuel

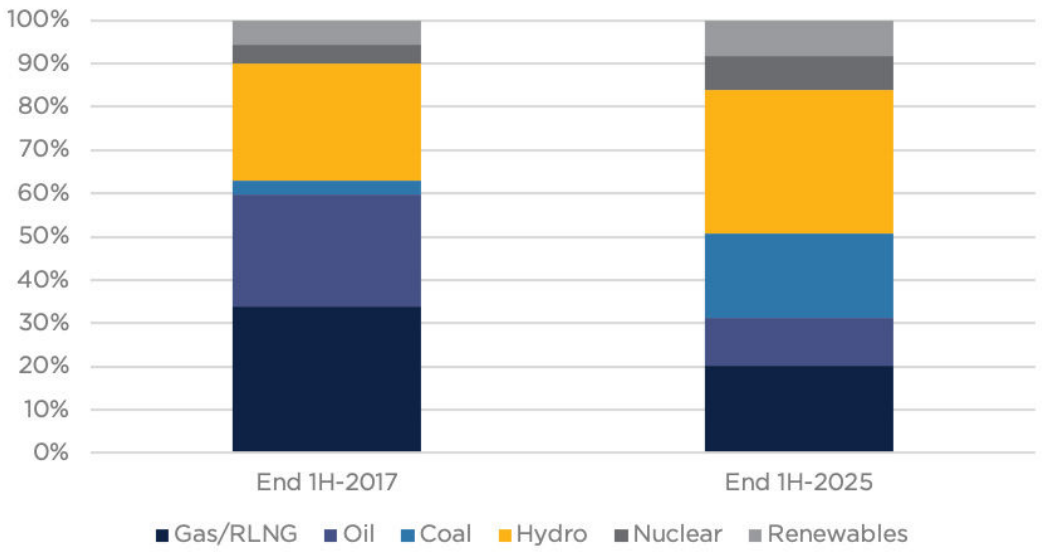


Source: CPEC Secretariat, "CPEC-Energy Priority Projects," China Pakistan Economic Corridor, accessed June 27, 2019, http://cpec.gov.pk/energy.

The CPEC power projects are helping to reduce—and should eliminate—Pakistan's power generation gap. If all the power plants included in the list of CPEC energy priority projects are completed as planned, they would add 11,190 MW of new capacity. 11,190 MW is 45 percent of Pakistan's total installed capacity of 24,823 MW as of June 30, 2015 (two months after the launch of CPEC), and is more than the extra capacity Pakistan needed to meet its record high 9,000 MW power shortage on June 25, 2018.[35]

If all the CPEC coal power plants are developed, they will also substantially increase the role of coal in Pakistan's power generation mix. Pakistan's National Electric Power Regulatory Authority (NEPRA) projects that coal's share of the country's generation capacity will expand from just 3 percent as of June 30, 2017, to nearly 20 percent as of June 30, 2025 (see figure 2).[36] Most of the growth will come from coal produced in Pakistan's Thar Desert, according to NEPRA.[37] For comparison, the US Energy Information Administration projects that coal's share of global power generation capacity will be 29 percent in 2025.[38]

FIgure 2: Pakistan's power generation capacity mix, June 30, 2017, and June 30, 2025



Source: National Electric Power Regulatory Authority, State of Industry Report 2017, 7, https://www.nepra.org.pk/Publications/State%20of%20Industry%20Reports/State%20of%20industry%20report%202017.pdf.

Why Are CPEC Power Projects Heavily Skewed toward Coal?

Coal-fired power plants constitute the majority of the new generation capacity to be added by CPEC priority energy projects because of a "pull" from Pakistan and a "push" from China. Pakistan has long sought to develop its vast coal reserves in the Thar Desert for power generation in an attempt to reduce the cost of electricity and conserve foreign exchange. Moreover, Pakistani officials regarded coal as the country's best option for rapidly building a large amount of generation capacity in the short term. Islamabad's quest to substantially increase the use of coal in power generation dovetailed with Beijing's ambitions to find new markets for Chinese manufacturers of coal power equipment as China greens its electricity mix and the generous financial incentives offered by Islamabad and Beijing to spur Chinese power companies to develop power plants in Pakistan. In addition, Chinese companies and financial institutions were willing to help Prime Minister Nawaz Sharif fulfill his campaign promise of ending power outages before he stood for reelection in 2018 by fast-tracking the execution of CPEC power projects.

The "Pull" from Pakistan

The large number of coal-fired power plants on the list of CPEC energy priority projects reflects the importance Islamabad has attached to increasing the role of coal in the country's power generation mix. In Pakistan's fiscal year 2015, during which CPEC launched, coal

accounted for just 0.1 percent of electricity generation, far below the 38 percent of global electricity generation in 2015.[39] Successive Pakistani power sector policies have focused on increasing the role of coal in the country's power generation mix. Pakistan's Policy for Power Generation Projects 2002 sought to attract international and domestic investment in the development of indigenous resources including coal.[40] As the country's federal minister for Water and Power stated in 2004, "the objective of the Government is to facilitate investors in developing coal mines and coal power plants in Pakistan."[41] Similarly, the National Power Policy 2013 calls for the "development of coastal energy corridors based upon imported coal (later mixed with local coal), rapid proliferation of coal mining all across the country—especially at Thar," and the conversion of fuel oil power plants to coal power plants.[42]

The government of Pakistan believes that the key to transforming the country's power generation fuel mix lies in the development of the abundant coal reserves in the Thar Desert in the country's southern Sindh Province. The Geological Survey of Pakistan, which discovered the coal deposits with the US Agency for International Development in 1992, estimates that they hold around 175 billion tons of coal, making Thar one of the world's largest lignite coal reserves.[43] According to a former federal minister for Water and Power, "God has blessed Pakistan with immense coal resources of more than 185.5 billion tonnes, and if half of these resources are exploited properly, it would be sufficient for generating 100,000 MW of electricity for 30 years."[44]

The Thar coal reserves had remained largely unexploited until the launch of CPEC. As Pakistan's Private Power and Infrastructure Board explained in 2004, the country's coal reserves had not been developed due to a lack of infrastructure, financing, and technical expertise.[45] Many companies shied away from investing in Thar coal in part because its poor quality made it costly to mine.[46] (The Thar desert contains lignite coal, which General Electric (GE) has described as being "about as combustible as soggy logs in a fireplace."[47]) Moreover, some international financial institutions including the World Bank and the European Bank for Reconstruction and Development, have restricted financing for the development of coal-fired generation because of concerns about carbon emissions.[48] The World Bank, for example, withdrew its support for a Thar coal and power project in 2009 because it was inconsistent with the bank's focus on low-carbon technologies.[49] As a result, China has emerged as a lender of last resort for Pakistan's coal power plants. According to Shahzad Qasim, the special assistant to Prime Minister Imran Khan on the power sector, "finding international financing for coal has been difficult, with China the only country willing to invest."[50]

Generate Cheaper Electricity

The large amount of coal-fired generation capacity added by CPEC power projects reflects the Pakistani government's long-standing objective of diversifying the country's fuel mix away from oil products to coal to generate cheaper electricity. In Pakistan's fiscal year 2014, for example, 40 percent of the country's generation capacity was based on residual fuel oil and high speed diesel, while just 0.1 percent was based on coal.[51] The cost of electricity generated from these oil products, which are largely imported, has been much higher than electricity generated by other fuels, especially coal. During Pakistan's fiscal year 2014, the average generation cost of electricity produced from residual fuel oil was four times higher than that

of coal (see table 3).[52] It was this gap between the generation costs of oil products and coal that underpinned Islamabad's decision to replace fuel oil with coal in power generation in the hope that it will reduce the cost of electricity.[53]

Table 3: Pakistan's average cost of generation (rupees/kilowatt hour) in fiscal years 2014 to 2015

Source	Fiscal year 2014	Fiscal year 2015
Hydro		
Residual fuel oil	16.0	12.4
Gas	4.8	4.7
High speed diesel	22.2	17.4
Coal	4.0	4.5
Nuclear	1.3	1.2
Wind		

Source: State Bank of Pakistan, Annual Report 2014–2015*, 34, http://www.sbp.org.pk/reports/annual/arFY15/Energy.pdf.*

Conserve Foreign Exchange

The large number of coal-fired power plants being developed as part of CPEC also reflects Islamabad's conviction that increasing the role of coal in Pakistan's power generation mix would reduce the country's import bill. Pakistan's State Planning Commission estimated in 2011 that the conversion of the country's 12 fuel-oil-fired power plants to coal-fired power plants could save $8 billion dollars, or almost 4 percent of GDP, based on the price of furnace oil and the exchange rate at that time.[54] Similarly, the State Bank of Pakistan estimated in its annual report for 2013–2014 that if the Jamshoro Power Plant, which the Asian Development Bank is helping convert from fuel oil to coal-fired generation, had been converted to coal earlier, it would have reduced Pakistan's import bill in fiscal year 2014 by $418 million if fueled by imported coal and $716 million if fueled by domestic coal.[55]

No Better Option in the Short Term

The dominance of coal-fired generation capacity in CPEC power projects reflected the view of the Sharif administration that coal plants were the best way for Pakistan to bring online a large amount of new generation capacity in a short period of time. In February 2014 Shahbaz Sharif, then the chief minister of Punjab Province (and brother of the prime minister), stated that the government preferred coal power plants because they were the shortest way to resolve the energy crisis.[56] In February 2015 NEPRA similarly argued that coal-fired generation was the best way to quickly increase the share of cheaper fuels in Pakistan's power generation mix when it granted a generation license for the Port Qasim coal power plant developed as part of CPEC:

> The Authority considers it imperative that efforts be made to change the energy mix based on relatively cheap fuels. In view of the depleting natural gas reserves in the country and the relatively longer lead time for hydro electric power projects to materialize, the coal power plants are considered the best option in the short and medium term planning. Therefore, in order to reduce the demand-supply power-gap and achieve sustainable development, it is vital that indigenous as well as imported coal projects are given priority for power generation and their development is encouraged.[57]

This preference for coal is despite Pakistan's vast renewable energy potential. Wind and solar plants could have been developed quickly, helping meet Sharif's goals of bringing new generation capacity online rapidly and increasing the use of domestic resources to generate electricity. Yet renewable energy projects account for only 12 percent of the generation capacity of the CPEC energy priority projects. There are probably several reasons for Islamabad's decision to give renewable energy projects a minor role in CPEC and in resolving the country's electricity crisis.

First, there are concerns within Islamabad about the ability of the country's overutilized transmission system to incorporate large amounts of new variable generation.[58] Indeed, NEPRA noted in its State of the Industry Report 2015 that renewable energy should be inducted gradually into the system and that detailed studies "to identify short term and long term expansion plans for strengthening the grid system" need to be conducted in order to create more space for renewable energy on the grid.[59] Similarly, several Pakistani energy experts argue in a paper published by the Asian Development Bank Institute in 2018 that the biggest obstacle to generating more electricity from wind and solar is the lack of adequate transmission and distribution infrastructure to absorb large amounts of power from intermittent sources of energy.[60]

Second, solar and wind were more expensive sources of electricity than coal when China and Pakistan launched CPEC, which made them a less attractive source of electricity than coal to Islamabad given its goal of generating more affordable electricity. For most of 2015, for example, the levelized tariff for new solar photovoltaic projects was between 14 and 15 cents per kilowatt hour, while the levelized tariff for a new wind project was between 13 and 17 cents per kilowatt hour.[62] In contrast, the levelized tariff for a new imported coal-based power plant was 8.6 cents per kilowatt hour (kWh) and for a new domestic coal-based power plant was 9.7 cents/kWh. Today, however, wind and solar are the least expensive sources of new electricity in Pakistan. In 2018 levelized tariffs averaged 5.25 cents/kWh for solar and 4.3 cents/kWh for wind while coal projects had levelized tariffs greater than 8 cents/kWh.[63]

Why are there no nuclear power plants in CPEC?

Nuclear power plants are not part of CPEC even though China virtually single-handedly built Pakistan's civilian nuclear program and continues to assist with its development. Nuclear power plants are probably excluded from CPEC because China's continued sale of reactors to Pakistan is perceived internationally to be a violation of the guidelines of the Nuclear Suppliers Group (NSG), which prohibits nuclear exports to nonmember states unless they agree to full-scope International Atomic Energy Agency safeguards.[64] When China joined the NSG in 2004, other members agreed to grandfather the construction of nuclear reactors in Pakistan for which contracts with China had been completed, including the Chashma-1 and Chashma-2 reactors.[65] However, China subsequently sold Pakistan the Chasma-3 and Chasma-4 reactors and is currently constructing two nuclear reactors in Karachi.[66] Beijing probably justifies its continued reactor sales to Pakistan on the basis of a bilateral agreement signed in 2003.[67] However, officials from the United States and other NSG members view these sales as inconsistent with the NSG guidelines.[68] As a result, Beijing may have pushed to exclude nuclear power plants from CPEC to avoid casting a pall over the initiative.[69]

Incentives for Foreign Investors

The government of Pakistan offers financial incentives to attract foreign companies to develop coal mines in the Thar Desert and build coal power plants. Some of these incentives, such as high rates of return on equity and sovereign guarantees, are available to all foreign investors. Other incentives, notably Islamabad's not yet fulfilled commitment to establish revolving funds to ensure uninterrupted payments to power producers, are exclusive to Chinese firms.

The need for these incentives is reflected in the assessments of Chinese government agencies and power companies of the risks of doing business in Pakistan. For example, China's State Administration of Taxation states in its latest guidance to Chinese companies investing in Pakistan that Pakistan's external debt is huge, its ability to service this debt is very low, and that China may become a high-risk creditor. It also noted that the returns on investment earned by Chinese companies are very low.[70] Chinese power companies have also identified numerous risks to investing in Pakistan, notably the risk of delayed payments for electricity, which makes it difficult for companies operating power plants to purchase coal and repay lenders.[71]

High Returns on Equity

Islamabad increased the guaranteed return on equity (ROE) for coal-fired power plants to entice foreign investors, especially from China, to invest in Pakistan's power sector.[72] In June 2013 NEPRA fixed the ROE for power projects based on local coal at 17 percent per year and the ROE for power projects based on imported coal at 20 percent per year.[73] NEPRA sets the ROE for power projects because the ROE is one of several factors that determines the cost of electricity.[74] However, the failure of these rates to secure new investments prompted the now-defunct Ministry of Water and Power to ask NEPRA in February 2014 to reconsider the tariffs,

and thus the ROEs, for coal power plants.[75] In June 2014 NEPRA increased the ROE for coal power plants to 26.5–29.5 percent for local coal and to 24.5–27.2 percent for imported coal.[76] The following month, NEPRA set even higher ROEs of 30.65–34.49 percent for mine mouth power plants based on Thar coal (see table 4).[77] In announcing the ROEs for Thar coal power plants, NEPRA noted that "Thar coal is a strategic energy resource, and investment in Thar has to be incentivized in order to expedite Thar coal development. The Authority acknowledges that ROE for Thar coal has to be more than the ROE offered to import/local coal (non-Thar)."[78]

Table 4: Pakistan's coal power tariffs in 2013 and 2014

Type of coal	2013	2014
Imported	20%	24.5% (220 MW plant with 40 months' construction time)
		27.2% (660/1099 MW plant with 48 months' construction time)
Local (other than Thar)	17%	26.5% (220 MW plant with 40 months' construction time)
		29.5% (660/1099 MW plant with 48 months' construction time)
Thar	None	30.65% (330 MW plant with 40 months' construction time)
		34.49% (660/1099 MW plant with 40 months' construction time)

Sources: National Electric Power Regulatory Authority, Determination of National Electric Power Regulatory Authority in the Matter of Upfront Tariff for the Projects on Imported/Local Coal (Other than Thar Coal), June 6, 2013, 8, https://www.nepra.org.pk/Tariff/Upfront/TRF-100%20UTC%20Determination%20Upfront%20Coal%2006-06-2013%205444-46.pdf; National Electric Power Regulatory Authority, Decision of the Authority Regarding Reconsideration Request Filed by Government of Pakistan in the Matter of Upfront Tariff for Coal Power Projects," June 26, 2014, 11–12, https://www.nepra.org.pk/Tariff/Upfront/Decision%20of%20the%20AUthority%20Upfront%20Coal.pdf; and National Electric Power Regulatory Authority, "Determination of the Authority in the Matter of Thar Coal Upfront Tariff," July 9, 2014, 9, https://www.nepra.org.pk/Tariff/Upfront/COAL%20UpFront%20Tariff.pdf

Comments by Pakistani officials and executives highlight the attractiveness of the ROEs for coal power plants. A NEPRA official, while explaining the decision in 2014 to increase the ROE to attract investment, stated that the ROE for power projects based on Thar coal "is the highest ever return on any investment in Pakistan's history."[79] A former member of Pakistan's Energy Planning Commission similarly noted in 2017 that "nowhere in the world such a high return has ever been allowed."[80] Officials with the Ministry of Water and Power stated in 2017 that high rates of return on equity had to be given to make coal power plants attractive because "people were not ready to invest in coal-based projects," according to Pakistani media.[81] More recently, the CEO of the Sindh Engro Coal Mining Company (SECMC) told the media that the ROE of 27.2 percent for the Sahiwal coal power project "was actually 18 percent internal rate of return on investment (IRR) on investment which was very high compared to 12 to 14 percent global IRRs."[82]

Sovereign Guarantees

The government of Pakistan guarantees the obligations of the Central Power Purchasing Agency to power producers.[83] This sovereign guarantee has made investing in the development of power plants in Pakistan more attractive to Chinese firms and their partners. For example, PowerChina, one of the owners of the Port Qasim Electric Power Corporation, identified the sovereign guarantee as a factor that will mitigate the risk of delayed electricity payments in a filing with the Shanghai Stock Exchange.[84] Similarly, Oracle Power PLC, a London-listed coal developer seeking to develop an integrated coal mine and power plant with Chinese firms as part of CPEC, mentions the sovereign guarantee in presentations and announcements about the project.[85] The government of Pakistan also issued a sovereign guarantee in the amount of $700 million to the consortiums of Chinese and Pakistani banks that are providing $1.5 billion to an integrated coal mine and power plant in Thar Block II being developed by project companies comprised of Chinese and Pakistani firms.[86]

Revolving Funds

The government of Pakistan also sought to attract Chinese investment in coal power projects by pledging to establish revolving funds backed by sovereign guarantees to ensure that power plants developed as part of CPEC are paid on time for the electricity they produce. Islamabad initially offered this incentive to CPEC coal power plants in April 2015 and subsequently extended it to all CPEC power projects in February 2016 as a result of concerns by Chinese investors about the risk of delayed payments.[87] Specifically, the government of Pakistan agreed to create a fund equal to a minimum of 22 percent of estimated monthly power purchases. If the power purchaser defaults on payments, the government of Pakistan will assume the liability and pay the Chinese power producers.[88]

Chinese officials and executives have indicated that Pakistan's commitment to establish the revolving fund, which has yet to be set up, helped facilitate Chinese investment in CPEC power projects. Zhang Yuqing, a former deputy director of China's National Energy Administration stated in a 2017 article that the revolving fund was one of several measures the government of Pakistan agreed to implement that led Chinese firms to assess that Pakistan's investment environment had improved, which increased their enthusiasm for doing business there.[89] Similarly, an executive with PowerChina told the Chinese media that the biggest problem in investing in power stations in Pakistan is delayed payments and that PowerChina, together with the National Energy Administration, pushed for the establishment of a revolving fund to be included in the intergovernmental agreement on CPEC energy cooperation to ensure uninterrupted payments to Chinese power producers.[90] His remarks align with a Pakistani press report detailing that the Chinese refused to build any power plants until Islamabad agreed to protect Chinese investors and lenders from circular debt.[91]

The "Push" from China

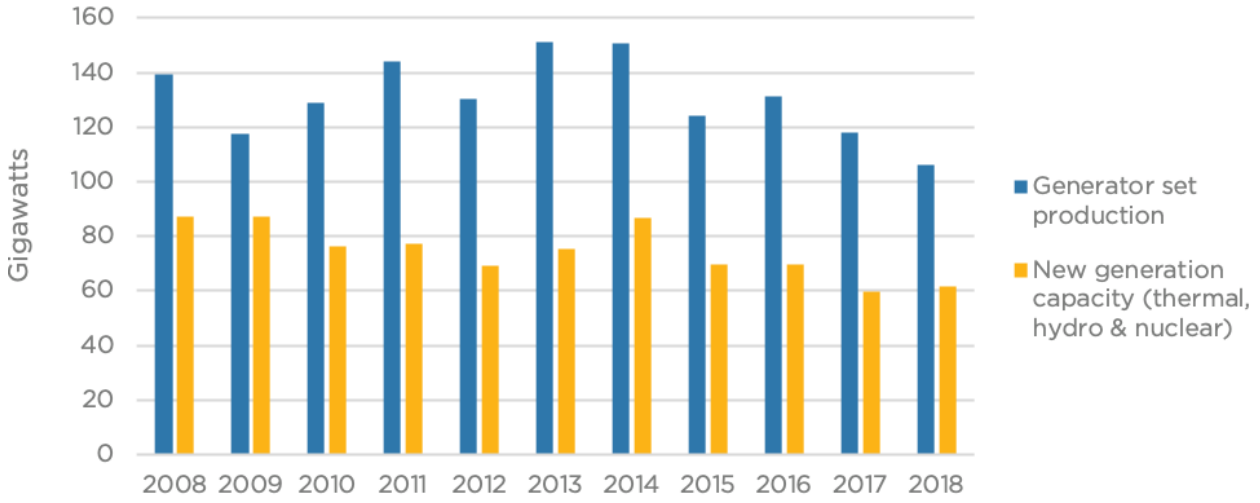
Islamabad's efforts to increase the role of coal in Pakistan's electricity mix aligned with the Chinese government's efforts to partially alleviate excess capacity in a variety of industries, including coal power generation equipment, by encouraging Chinese companies to find new markets abroad. To this end, Beijing has called on Chinese financial institutions to support the development of overseas power projects to drive the export of Chinese equipment. Moreover, the ability of Chinese firms and financial institutions to expedite the financing and construction of power plants aligned with former prime minister Sharif's goal of bringing on a large volume of new generation capacity as quickly as possible.

Find New Markets Abroad

Chinese firms are developing coal-fired power plants in Pakistan and other countries to generate new sources of demand for coal power equipment in the face of constrained opportunities to expand at home as China continues to green its electricity mix. Thermal's share of China's power generation capacity, most of which is coal, declined from 76 percent in 2008 to 62 percent in 2017.[92] Meanwhile, renewables have come to dominate new capacity installations. As a result, Chinese manufacturers of coal power equipment are looking abroad for new markets, especially to countries rich in coal resources and short of generation capacity.

China's production of generator sets, which are used in thermal, hydro, and nuclear power plants, is a case in point. The country produced far more generator sets than it installed domestically over the past decade (see figure 3). The capacity of generator sets produced that were actually installed declined from 62 percent in 2008 to 50 percent in 2017 before increasing to 58 percent in 2018.[93] The share of capacity of generator sets manufactured in 2013 that were actually installed in that year was less than 50 percent.[94]

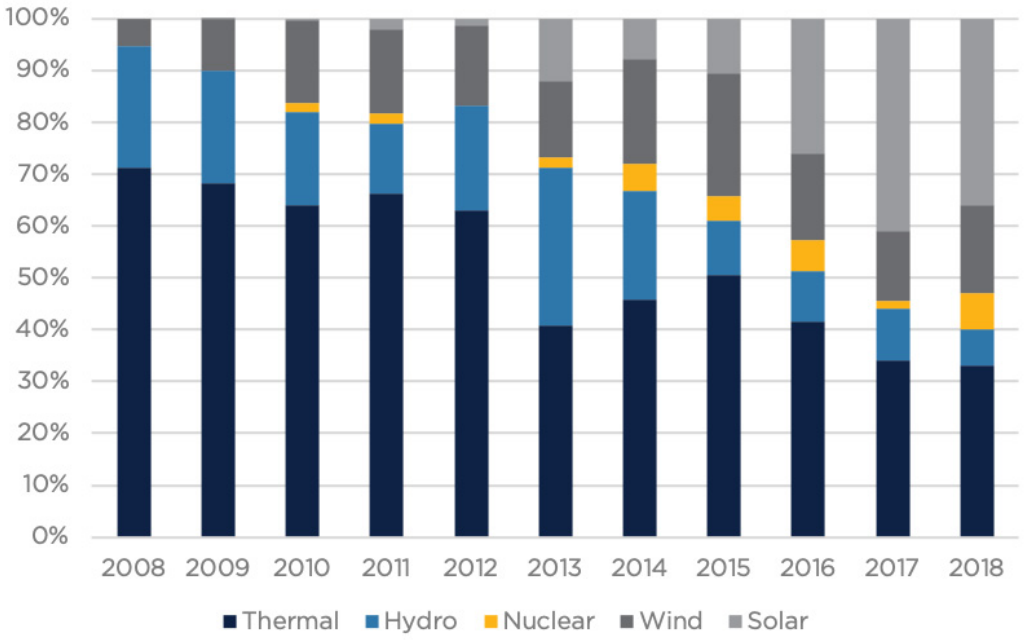
Figure 3: China's generator set production exceeds new generation capacity



Source: National Bureau of Statistics of China and China Electricity Council

This excess capacity is largely the result of the decline in coal and the rise of renewables in new installations of power generation capacity in China. Thermal's share of new installations (the majority of which were for coal power plants) dropped from 71 percent in 2008 to 33 percent in 2018. The share of renewables increased from 29 percent to 60 percent over the same period (see figure 4).[95]

Figure 4: China's new generation capaciity by fuel



Source: China Electricity Council

The weakening demand for generators is partly due to Beijing's efforts to combat air pollution by increasing China's use of hydropower and other renewables. China's Eleventh Five-Year Plan (2006–2010) introduced for the first time a target of 10 percent for nonfossil energy consumption.[96] Beijing subsequently increased the nonfossil energy target to 11.4 percent in the Twelfth Five-Year Plan (2011–2015), to 15 percent in the Thirteenth Five-Year Plan (2016–2020), and to "around 20%" by 2030.[97] The Chinese government is also considering requiring that renewables account for at least 35 percent of China's electricity consumption by 2030, according to a draft plan viewed by Bloomberg in September 2018.[98]

Meanwhile, major cities have also shuttered coal-fired power plants to improve air quality. The Beijing Municipal Environmental Protection Bureau, for example, announced in August 2014 that it would ban coal sales and use in Beijing's six main districts by the end of 2020.[99] The city's last coal-fired power plant closed in March 2017, making Beijing the first city in China to rely on cleaner energy sources, including nuclear, wind, and natural gas for power.[100]

China's excess capacity in generator sets is also partly the result of Beijing's decision in October 2014 to devolve authority for permitting new coal-fired power plants to the provinces in a bid to cut bureaucratic red tape.[101] Beijing had assumed that local governments would be able to make faster and better decisions about new generation capacity based on their greater understanding of local power demand. The provinces were quick to take advantage of their newfound authority, lured by the employment and tax revenue created by investment in fixed assets and aware that Beijing's push to green China's energy mix meant they had a limited period to act. They granted permits to 210 new coal-fired power plants with a combined capacity of 165 GW in 2015.[102] Although Beijing subsequently canceled some of these projects, the decentralization of permitting probably did result in the addition of new coal-fired generation capacity that China did not need. For example, China's new capacity additions for coal-fired power generation increased from 35 GW in 2014 to 54 GW in 2015 and then fell to 38.7 GW in 2016 and 35 GW in 2017.[103]

The Chinese government has encouraged Chinese manufacturers to export excess generator sets rather than warehouse them. This push to sell more generation equipment abroad is in line with Beijing's preference for partially alleviating industrial overcapacity through exports. For example, the "Guiding Opinions on Resolving the Contradiction of Serious Overcapacity" ("Guiding Opinions on Overcapacity"), released in October 2013, calls on Chinese firms to undertake major infrastructure and industrial projects overseas to drive the export of Chinese equipment, technology, products, standards, and services.[104] Similarly, the State Council's "Guiding Opinions on the Promotion of International Production Capacity and Equipment Manufacturing Cooperation" ("Guiding Opinions on International Production Capacity"), published in May 2015, states that overseas projects should be vigorously developed to enlarge China's export of power equipment and technology, with thermal and hydropower projects discussed first.[105] When Premier Li Keqiang visited the Guangdong Electric Power and Design Research Institute in January 2015, he stated that it is necessary for China's power sector to lead the globalization of China's equipment industry not only because of overcapacity in generation equipment but also because China's technologies are advanced.[106]

The CPEC power sector projects are driving the export of Chinese equipment. For example, Chinese firms manufactured 99 percent of the equipment used in the Port Qasim coal power plant, including the steam turbines, boilers, and generators. The construction of the power plant drove the export of more than RMB 7 billion ($1.1 billion) worth of equipment, making it a "model project" for the export of Chinese standards, equipment, and technology according to the China Power News Network.[107] Similarly, the Hub coal power plant is expected to drive the export of $900 million of equipment, including boiler systems, fuel systems, and circulating water systems.[108]

Meanwhile, the State Grid Corporation of China is building it first overseas ±660 kV high-voltage direct current (HVDC) transmission line in Pakistan between Matiari and Lahore, which will evacuate electricity produced by seven CPEC coal power plants.[109] The project uses the company's direct current technology. Nearly 80 percent of the project adopts China's technical standards, which State Grid estimates will drive RMB 6.7 billion (around US$ 1 billion) of equipment and technology service exports.[110]

Financial Support

Another reason Chinese power companies and banks are developing coal power plants is the financial support provided by Chinese financial institutions. The Chinese government has encouraged them to facilitate the export of power generation equipment to help alleviate domestic excess capacity in this industry. Beijing's guidance is contained in government documents and speeches made by Xi Jinping. The State Council's "Guiding Opinions on Overcapacity" calls for increased debt financing to support international expansion in overcapacity industries.[111] Its "Guiding Opinions on International Production Capacity" similarly encourages Chinese financial institutions, especially policy banks such as the China Development Bank and the Export-Import Bank of China (China Eximbank), to provide additional financing for overseas projects that will drive exports of Chinese equipment, including power generation equipment. The document also calls for strengthening and improving export credit insurance to facilitate the export of large-scale, complete sets of equipment, which presumably includes turnkey power plants.[112]

More broadly, President Xi announced an additional $113 billion in financial support at the Belt and Road Forum in Beijing in May 2017.[113] The $113 billion includes $69.5 billion of additional funds for the Silk Road Fund, China Development Bank, and China Eximbank. (Specifically, Xi said that "China" will contribute $14.5 billion to the Silk Road Fund and that the China Development Bank and China Eximbank will establish special BRI funds in the amounts of $36.2 billion and $18.8 billion, respectively.) Xi also encouraged financial institutions to deploy the equivalent of $43.5 billion in Chinese currency to help develop the BRI.

Chinese state-owned financial institutions are supporting the development of overseas coal-fired power plants in line with Beijing's guidance.[114] As of July 2018, Chinese banks and firms had committed or provided funding for more than 25 percent of all coal plants under development outside of China. Pakistan was the fourth largest recipient of Chinese financing for coal power plants behind Bangladesh, Vietnam, and South Africa. The principal Chinese financiers include policy banks (institutions with a mandate to support Beijing's policy priorities) such as the China Development Bank and China Eximbank and commercial banks such as the Industrial and Commercial Bank of China and Bank of China.

While China's policy and commercial banks feature prominently in discussions of Chinese financing for coal-fired power plants, the Chinese financial institution that arguably plays the most important role in facilitating the development of overseas coal power plants is the state-owned China Export and Credit Insurance Corporation, known as Sinosure. It is China's only official export guarantee agency. Sinosure has a mandate to promote Chinese equipment exports and overseas investment through the provision of insurance against nonpayment and economic losses due to risks including war, expropriation, and breach of contract.[115] Sinosure covers up to 95 percent of the equity, debt, or deferred payment.[116]

China requires Chinese financial institutions and state-owned enterprises to obtain insurance from Sinosure before lending and making investments overseas.[117] Sinosure guarantees are likely to be especially important for coal power projects, which can cost hundreds of millions of dollars to develop and thus are a significant credit risk to lenders.[118] Sinosure has

underwritten 11 power sector projects in Pakistan with an insured amount of $14.92 billion.[119] NEPRA has allowed a Sinosure fee of up to 7 percent of the total debt servicing to be included in the project cost used to calculate the tariffs for all CPEC power generation projects.[120]

Sinosure is one of the reasons Chinese firms are developing coal power projects in Pakistan. The Port Qasim coal power plant is a case in point. Even though the government of Pakistan provided a sovereign guarantee for the power purchase agreement, PowerChina was concerned that Islamabad might not be able to honor its guarantee because of the Pakistani power sector's debt.[121] Consequently, Sinosure agreed to underwrite delayed payments from Pakistan; if the government of Pakistan is unable to reimburse in a timely fashion the project company jointly owned by PowerChina and Qatar's Al Mirqab Capital for power purchases, the company can file a claim with Sinosure for breach of contract.[122]

The Need for Speed

The large share of coal-fired capacity in CPEC power projects is also consistent with the priority former Pakistani prime minister Nawaz Sharif placed on bringing online as much new generation capacity as fast as possible to make good on his pledge to end Pakistan's electricity shortages before he stood for reelection in 2018.[123] Chinese companies can build coal power plants very quickly, even in as short a time frame as less than a year.[124] Moreover, coordination between Chinese financiers and power companies expedited the financing for CPEC power projects.

Chinese companies met Sharif's need for speed on some projects. PowerChina, the firm that built the Sahiwal coal-fired power plant, hung floodlights from cranes so construction could continue at night.[125] The company completed the project in just 22 months, 200 days ahead of schedule, setting a record for the shortest construction period for this type of unit abroad.[126] The Pakistani government reportedly regarded the speed at which the Sahiwal plant was constructed as a miracle in the history of Pakistan's electric power construction.[127]

PowerChina came under pressure from the Pakistani government to rapidly develop the Port Qasim coal-fired plant. According to one Chinese media report, the biggest "roadblock" PowerChina faced in completing the project was the requirement from Islamabad to reduce the construction period from 48 months to 42 months and then to 36 months.[128] PowerChina executives spoke about the difficulty of satisfying this request in interviews with Chinese journalists. The chairman of the Port Qasim Electric Power Company, a subsidiary of PowerChina, noted that the average construction time globally for a plant the size of Port Qasim was 42 months.[129] In another interview, the chairman of PowerChina, Yan Zhiyong, revealed that during negotiations over the project, the Pakistanis asked PowerChina if it could complete the plant and connect it to the grid six months ahead of schedule in light of the country's power shortages and the 2018 elections. Chairman Yan responded, "from the perspective of a politician, I understand this request very well. But from the perspective of an engineer and from the perspective of the chairman of a central state-owned enterprise and global Fortune 500 company, I must responsibly tell you that this request is impossible to achieve."[130] Nonetheless, PowerChina connected the plant's two generating units to the grid in just 32 months. The Port Qasim coal power project began commercial operation 67 days ahead of schedule on April 25, 2018, three months before Pakistan's general election.[131]

The ability of Chinese companies to execute projects quickly was a factor in Pakistan's selection of a Chinese firm to build a major transmission line. The Pakistani government awarded the contract for the Matiari-Lahore HVDC line to State Grid over GE, even though GE's initial cost estimate was two-thirds that of State Grid ($800 million versus $1.26 billion), because the Chinese company said it could complete the project in 27 months.[132] When Islamabad asked Western companies to match State Grid's timeline, the companies said it would take at least 48 months to complete the project.[133]

According to Zhang Yuqing, former deputy director of China's National Energy Administration, coordination between Chinese financial institutions and power companies enabled CPEC power projects to secure financing in a timely fashion, which helped accelerate their development. Chinese banks and Sinosure participated in planning and negotiating the CPEC power projects from the very start.[134] In the case of the Hub coal-fired power plant, the project secured financing so quickly that it was reportedly viewed as a "miracle" by the outside world.[135] Similarly, the integration of the financing for the Thar Block II coal mine and power plant helped expedite the approval of the project within China.[136]

PART 2: CPEC AND ENVIRONMENTAL SUSTAINABILITY

Analysts have raised concerns about the likelihood of infrastructure being developed as part of the BRI adversely affecting the environment. Infrastructure likely to have the greatest impact on the environment include roads and railways; thermal, hydro, and nuclear power plants; electricity transmission systems; oil and natural gas pipelines; mining projects; and heavy industry. The risks associated with these infrastructure projects include increased air and water pollution, habitat loss and fragmentation, deforestation, greater wildlife mortality, the threat of invasive species; and increased greenhouse gas emissions that undermine global action to combat climate change.[138] Ma Jun and Simon Zadek of Tsinghua University have warned that BRI countries could account for more than 50 percent of global carbon dioxide emissions by 2050 in the worst-case scenario.[139]

Coal power plants often feature prominently in discussions of the environmental sustainability of the BRI because they account for a large share of the power generation projects being developed and financed by Chinese entities in BRI countries. A study by the World Resources Institute finds that Chinese debt financing for power generation and transmission projects in BRI countries is skewed toward coal. Specifically, in 2014–2017, 40 percent (or $10.2 billion) of syndicated loans for such projects involving at least one of six major Chinese banks was used to finance coal-fired power plants.[140] Moreover, Fitch Solutions expects coal power projects to remain a core focus of generation projects developed under the BRI. According to its calculations in 2018, coal accounts for 52 percent (or 80 GW) of the 153 GW capacity in its BRI power project pipeline.[141]

The CPEC coal power plants pose several threats to Pakistan's environment. First, they will increase substantially Pakistan's greenhouse gas emissions, which is likely to complicate Pakistan's pledge, made at the United Nations Framework Convention on Climate Change in Paris in December 2015, to reduce its greenhouse gas emissions.[142] Second, new coal power plants risk exacerbating Pakistan's water scarcity because mining coal and burning it for power generation are water-intensive activities.[143] Third, CPEC coal power plants may create health problems from increased emissions of air pollutants and the handling and disposal of coal ash, which contains carcinogens.[144]

The production of Thar coal for power generation also threatens the local environment. The Thar Desert contains lignite coal, which has a lower heating value than bituminous coal. This means that more coal must be burned to produce a given amount of power, which means more pollutants, including greenhouse gases, are generated.[145] Some residents of Thar have worried that the projects will contaminate and deplete their water supplies, destroy the local ecology, and result in a loss of trees and grazing lands.[146]

Consequently, most CPEC power projects are out of line with Beijing's pledge to build a green BRI. The Chinese government has highlighted green development as a goal of the BRI. In August 2016 six central government agencies, including the People's Bank of China, released "Guidelines for Establishing the Green Financial System," which calls on Chinese banks, firms,

and multilateral development banks in which China actively participates to adopt green financing and strengthen environmental risk management for BRI projects.[147] In May 2017 China's Ministry of Environmental Protection, Ministry of Foreign Affairs, National Development and Reform Commission, and Ministry of Commerce jointly issued "Guidance on Promoting Green Belt and Road," which aims to align the BRI with the trend of "green, low carbon and circular development."[148] Later that month, President Xi himself stated at the opening ceremony of the inaugural Belt and Road Forum that "We need to seize opportunities presented by the new round of change in the energy mix and the revolution in energy technologies to develop global energy interconnection and achieve low-carbon development."[149] In November 2018 China's special representative on climate change, Xie Zhenhua, told journalists that the central government has made clear that BRI projects should be green and follow a low-carbon path.[150] Xi recommitted to using the BRI to promote green development at the second Belt and Road Forum in April 2019.[151]

What explains the disconnect?

The CPEC power projects indicate that the disconnect between Beijing's green BRI rhetoric and the reality on the ground can be explained by two factors. First, it is ultimately up to a host country to determine its power generation mix, and Chinese officials and power company executives may be reluctant to interfere in the decision-making process. Second, some of the Chinese firms developing coal power plants abroad maintain they are clean, especially if they produce less emissions than the alternatives.

Host Country Preferences

The CPEC power projects highlight the importance of host country preferences in determining the composition of their power generation mixes. Chinese firms would not be building so many coal-fired power plants overseas without a large customer base abroad. China can't force other countries to buy power generation equipment they do not want. Although Chinese companies certainly have a strong incentive to sell excess thermal power generation sets overseas, they also had an eager buyer in Pakistan. The country had been courting foreign investors, including Chinese firms, to invest in the development of the Thar coal fields long before Beijing and Islamabad decided to launch CPEC.[152] Given that Chinese firms can build other types of power plants and that Beijing is promoting the export of wind turbines and solar panels along with thermal and hydropower generation equipment, it is plausible that if Pakistan had prioritized the development of renewable energy projects, the composition of the generation mix of the CPEC power plants would be different.[153] The dominance of coal in the generation mix of the CPEC power plants may also reflect a reluctance on the part of the Chinese government to dictate the environmental policies of other countries even though China certainly has the financial resources and expertise in building solar, wind, and hydropower projects to help countries to shift their generation mixes in a greener direction.

Imran Khan's election as Pakistan's prime minister in July 2018 prompted Chinese officials to reaffirm Pakistan's leading role in determining CPEC's trajectory. Indeed, China's ambassador to Pakistan, Yao Jing, has indicated that it is ultimately up to Pakistan to decide what type of projects are included in CPEC. In an interview with Reuters in September 2018, he said that

Beijing would definitely follow the agenda of the new government of Prime Minister Imran Khan to develop a road map for BRI projects and would only move forward with projects Pakistan wanted. "This is Pakistan's economy, this is their society," he said.[154] That same month China's foreign minister, Wang Yi, said that "in terms of how we advance the construction in the next stage [of CPEC], we will always respect the will of the Pakistani side."[155]

Khan is shifting the focus of CPEC away from projects aimed at fulfilling his predecessor's promise to end power outages and toward projects in line with his campaign pledge to boost social spending.[156] The outcomes of the meeting of CPEC's Joint Cooperation Committee in Beijing in December 2018 reflect Khan's priorities. The Pakistanis requested that the proposed 1,320 MW Rahim Yar Khan imported coal-based power plant be removed from CPEC because Pakistan had already contracted sufficient generation capacity and more contract would result in a "capacity trap." (The project had already been deleted from the list of CPEC energy priority projects after Islamabad announced a ban on new power plants using imported fuels in June 2016.)[157] In addition, the two countries agreed to expand CPEC to include industrial, agricultural, and socioeconomic projects. The Chinese also committed to providing a grant of $1 billion for projects in areas including education, health, and irrigation.[158]

Seeing Green

The disconnect between the large number of coal power plants under development with Chinese financing in Pakistan and Beijing's emphasis on building a green BRI may also be explained by the fact that at least some of the CPEC coal power plants, notably those built at Port Qasim and Sahiwal and under construction at Hub, are viewed as "green" in China. PowerChina, which is involved in all three plants as an owner or builder, has touted their green credentials. For example, one executive told the Pakistani media that the company had adopted the highest international standards and most modern technology to ensure the production of clean energy at the Port Qasim plant.[159] Similarly, an article on PowerChina's website states that the Sahiwal power plant "has the highest operation efficiency, most advanced technologies and is the most environmentally-friendly of any coal-fired plant in the country."[160] Wang Binghua, the chairman of PowerChina's parent company, China State Power Investment Corporation, said that the company is adopting "top international technologies on environment protection" at Hub, explaining that "we are adopting a super clean emission technology which could make the emissions at the plant the same as a gas fired power plant."[161]

While PowerChina certainly has an incentive to portray its coal-fired power plants in Pakistan as green to counter criticisms about the environmental risks posed by these projects, there is some truth in the company's statements. First, all three plants use supercritical power generation technology.[162] Coal plants are categorized as subcritical, supercritical, or ultra-supercritical depending on how efficiently they burn coal to generate electricity. Supercritical plants emit less carbon dioxide than subcritical plants but more than ultra-supercritical plants.[163] Second, the Port Qasim and Sahiwal plants also have advanced pollution abatement equipment, such as flue gas desulfurization (FGD) and selective catalytic reduction (SCR) to reduce sulfur and nitrogen emissions and electrostatic precipitators (ESPs), which control particulate emissions, while the Hub plant has ESPs and FGD and the option to add SCR.[164]

Third, the supercritical coal plants being developed as part of CPEC should emit fewer greenhouse gasses than the fuel oil plants that Pakistan is seeking to replace with the coal-fired ones. Indeed, the Asian Development Bank, which is financing the construction of a 600 MW supercritical coal-fired unit at the Jamshoro Thermal Power Station, stated that supercritical coal plants emit fewer greenhouse gases than Pakistan's existing heavy-fuel-oil-fired plants.[165] According to the Asian Development Bank, the new supercritical coal-fired unit at Jamshoro will emit 750 grams of carbon dioxide per kilowatt hour compared to the 930 grams of carbon dioxide emitted by the existing heavy fuel oil unit at Jamshoro.[166]

However, other CPEC coal power plants are less environmentally friendly, especially from a climate perspective.[167] Three of the Thar coal plants and the Gwadar coal power plant use—or will use—subcritical technology (see table 5). As a result, these four plants will emit a lot more carbon dioxide per unit of electricity. The Gwadar coal power plant should be as clean from a traditional pollutant perspective as a supercritical plant if all the planned pollution abatement equipment, including FGD, ESP, and SCR, is installed and run well.[168]

Table 5: Generation technologies of CPEC coal power plants

Coal power plant	Generation technology
Port Qasim coal power plant	Supercritical
Sahiwal coal power plant	Supercritical
Engro Thar Block II coal power project	Subcritical
TEL Thar Block II coal power project	Subcritical
Thalnova Thar Block II coal power project	Subcritical
Gwadar coal power project	Subcritical
SSRL Thar Block I coal power project	Supercritical
Hub coal power plant	Supercritical
Thar Mine Mouth Oracle power plant	Supercritical

Sources: See Appendix A.

It's worth noting that Pakistan's appetite for additional subcritical coal plants may be limited. In July 2017 NEPRA announced that its new upfront tariff for Thar coal power plants will only be available to projects that use supercritical technology or above and that the use of subcritical technology would not be allowed.[169] As a result of this new tariff policy, Oracle Power expanded the size of its planned power plant in Thar Block IV from 1,320 MW to 1,400 MW to comply with the new requirement to apply supercritical technology.[170]

PART 3: CPEC AND DEBT SUSTAINABILITY

The BRI has generated concerns about whether Chinese loans for infrastructure development will create debt problems in borrowing countries. A frequently cited analysis of the debt implications published by the Center on Global Development in March 2018 found that the BRI increases the risk of debt distress in some borrowing countries.[171] International Monetary Fund (IMF) officials have also warned of the risks to debt sustainability posed by the BRI. Christine Lagarde, a former managing director of the IMF, cautioned in remarks in Beijing in April 2018 against the financing of unneeded and unsustainable infrastructure and urged careful management of financing terms in countries where public debt is already high.[172] Maurice Obstfeld, economic counselor at the IMF, offered similar advice about China's financing of infrastructure in Pakistan at a press conference in October 2018. He noted that although Pakistan needs more infrastructure, "it is important that the design of projects, the governance of projects be sound and that excessive debts which cannot be repaid are avoided because that just leads to financial instability and lower growth."[173]

Some observers maintain that China is intentionally attempting to saddle countries with unsustainable levels of debt in order to gain control of strategic infrastructure or political influence when borrowing countries can't repay their loans. For example, in August 2018, Ray Washburne, president of the Overseas Private Investment Corporation, said that China's "projects economically don't make a lot of sense. It's a loan-to-own program the Chinese are doing."[174] That same month, a group of US senators sent a letter to Treasury Secretary Steven Mnuchin and Secretary of State Michael Pompeo expressing concern about potential bailout requests to the IMF by countries that have "accepted predatory Chinese infrastructure financing" and stating that China "attempts to hold other countries financially hostage and force ransoms that further its geostrategic goals."[175] The senators also warned that China might use debt as leverage to establish naval bases in countries unable to repay loans where Chinese firms hold concession agreements to operate and develop ports, including Pakistan and Sri Lanka.[176]

Pakistan frequently appears in discussions of the debt sustainability of the BRI because of the country's heavy and increasing debt burden. Pakistan's debt-to-GDP ratio increased from 70 percent in 2017 to 75.3 percent in 2018 and is projected by the IMF to reach a high of 80.5 percent in 2020. Research indicates that countries with rising debt-to-GDP ratios above 50–60 percent are at greater risk of default or debt treatment.[181] Pakistan's debt is partly the result of borrowing from China. According to an IMF report published in July 2019, Chinese bilateral and commercial loans accounted for 26 percent of Pakistan's total outstanding debt of $85.5 billion.[182]

Pakistan turned to the IMF in October 2018 to avoid a default.[183] In July 2019 the IMF's executive board approved a 39-month bailout package in the amount of $6 billion that will unlock around $38.6 billion in support from Pakistan's international partners over the three-year period.[184] The IMF expects Pakistan's external debt to remain sustainable due to a projected fall in external borrowing after Pakistan's fiscal year 2021 and the commitments from Pakistan's international partners.[185]

Hambantota Port's central role in the "debt trap diplomacy" narrative

Proponents of the argument that China is practicing debt trap diplomacy to seize strategic assets tend to focus on a single example, Hambantota Port in Sri Lanka, despite China's established track record of waiving or restructuring loans without taking control of assets.[177] The government of Sri Lanka's previous president, Mahinda Rajapaksa, who was in office from 2005 to 2015, borrowed money from China to build infrastructure in his hometown of Hambantota, including a port.[178] Struggling to repay Sri Lanka's loans, the government of Rajapaksa's successor, Maithripala Sirisena, broached the idea of an equity swap for some of its debt to China. During then Sri Lankan prime minister Ranil Wickremesinghe's visit to Beijing in April 2016, he told reporters "we've been talking with some companies and also the government of China about the possibility of some infrastructure projects becoming public-private partnerships, in which part of the debt will become equity held by Chinese companies."[179] In 2017 China Merchants Port Holdings (CMPH) became the majority shareholder in a joint venture with Sri Lanka Ports Authority that holds a concession to develop and operate the port for 99 years. CMPH paid the Sri Lanka Ports Authority $1.12 billion for the joint venture stake. [180]

Sovereign Debt Risks from CPEC Power Projects

Concerns that the CPEC power sector projects may increase Pakistan's sovereign debt are valid for two reasons. First, the government of Pakistan has issued sovereign guarantees to CPEC power producers for payments from the country's sole buyer of electricity, the Central Power Purchasing Authority (CPPA) and to the lenders to a coal mine and power plant being developed under CPEC. Second, the CPEC power plants may increase the circular debt in Pakistan's power sector, which the government may pay off based on past practice.

In theory, CPEC power sector projects should not increase the Pakistani government's debt burden—if consumers pay their bills in full—because the government is not borrowing money to finance these projects. Instead, Chinese and other financial institutions are lending money to special purpose companies (SPCs) established to develop the projects. Most of these SPCs are majority owned by Chinese firms (see table 6). For example, the International and Commercial Bank of China is the head of a syndicate that agreed to provide $1.44 billion to Huaneng Shandong Ruyi (Pakistan) Ltd., an SPC owned by China's Huaneng Shandong Power and Shandong Ruyi Group that developed and operates the Sahiwal coal-fired power plant. Similarly, the Export-Import Bank of China provided $1.55 billion to Port Qasim Electric Power Company Limited and an SPC owned by PowerChina and Qatar's Al Mirqab Group that developed and is now operating the Port Qasim coal-fired power plant.

(The CPEC power projects also involve equity financing equivalent to 15–30 percent of the total project cost. This capital is typically provided by Chinese firms and their partners. For example, China Three Gorges Corporation provided 93 percent [$316.2 million] of the equity financing for the Karot Hydropower Station.[186])

Table 6: Debt financing arrangements for select CPEC power projects

Project	Debt: equity	Lender	Borrower	Borrower's owner	Amount ($ million)
Port Qasim coal power plant	75:25	China Eximbank	Port Qasim Electric Power Co.	PowerChina, Al Mirqab Group	1,550
Suki Kinari Hydropower Station	75:25	China Eximbank, ICBC	SK Hydro	China Gezhouba Group, Haseeb Khan	1,416
Sahiwal coal power plant	80:20	ICBC-led syndicate	Huaneng Shandong Ruyi (Pakistan)	Huaneng Shandong Power, Shandong Ruyi Group	1,440
Engro Thar Block II coal power plant	75:25	Bank of China, Bank of Communications, CCB, CDB, China Eximbank, ICBC, Pakistani Banks	Engro Powergen Thar Limited	Engro Powergen, China Machinery & Engineering Corp., Habib Bank, Liberty Mills	831
TEL Thar Block II coal power plant	75:25	CDB, Habib Bank	Thar Energy Limited (TEL)	Hub Power Company, Fauji Fertilizer Limited, China Machinery & Engineering Corp.	262 (from CDB)
Hydro China Dawood wind farm	70:30	ICBC	Hydro China Dawood Power	Hydro China, Dawood Power	78.8
Quaid-e-Azam solar park	80:20	CDB, China Eximbank	Zonergy	ZTE Corp.	62.2 (and RMB 400 million)
UEP wind farm	75:25	CDB	United Energy Pakistan	United Energy Group, Orient Group Investment Holdings	252
Sachal wind farm	85:15	ICBC	Sachal Energy Development	Arif Habib	100 (export buyer's credit)
Karot Hydropower Station	80:20	CDB, China Eximbank, SRF, IFC	Karot Power Co.	CSAIL (owned by China Three Gorges Corporation, SRF, IFC)	1,392
Three Gorges second and third wind power projects	70:30	CDB	Three Gorges Second Wind Farm Pakistan, Three Gorges Third Wind Farm Pakistan	CSAIL (owned by China Three Gorges Corporation, SRF, IFC)	NA
Hub coal power plant	75:25	Bank of China, Bank of Communications, CCB, CDB, China Eximbank, ICBC	China Power Hub Generation Co.	China Power International Holding, Hub Power Co.	1,500

Sources: See Appendix B.
Abbreviations: CCB = China Construction Bank; CDB = China Development Bank; China Eximbank = Export-Import Bank of China; CSAIL = China Three Gorges South Asia Corporation Limited; ICBC = Industrial and Commercial Bank of China; IFC = International Finance Corporation; SRF = Silk Road Fund

However, Pakistan's sovereign debt is likely to increase if the government has to honor the sovereign guarantees it issues to back the development of CPEC power projects. Some of these sovereign guarantees support the payment obligations of power the purchaser, the CPPA, to the power producers.[187] As discussed above, if consumers do not pay the distribution companies in full, the distribution companies will not have enough money to pay the CPPA, which will not have enough money to pay the power producers. Under the sovereign guarantee, in the event of a default of payments by the CPPA leading to the termination of the power purchase agreement between the power producer and the CPPA, the power producer can exercise a put option to sell its power plant and recover its investment and return on investment from the government of Pakistan.

Another risk to Pakistan's debt sustainability posed by CPEC projects to which Islamabad has issued a sovereign guarantee to the lenders is the fact that the majority of the loans made by Chinese financial institutions to the companies operating the CPEC power plants are in foreign currencies, mostly US dollars.[188] If there is an external shock that results in a substantial devaluation of Pakistan's currency (which Islamabad devalued five times in 2018 alone), then otherwise well-performing power plants may become financially unviable.[189] As the Pakistani rupee devalues, the cost domestically of servicing the debt increases and the risk of default also increases because the loans to the project companies are in foreign currency and the power projects are earning revenue in Pakistani rupees. (This risk applies to the Engro Thar Block II integrated coal mine and power plant, for which the government of Pakistan issued a sovereign guarantee in the amount of $700 million to the consortiums of Chinese and Pakistani banks that are providing $1.5 billion to help finance the project.[190])

External shocks are one of the primary reasons that countries develop external debt problems. For example, during the East Asian Financial Crisis of 1997–1998, the decline (and eventual reversal) of capital flows to the region resulted to currency devaluations. The devaluations caused the size of external debt, measured in terms of domestic currency, to suddenly balloon. The inability of private sector borrowers to service foreign currency debts, which resulted in widespread financial distress and even bankruptcies, contributed to the decision of Thailand, Indonesia, and South Korea to seek financial support from the IMF and other multilateral financial institutions.[191]

Finally, the CPEC power plants may increase Pakistan's sovereign debt by increasing the circular debt in Pakistan's power sector. Electricity generated by new power plants—regardless of whether they are part of CPEC—is likely to increase circular debt if the percentage of transmission and distribution losses remain constant and electricity consumption and bills increase.[192] When circular debt among power sector stakeholders becomes unsustainable, the government steps in to either repay the growing debts of the sector or engages in government borrowing to reduce the debts (or both). For example, the government of former prime minister Nawaz Sharif paid off cleared circular debt of $4.8 billion after coming to power in June 2013.[193] More recently, in March 2019, the government of Prime Minister Imran Khan raised $1.44 billion from Islamic banks to reduce circular debt.[194]

Deliberate Debt Trap Unlikely

It seems unlikely that Chinese banks and firms are developing power plants in Pakistan for the purpose of trapping the country in debt. After all, as some analysts have noted, there is no evidence that Beijing has such a strategy.[195] Moreover, several features of the China-Pakistan relationship, the stake the Chinese government and companies have in sustainable CPEC projects, and the involvement of non-Chinese firms and banks in some of the CPEC power projects suggest that these projects are not part of a Chinese plan to generate problematic increases in Pakistan's sovereign debt.

First, an attempt by China to intentionally weaken Pakistan's economy would risk undermining the broader China-Pakistan relationship. Leaders from both countries speak of the bilateral relationship in glowing terms, characterizing it as "higher than the Himalayas, deeper than the ocean and sweeter than the sweetest honey."[196] According to Andrew Small, an expert on China-Pakistan relations at the German Marshall Fund, the bilateral relationship is supported by favorable views of China across the political system and with the general public. Indeed, a poll conducted by the Pew Research Center in 2015 found that Pakistan had the most favorable views of China (besides China itself) out of 40 countries surveyed, with 82 percent of Pakistanis surveyed holding a favorable opinion of China.[197] If Pakistan's political elites and population were to perceive China as intentionally seeking to harm Pakistan's economy, this perception would likely undercut public support for a strong relationship with China and make the Pakistani government less responsive to Chinese interests.[198]

Second, saddling Islamabad with an unsustainable debt burden runs counter to Beijing's interest in a more prosperous and stable Pakistan.[199] The Chinese government likely regards greater economic prosperity in Pakistan as benefiting China by enabling Pakistan to more effectively address challenges to China's security from inside and outside of Pakistan's borders. Beijing is concerned about Pakistan's role as a hub for growing militance in South Asia, which creates an enabling environment for extremist groups, including ones that have threatened China.[200] There is a sense in China that a stronger economy could ease such threats by generating more resources for law and order and creating more employment opportunities.[201] Similarly, a more prosperous and stable Pakistan enhances its ability to serve as a counterweight to India.[202]

Third, deep ties between the Chinese and Pakistani militaries make it unlikely that China would have to resort to using debt as a source of leverage to pressure Pakistan to grant China's navy greater access to Pakistani ports or establish a base. After all, military relations are the core of the bilateral relationship.[203] China has been Pakistan's only reliable weapons supplier and has helped Pakistan develop ballistic missiles and nuclear weapons.[204] Moreover, China's navy already has access to Karachi, which it visited 10 times between 2008 and 2017.[205]

Fourth, China's support for the IMF's latest program for Pakistan is another indicator that Beijing is not deliberately seeking to create a problematic increase in Pakistan's debt. China is the largest contributor to the $17.5 billion that the IMF program has mobilized from key bilateral partners and multilateral development banks for the first 12 months of the 39-month bailout package providing $6.3 billion.[206] It is IMF staff and management that have the

most leverage over Pakistan because they set Pakistan's borrowing ceilings and targets for budgetary and monetary policy.[207] Moreover, China has agreed to ensure that any new financing it provides to Pakistan is consistent with the debt sustainability objectives of the IMF program.[208]

Fifth, if the CPEC power projects were to push Pakistan into a debt crisis, such an outcome would likely tarnish the image of the BRI, an outcome China's government wants to avoid. Beijing's release of a debt sustainability framework for BRI projects at the Belt and Road Forum in April 2019 reflects both concern in Beijing about the "debt trap diplomacy" narrative and an effort to support sustainable projects.[209] To be sure, one of the reasons Beijing published the framework is to rebuff international criticism of Chinese lending practices.[210] However, the development of the framework, which the ministry of finance says is based on the IMF/World Bank debt sustainability framework for low-income countries, appears to reflect an effort to understand and promote debt sustainability.[211] According to Christine Lagarde, the IMF worked with the Chinese "for weeks and weeks…to explain how debt sustainability matters."[212]

In addition, the Chinese companies developing the CPEC power sector projects are probably aware that the sustainability of these projects may have implications for their ability to expand into other overseas markets. For example, Shanghai Electric, which is involved in the construction of a mine mouth power plant in Thar Block I, stated in a filing with the Hong Kong Stock Exchange that "being the Company's first general contracting project on coal-fired supercritical units in the international market, this would lay the foundation for the Company to explore its overseas market on supercritical coal-fired power generation equipment."[213] Similarly, PowerChina apparently intends for the Sahiwal coal power plant to help it attract additional business abroad. According to a Chinese energy industry publication, the PowerChina employees who built the plant maintain that "the quality of overseas projects is the best international business card."[214]

Sixth, the participation of non-Chinese entities in CPEC power projects suggests that other actors expect these projects to be sustainable. For example, the World Bank's International Finance Corporation (IFC) owns a 15 percent stake in China Three Gorges South Asia Investment Corporation (CSAIL), whose subsidiaries developed three wind farms in Pakistan. Another CSAIL subsidiary is developing the Karot hydropower project. The IFC also provided $100 million in debt financing to support the development of Karot.[215] Meanwhile, the United Kingdom's Oracle Power is involved in another CPEC project, the development of a surface mine and a 1,320 MW mine mouth power plant in the Thar Desert.[216] Qatar's Al Mirqab Capital is a sponsor of the Port Qasim coal-fired power plant.[217] Saudi Arabia's Al Jomaih Group is a sponsor of the Suki Kinari hydropower project.[218]

Numerous Pakistani firms are also involved in CPEC power projects. The Hub Power Company Limited, for example, is invested in three CPEC power plants (Hub, TEL, and Thalnova) and the Sindh Engro Coal Mining Company (SECMC), a Pakistan-China joint venture, which is developing a coal mine in Thar Block II as part of CPEC.[219] Habib Bank, Pakistan's largest bank, has provided equity and debt financing for the development of a coal mine by SECMC and an associated power plant in Thar Block II.[220]

It is probably safe to say that these companies would not purposely invest in unsustainable power plants. This is especially true for the IFC, a global development institution with a mission to help the private sector end extreme poverty and boost prosperity.[221] The IFC is supporting the Karot Hydropower Project to end Pakistan's power shortage and improve the sustainability of Pakistan's power sector.[222] Similarly, shareholders of Oracle, which is listed on the London Stock Exchange, and the Hub Power Company Limited, which is listed on the Pakistan Stock Exchange, probably expect their companies to make investments that generate positive returns.

"Debt Trap Diplomacy": Who is Trapping Who?

Much of the commentary on the debt traps of China's Belt and Road Initiative focuses on the risks to host countries that borrow money from Chinese financial institutions to finance the development of infrastructure projects. Analysts have warned that if these projects prove to be economically unviable, the borrowing country may be forced to sell strategic assets to Chinese buyers to repay their debts or find themselves subject to Chinese influence.

However, Yasheng Huang of MIT argues that China may also find itself "trapped" by unsustainable infrastructure projects financed by Chinese banks. He notes that China may fall victim to the "obsolescent bargaining model," which holds that a foreign investor loses bargaining power as its invests more in a host country.[223]

Pakistan may serve as a cautionary tale of the risks Chinese firms face as they deepen their involvement in BRI countries with challenging economic environments. Islamabad's failure to make good on its promise to insulate Chinese power companies from circular debt is a case in point. Pakistani government officials agreed to set up a revolving fun to ensure uninterrupted payments to CPEC power plants for electricity.[224] Chinese power companies and government officials regarded the fund as a key measure for mitigating the risk of producing power in Pakistan.[225] However, the fund has yet to be established. In December 2018, officials with Pakistan's Central Power Purchasing Agency (CPPA) said the agency had no money to establish the fund while the Ministry of Finance also refused to contribute to the fund.[226]

As a result, the Chinese companies that operate the Sahiwal and Port Qasim coal power plants are exposed to circular debt. In April 2018, Pakistani press reported that the Sahiwal plant, the first generating unit of which came online in May 2017, had "neared the brink of closure" because the government had yet to pay it US$ 172 million for power purchases.[227] In May 2019, roughly one year after the Port Qasim coal power plant started commercial operations on April 25, 2018, the CPPA owed the Chinese-Qatari joint venture that operates the plant, Port Qasim Electric Power Company (PQEPC), more than $150 million in late payments for electricity.[228] The company's CEO, Shen Yuming, told the Pakistani media in May 2019 that the delayed payments were a daily problem for the company: "We are trying our best to generate more power and get more tariff payment timely as you know this is a power plant, we have to import coal from the international market, also we have to repay debt to the financing banks."[229]

Although the government of Pakistan issued a sovereign guarantee to support the CPPA's payment obligations to PQEPC, history shows that getting the government of Pakistan to honor its obligations under the sovereign guarantee may be easier said than done. Power producers in Pakistan have invoked sovereign guarantees to collect recover unpaid bills at least four times in the 2010s, with Islamabad defaulting in 2012.[230]

CONCLUSION

The dominance of coal in the CPEC power generation mix reflects not only a "push" from China but also a strong "pull" from Pakistan. Nawaz Sharif's election as prime minister on a platform to end energy electricity shortages in the same year that Xi Jinping unveiled the BRI laid the groundwork for China's emergence as a major financier of coal power plants in Pakistan. Sharif's objective of ending Pakistan's electricity crisis before he stood for reelection in 2018 and to prioritize the use of domestic coal in a bid to decrease generation costs and conserve foreign exchange dovetailed with China's search for overseas markets in which to export excess coal power generation equipment and the ability of Chinese power companies and financial institutions to quickly execute projects.

The large amount of coal-fired generation capacity being developed under CPEC underscores the importance of host country preferences in determining the environmental sustainability of the BRI. Many analyses of China's export of coal power plants tend to focus more on the factors driving China to sell coal power generation technology and equipment than on the factors pushing host countries to buy them.[231] In the case of Pakistan, Chinese officials and executives had an eager customer; Pakistan had been waiting for decades for foreign investors to provide the capital and know-how to develop the vast coal resources in the Thar Desert as a fuel for power generation. Consequently, it is not just China but also host countries that will determine how green the BRI will be.

That said, China is certainly in a position to do more to influence the decisions other countries make about what kinds of generation projects to build. While China can't force other countries to buy power generation equipment they do not want, China does have the experience and the money to encourage host countries to move toward cleaner power generation mixes. China has done a remarkable job of expanding the role of renewables—and shrinking the role of coal—in its own electricity mix. As a result, Chinese firms have considerable expertise in installing and commencing operation of wind and solar plants that could be shared with Pakistan and other countries less familiar with renewable energy. An issue to watch is whether Beijing will become more comfortable in shaping the environmental preferences of other countries to conform with its emphasis on green development as an important component of the BRI.

It seems unlikely that China's financing for the CPEC power projects is part of a deliberate strategy to create debt problems in Pakistan in order to gain control of strategic assets or influence over decision-making in Islamabad. Indeed, the economic and strategic interests of the Chinese government are arguably better served by the development of sustainable infrastructure projects that support the growth of Pakistan's economy. That said, there are risks that the CPEC power projects may add to Islamabad's debt burden because of the sovereign guarantees issued by the government of Pakistan to support the projects and the ongoing buildup of circular debt in the country's power sector.

The CPEC power plants also demonstrate that it is not just host countries but also Chinese companies that may suffer adverse consequences from financing economically unviable

infrastructure projects. It appears that one of the main reasons Chinese firms were willing to do what many other foreign investors were not—develop a large number of power plants in Pakistan—is because the government of Pakistan committed to establishing a revolving fund to ensure uninterrupted payments to Chinese power producers. The fund has not been established, probably due to Pakistan's precarious financial situation, and Chinese power producers are not being paid on time, making it difficult for them to purchase coal and repay debt.

APPENDIX A: SOURCES FOR TABLE 5. GENERATION TECHNOLOGIES OF CPEC COAL POWER PLANTS

Port Qasim Coal Power Project

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APPENDIX B: SOURCES FOR TABLE 6. DEBT FINANCING ARRANGEMENTS FOR SELECT CPEC POWER PROJECTS

Port Qasim Coal Power Plant

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