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SUPPLY AND DEMAND FOR CLEAN POWER IN THE BELT AND ROAD: COMPARING THE POLITICAL ECONOMY OF PAKISTAN AND INDONESIA

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EXECUTIVE SUMMARY

The rapid growth of China's overseas electricity investment under the Belt and Road Initiative (BRI) has profound impacts on the local development of recipient countries as well as global climate change. On the one hand, as the BRI focuses on infrastructure investment across the Global South, China's electricity projects are expected to play a vital role in promoting the socioeconomic development of many developing countries. On the other hand, since Chinese electricity financing and investments remain concentrated in coal-fired power plants, the global expansion of these projects undermines efforts to mitigate against climate change. However, President Xi Jinping's announcement in September 2021 that China would halt building new coal plants abroad, among other announcements, indicates that the government will now take more measures to "green" the BRI.

Understanding the energy mix in China's electricity projects under the Belt and Road Initiative is critical to have a better sense of what comes next in the economic development of the Global South and the future of climate change. This report seeks to explore what factors lead to more or less green outcomes in Chinese-backed power plants under the BRI. In particular, we aim to answer the following questions:

- Why do Chinese actors engage in the renewable energy sector in some BRI countries instead of others?
- Why are Chinese-backed coal-fired projects cleaner in some countries more than others?

Key Findings

A review of Chinese investments in the Indonesian and Pakistani power sectors reveals two striking differences: (1) Chinese actors are involved in building renewable power generation in Pakistan, but not Indonesia, and (2) Chinese-backed coal-fired projects in Pakistan are cleaner than in Indonesia.

What are the causes of these dissimilarities? We find that variations along three dimensions – scope, governance regime, and issue linkage – have led to different energy mixes in Chinese-invested power plants in the two countries. "Scope" refers to whether vested interests in coal in the BRI recipient country can influence the formulation and implementation of the country's electricity projects. "Governance regime" indicates the degree to which the regulatory system governing a BRI country's Chinese-backed project is institutionalized. An institutionalized

governance regime entails significant transnational coordination between regulators in China and host countries, which can create conditions for better enforcement of environmental standards. "Issue linkage" means there is potential for the host country to link its renewable energy goals to China's own foreign policy goals.

Both the scope and issue linkage mechanisms help us understand variations in the overseas expansion of Chinese renewable energy firms. In the case of Indonesia, the limited engagement of Chinese renewable power generators is largely a result of two factors: the political clout of Indonesia's coal interests, and a lack of alignment between Chinese renewable energy expansion and the geopolitical objectives of the Chinese state in Indonesia. By contrast, Chinese companies actively participate in Pakistan's renewable development for two reasons. Chinese renewable energy developers do not encounter policy barriers erected by Pakistan's domestic coal producers and Beijing's interest in enhancing its political influence in Pakistan results in support for solar and wind power projects.

The institutionalized governance mechanism, in turn, helps explain cross-country differences in adopting environmentally friendly technologies among Chinese-backed coal-fired power plants. In Indonesia, coal-fired power plants use less expensive but environmentally damaging technologies because the regulatory system lacks sufficient administrative capacity to monitor and enforce environmental standards. On the other hand, Chinese developers in Pakistan are inclined to employ more environmentally friendly technologies because they face more effective supervision by a transnational governance regime established by Beijing and Islamabad. This regime also facilitates the adoption of more efficient technologies as it reduces transactions costs associated with large-scale cross-border electricity investments.

Recommendations:

The 2021 announcement that China will stop financing coal plants abroad represents a major step forward in aligning the BRI to global climate objectives. But when the priority of greening the BRI is achieved, new, harder policy challenges will arise. How will existing coal capacity be phased down and then out? When will new investments in oil and gas facilities stop? How can renewables be accelerated to compensate for the transition away from fossil fuels? How will EU and US-led infrastructure programs interact with the BRI? These questions will likely dominate the next phase of "greening BRI." The findings of the report suggest that it may be harder to shift BRI toward phasing out existing coal infrastructure, or stopping new investments in oil and gas, as

these objectives do not align to the commercial needs of Chinese financial institutions or the country's foreign policy objectives. The findings also suggest that greater institutionalization may help deliver greater investments in renewables.

1. INTRODUCTION

The world will need trillions of dollars of investment in clean power over the coming decades to achieve its global climate goals.[1] China's Belt and Road Initiative (BRI) has the potential to make an enormous contribution to this transition, but to date BRI support has flowed primarily to fossil fuels not renewable energy. However, in September 2021 President Xi Jinping announced at the UN General Assembly that China would no longer finance coal abroad, a significant step toward "greening" the BRI. This shift comes alongside new pledges by China to expand renewable energy abroad, new coal phaseout announcements in a number of BRI countries (e.g. Vietnam, Indonesia, Egypt) and calls from developing countries for greater assistance in phasing out fossil fuels. At the same time, both the United States (Build Back Better World) and the EU (Global Gateway) have announced ambitious plans to support green, high quality infrastructure in developing countries. To understand what comes next, it is important to understand what factors lead to more or less green outcomes in BRI projects. This report examines the political economy of both "supply" and "demand" factors for clean energy, as well as their interaction, to help policymakers, civil society groups, and researchers better understand the conditions under which clean energy is more or less likely to emerge.

1.1 Why BRI Matters for Global Climate Outcomes

The BRI is designed to build infrastructure across Eurasia, Africa, and Latin America through coordinated policymaking with Chinese companies and financiers. BRI was officially launched by Chinese president Xi Jinping in 2013 and is widely viewed as his signature initiative regarding China's foreign policy. BRI is important for the development of energy sectors in the Global South as China has become one of the largest financiers of energy projects globally. Between 2007 and 2016, China's two major policy banks, the Chinese Development Bank (CDB) and the Chinese Export-Import Bank (EXIM),[2] financed a total of $196.7 billion in overseas energy sector loans.[3]

[1] IEA, 2021, World Energy Outlook 2021, IEA, Paris, accessed from https://www.iea.org/reports/world-energy-outlook-2021
[2] The two policy banks serve as key suppliers of China's official development finance (ODF). For a detailed discussion of the role played by CDB, CHEXIM, and ODF in China's global economic engagement, see Hale, Liu, and Urpelainen (2020).
[3] Gallagher et al., 2018, p.315.

This amounted to as much as all the energy finance of major Western-backed multilateral development banks combined.

BRI has profound implications on climate outcomes because most of its energy financing and investments across 56 BRI countries remains focused on fossil fuels. Between 2014-2017, more than 60% of CDB and EXIM's energy loans flowed into fossil fuels. 72% of energy-sector syndicated loans issued by Chinese policy banks and the four largest state-owned commercial banks went into in fossil fuels. The Silk Road Fund, which is a state-owned financial institution designated to sponsor BRI projects, made 93 percent of its energy-sector investments in fossil fuels.[4] Within the electric sector, Chinese overseas investments tend to concentrate in coal-fired power plants. Between 2000 and 2018, 45% of China's official development finance (ODF) for the power sector went to coal-fired power plants. In contrast, during the same period renewable energy projects only accounted for 2.6 percent of ODF provided by CDB and EXIM.[5]

As a result, Chinese outward investments in the electric power sector under the BRI have undermined efforts to mitigate global climate change. According to Boston University's Global Development Policy Center, "fossil fuel power plants with Chinese overseas investment and finance are currently leading to approximately 314 million tons (Mt) of CO2 emissions per year, nearly 3.5 percent of the annual CO2 emission from the global power sector outside of China."[6] Likewise, according to Tsinghua University, "business as usual" development in BRI countries will put their 2050 emissions two times above the level needed to limit climate change to 2°C, even if the rest of the world follows a 2°C pathway.[7]

Given the importance of China's overseas electricity projects on climate outcomes, it is crucial to understand the energy mix in China's electricity projects under the Belt and Road Initiative. We aim to answer the following questions from a framework that examines both supply and demand factors and their interaction: What are the factors that affect the energy mix of Chinese-backed power plants under the BRI?

- Why do Chinese actors engage in the renewable energy sector in some BRI countries instead of others?
- Why are Chinese-backed coal-fired projects cleaner in some countries more than others?

[4] Zhou et al., 2018.
[5] Kong and Gallagher, 2020, pp.2-3.
[6] Ma, 2020, p.6.
[7] Ma and Simon, 2019, p.4.

1.2 The Relations with Our Previous Report

Before laying out our analytic framework to answer these questions, we want to first discuss how the current policy report is related to our previous report – "Belt And Road Decision-Making In China and Recipient Countries: How and To What Extent Does Sustainability Matter?" (hereinafter referred to as Hale, Liu, and Urpelainen (2020)). Our previous report depicts the key actors in both China and recipient countries and the associated process of decision-making with regard to BRI projects. It shows that the initiative is not systematized or institutionalized. Rather, it is an overarching "campaign" style directive that sits atop, and is largely continuous with, China's wide range of previous overseas investment activities. Because there is no single model or system covering all Chinese overseas projects, understanding BRI projects requires understanding the bottom-up process through which various stakeholders affect the project formation and implementation in recipient countries. These stakeholders seek to operationalize the broad BRI objectives in ways that advance their own goals and thus lead to significant heterogeneity across different countries and sectors.

While Hale, Liu, and Urpelainen (2020) provide a first cut at the BRI as a whole, this report extends the analysis by zooming in a particular industry – the electricity sector—and in two major recipient countries. Our disaggregated approach is in line with Hale, Liu, and Urpelainen (2020)'s suggestion to take BRI's heterogeneity into account. But unlike the previous report, which emphasized decision-making on the Chinese side, we now focus on two major BRI recipient countries – Indonesia and Pakistan.

1.3 Methodology

Indonesia and Pakistan serve as the main basis of our investigation for several reasons. First, they are two of the top three countries in terms of the power generation capacity built with Chinese investment and finance (Ma, 2020, p.8). Second, Pakistan's case allows us to see how supply and demand factors interact in a country where China's geopolitical interests dominate. By contrast, the case of Indonesia illustrates a more conventional BRI context in which commercial interests play a primary role in determining the energy mix of BRI projects. Third, understanding the development of the power sector in these two countries has significant policy implications for global de-carbonization given both Indonesia and Pakistan are among the most populous nations in the world.

Methodologically, the similarities between Indonesia and Pakistan allow us to conduct a comparative study. The two countries share a set of characteristics including religion, regime type, and central-local relations[8] (Lieven, 2012; Aspinall, 2013; Davidson, 2015). Despite these cultural and institutional similarities, the two countries exhibit stark differences with regard to how Chinese actors engage in their power sectors.

For our study, we employ a mixed method design that uses both quantitative and qualitative data. Between 2019-2021, we used a snowball technique to conduct dozens of in-person and teleconference interviews with power sector stakeholders in China, Indonesia, and Pakistan. Our interview subjects include international and local NGOs, government officials, researchers from think tanks and institutes, journalists, and managers from Chinese policy banks and power companies (see Appendix A). In addition, we compiled a dataset on power plants in Indonesia and Pakistan. The data was compiled from the Global Energy Monitor, AidData, Water & Power Development Authority, and was further crosschecked with websites of regulators and major electricity companies, Chinese, Bahasa, English, and Urdu media articles, and CSIS's Reconnecting Asia Data map (see Appendix B and C). The dataset is available from Harvard Dataverse.[9]

1.4 Our Analytical Framework

We deploy a theoretical framework that views the formation and implementation of Chinese electricity projects under the BRI as a result of both supply and demand factors and their interaction. For supply factors, this report unpacks preferences of the Chinese state, project developers (electricity corporations), and financial institutions inside China. For demand factors, we examine how economic and political dynamics within BRI recipient countries shape the demand for Chinese-backed power plants, including preferences of the host country's central government, local governments, regulatory agencies, and domestic business consortia.

On the supply side, China's outward electricity investment can be attributed to two reasons. First, they may simply serve the commercial interests of Chinese business groups or secondly, these projects are promoted by the Chinese state to achieve its geopolitical goals despite the associated costs and financial risks. For those projects motived by economic considerations, Chinese

[8] Both of them have a highly decentralized democratic system that is largely based on patronage.
[9] The link to access the data is following: https://doi.org/10.7910/DVN/WYGSPW

electricity corporations and financiers prefer certain energy projects based on profitability, bankability risks, and technology barriers. Under this circumstance, factors such as the investment climate (e.g., GDP per capita), pricing policy (e.g., feed-in-tariff), and natural resource endowment constitute a crucial component of the cost-benefit calculation for Chinese investors. On the other hand, Chinese companies and banks have greater incentives to invest in BRI electricity projects when they are in concert with the strategic interests of the Chinese government even if it incurs losses for Chinese developers. Chinese government officials may directly encourage such investments in strategically important countries, or companies may put them forward voluntarily in order to demonstrate alignment to state priorities.

On the demand side, the interactions between private interests, ideas, and institutions determine the energy mix of Chinese-backed power plants in a specific BRI country. We can categorize these complex interactive processes into two types of demand factors: political and economic factors. Although the two are highly correlated, it is analytically useful to conceptualize them in separate categories. With regard to political factors, for BRI countries with powerful electricity incumbents and entrenched vested interests in coal, it is politically challenging to mobilize policy support for renewable power projects. For instance, if a state-owned monopolistic utility dominates a BRI country's electric system, this highly centralized institutional arrangement is more likely to hinder the market entry of foreign renewable companies. On the other hand, when a BRI country relies on coal imports for fueling its power plants, concerns about domestic energy security may make them more likely to seek China's assistance with the development of renewable energy. In terms of economic factors, relative costs of renewables and perceived electricity growth exert considerable influence over the way key actors of the recipient country's policy community interact with Chinese actors. More specifically, natural resource endowment (e.g., coal deposits and renewable energy potential), fluctuation of the global fossil fuels market, and rate of domestic demand for power collectively affect whether the development of RE (renewable energy) will be regarded as a policy priority.

Our report utilizes this supply-and-demand framework to explain observed cross-country variations in Chinese-backed renewable power in Indonesia and Pakistan. On the demand side, political clout of entrenched coal interests creates considerable barriers for the market entry of Chinese RE corporations in Indonesia. On the other hand, Islamabad's concerns about coal imports, the lack of powerful coal incumbents, and a supportive institutional arrangement facilitate the involvement of Chinese RE companies. On the supply side, Chinese corporations and

financial institutions are driven by commercial motives and mainly care about profitability and bankability risks. However, Chinese suppliers are reluctant to develop renewable projects in Indonesia due to the hurdles with existing coal interests. In contrast, China decided to meet the demands of Pakistan in developing the latter's RE sector largely out of the former's strategic interests. China's top leadership mobilized major Chinese state-owned enterprises (SOEs) to finance and construct seven renewable power plants as a part of the China–Pakistan Economic Corridor.

These cross-country differences, however, cannot be fully explained by supply and demand factors. In particular, we find that the degree of institutionalization of BRI processes in each country significantly affects the environmental consequences of Chinese-backed power plants. The degree of institutionalization of BRI processes is an interactive dynamic between regulators from BRI recipient countries and Chinese actors. When the BRI processes in a recipient country are more institutionalized, we are more likely to witness that BRI projects are better monitored by local regulatory agencies and environmental standards are more effectively enforced on the ground. In contrast, when the BRI processes are less institutionalized, the management of cross-border investments is poorly coordinated between the Chinese and local regulators. Therefore, a less institutionalized governance system results in lower levels of transnational monitoring and project developers are less inclined to adhere to environmental standards as these rules are deficiently enforced.

The degree of institutionalization of BRI processes explains some of the cross-country differences between Indonesia and Pakistan in adopting environmentally friendly technologies. In Indonesia, Chinese built coal-fired power plants can use less expensive but environmentally damaging technologies because the transnational regulatory system is less institutionalized and lacks sufficient capacity to monitor and enforce environmental standards. In Pakistan, Chinese developers are more inclined to employ environmentally friendly technologies because they are facing more stringent supervision by a transnational governance regime. This regime also facilitates the adoption of more efficient technologies as it reduces transactions costs associated with large-scale cross-border electricity investments.

1.5 Roadmap

In the second section of this report, we examine the political economy of China's power sector to reveal how the dynamics inside the country's electric system affect overseas electricity investment.

In particular, this section illustrates the reasons why Chinese electricity corporations suffer from overcapacity, which leads them to pursue international expansion. This section discusses supply factors, which are equally applicable to Chinese electricity investments in Indonesia and Pakistan. We address supply-side factors that are specific to BRI recipients in both third and fourth sections.

In the third section, we present an in-depth statistical portrait of Chinese electricity investment in Indonesia based on newly gathered project-level data. To account for demand factors inside Indonesia, we describe key actors, institutions, and major characteristics of the country's electric system. Following our analytic framework, we then show how the interaction between both supply and demand factors results in China's electricity projects being fashioned in a particular configuration. After that, two project-level case studies serve as specific demonstrative evidence for our arguments.

The fourth section is a similar investigation of Chinese-backed power plants in Pakistan. After presenting statistics on China's electricity projects in Pakistan, we sketch out key actors, institutions, and characteristics of the country's electric sector as a description of demand-side factors. Then, we articulate how both supply and demand factors, especially the interaction between them, lead to a distinct profile of China's electricity projects in Pakistan. Again, two project-level case studies exemplify how power plants under the BRI are proposed and implemented on the ground.

In the conclusion, we discuss policy implications of our key findings.

2. THE POLITICAL ECONOMY OF CHINA'S ELECTRIC POWER SECTOR

Despite China's electric power sector having achieved impressive progress in the last several decades, the whole sector still suffers from substantial inefficiencies, including excess cost, underutilization of high-efficiency generators and transmission capacity, and high curtailment rates of renewable energies. A political economy analysis reveals that institutional factors are the primary cause of these interrelated problems. First, China's electricity system involves coordination and cooperation across a variety of stakeholders – central-level bureaucratic agencies, generating and grid management companies, and local governments (Zhang, 2015). Given the highly fragmented bureaucratic system, policy formulation and implementation are susceptible to constant negotiations (Liou and Tsai, 2020). Second, the fragileness of this governance structure is exacerbated by the absence of an independent regulator. Since the 1980s,

several rounds of reforms in China's electricity system have failed to establish an independent regulator that can exert effective authority over the power sector (Tsai, 2014; Lin and Purra, 2019). Finally, the domestic electricity industry is characterized by a state-permeated market, and that creates several distortions. Most importantly, these institutional factors also explain the problem of overcapacity, which is crucial to understand the recent global expansion of China's electricity industry.

2.1 Vulnerabilities in China's Power Sector

According to the calculations of Rawski (2019), China's electricity industry is characterized by excess cost. Although the Chinese power sector enjoys "multiple cost advantages over U.S. electric utilities" with a vast supply of lost-cost labor and land (Rawski, 2019, p.304), electricity prices between the two countries are quite similar. However, higher prices do not lead to more profits for Chinese power providers. Between 2005 and 2016, the average profit margins – the ratio of profits to annual sales – of U.S. electric utilities exceeded those of their Chinese counterparts by 40% (Rawski, 2019, p.332). If we use ROA – the ratio of annual pre-tax profits to total assets – as an alternative measure of profitability, U.S. utilities exceed their Chinese counterparts by over 70% (Rawski, 2019, p.332). With regard to central state-owned enterprises (SOEs) that are directly under the purview of the State-owned Assets Supervisory and Administration Commission, electric firms also lag behind their domestic SOE peers in other industries in terms of the ROA (Rawski, 2019, p.337). This surprisingly dismal financial performance of China's electric firms is a result of the excess costs of producing and transmitting electricity in China. Rawski (2019, p.343)'s review of the years 2005 - 2016 shows that 30% is "a plausible lower bound estimate of excess costs in China's electricity industry."

In addition to the issue of excess cost, China's electricity industry also suffers from underutilization of high-efficiency generators and transmission capacity. The power grid is in charge of a crucial part of the electricity system – the "dispatch" of electricity production quotas to various generators. Given the continual ebb and flow of electricity demand across time and space, the grid company has to assign "annual, monthly, daily, hourly, and even minute-by-minute delivery quotas to individual power plants" (Rawski, 2019, p.337). For modern power grids, the operators of the dispatch function tend to follow a "merit order" which prioritizes plants with lower marginal costs (Davidson, 2019, p.143). However, Chinese grid management companies depart from this common practice and embrace a more politicized approach. They are inclined to adopt an "equal shares" dispatch that assigns quotas proportionally to all power

stations. As a consequence, many advanced power plants with larger capacity have been dispatched less than their smaller and less efficient counterparts (Davidson, 2019, pp.144-145). Because of this "equal shares" dispatch, many Ultra Supercritical (USC) and Supercritical (SC) coal-fired power plants are operating "at less than their rated output" (Davidson, 2019, p.149). Consequently, low-loadings render these plants unable to deliver their full efficiencies. In addition, without an integrated nation-wide market, regional and provincial subsidies of the two major grid management companies – State Grid and Southern Grid – are responsible for balancing the supply and demand of electricity within their own jurisdictions. Political considerations, including local protectionism, significantly affect the way different regional grids bargain with each other for inter-regional transmission contracts. The uneven spatial distribution of natural resources – coal, wind, solar, and hydro – and economic activities further aggravate the issue of cross-regional coordination. Rigid, long-term inter-regional contracts make local grid companies unable to adjust swiftly based on shifting shortages and surplus conditions. In short, high transaction costs between different regional grids result in inefficient transmission line utilization (Davidson, 2019, pp. 145-147).

Curtailment has been another problem that plagues both solar photovoltaic (PV) and wind power generation in China. Although the country has witnessed an explosive growth of renewable energy in last ten years, many newly built solar PV stations and wind farms cannot connect to the grid. As a result, a substantial proportion of installed renewable energy power capacity is wasted. The issue of curtailment is much worse in China than other developed countries. For instance, the solar curtailment rate in China was about 20% in 2016 while only around 1% in German (Liu and Xu, 2018, p.853). Likewise, the average wind curtailment rate was consistently higher than 10% in China in many years. In contrast, the rate was less than 2% in Italy around the same time (Qi, et al., 2019, p.1364). The curtailment problem is especially striking in regions that are with abundant solar and wind resources. For example, in 2016, wind curtailment rates were as high as 40% in Gansu and Xinjiang (Qi, et al., 2019, p.1364). The power sector bears considerable financial burdens from curtailment. China's wind curtailment resulted in "a loss of 49.7 million MWh in 2016", which was "equivalent to nearly 75% of total solar power generation in China that year" (Zhu, et al., 2019, p.200).

2.2 Institutional Originals of the Weakness of China's Electricity Industry

To understand the weak performance outcomes of China's electric system, we need to investigate the ways in which various actors in the power sector are shaped by the broader institutional

environment. We can divide these actors into four groups – central-level regulatory agencies, local governments, power generators, and power grid companies.

Turf wars between different central-level regulators, and substantial *de facto* discretion of policy implementation enjoyed by local governments lead to a highly fragmented governance system. This disintegrated structure obstructs fundamental reforms that are necessary to correct the problems afflicting China's power sector. Moreover, the fragmentation of the administrative institution results in the absence of an independent regulator, which makes the whole regulatory system particularly susceptible to the capture of various vested interests. Finally, as the domestic market is controlled by a small number of central SOEs, it is not surprising to observe inefficiency and distortions given the statist nature of this oligopoly market.

I.Central-level Regulators

At the level of the central government there are various regulators that are competing for rule ownership and the control of policy formulation for the power sector. The regulatory system of the power sector has experienced several waves of institutional reforms since the 1980s (Andrews-Speed, 2012). After the disbandment of former State Electricity Regulatory Commission (SERC) in 2013 (Tsai, 2014), there are four major players in the field of the electric regulation at the central level in Beijing: National Development and Reform Commission (NDRC), National Energy Administration (NEA), Ministry of Environmental Protection (MEP), and State-owned Assets Supervision and Administration Commission (SASAC). Constant conflicts between these bureaucratic actors lead to a poorly coordinated regulatory governance regime. As a result of these discords, the national planning for the electricity sector was absent between 2005 and 2015 (Zhang, 2019, p.165).

NDRC is a dominant player among these regulatory agencies. As the key manager of national macroeconomic policies, the NDRC is in charge of pricing and investment project approval. For example, instead of using a market-based tariff system for electricity pricing, the NDRC employs a "cost repayment plus return" model to set on-grid tariffs that allow "the recovery of investment costs and the earning of reasonable profits" (Zhang, 2015, 487). NDRC's control of the two crucial policy areas gives the agency significant advantages over other bureaucratic actors. For example, although the NEA opposed the adoption of a fixed solar feed-in-tariff (FIT), the NDRC was able to implement this policy in 2011 anyway (Liu and Xu, 2018, pp.858-859). Since 2015 the NDRC has begun to carry out a set of reforms to liberalize the on-grid tariffs and retail prices for

industrial users (Lei et la., 2018; Zhang, 2019). However, these reforms are not always durable or successful. For example, the NDRC first decentralized the right of approving construction of power plants to local governments and but recentralized the approval process later (Alkon and Wong, 2020).

In theory, the NEA is responsible for coordination of energy-related issues and stipulation of development plans for the energy industry. For example, "the NEA's Renewable Energy Department is the direct regulator that oversees all wind and solar investment activities across the country" (Shen, 2017, p.90). However, compared with the NDRC, the NEA lacks the control over pricing to enforce mandates on the electric system. In fact, "its multitasking – including international energy policy advisory and scientific cooperation – diluted the commitment to domestic regulation and reform implementation" (Lin and Purra, 2019, p.407) Furthermore, the NEA is ranked as a vice-ministerial unit and many central SOEs are also at the same administrative rank. Consequently, the former cannot exert regulatory authority over the latter (Liou and Tsai, 2020, 165). Lastly, the NEA has only a five hundred person staff, which prevents effective monitoring and oversight of the power sector given the latter has millions of employees (Liou and Tsai, 2020, 165).

The MEP plays an increasingly important role in regulating China's electricity sector. The ministry is responsible for conducting Environmental Impact Assessments (EIA) for power plants, which is now a prerequisite for project construction approval (Alkon and Wong, 2020). With this power, the MEP can exert substantial influence on the process of decision-making for both coal-fired and renewable power plants. Moreover, since the 2008 Super Ministry Reform, the MEP has enjoyed more authority over national-level decision-making. MEP can participate in the State Council's annual meeting and bring environmental considerations into the formulation of the National Economic and Social Development Plan, or the Five-Year Plan (FYP) (Qiu and Li, 2009). The FYP has been a crucial policy tool for the Chinese government to carry out environmental regulations, especially emission control and energy savings since 2006 (Wong and Karplus, 2017). From the Twelfth FYP (2011-2015), the Chinese government has further incorporated a binding target to reduce CO_2 intensity (Zhang, 2017, p.754).

Local environmental protection bureaus (EPBs) are key actors who are directly responsible for implementing pollution control targets, enforcing pollution law, and reporting environmental data on the ground. In theory, EPBs at the provincial, city, district, and county level are responsive to two leaders. The first is the higher levels of the environmental protection apparatuses, and the

second is the local governments in which the EPBs reside. However, despite its nominal authority, the MEP does not exert a strong *de facto* control over local EPBs. Subnational EPBs receive most of their funding from local governments (Jahiel, 1998). This financial dependence on local governments makes subnational environmental regulators extremely vulnerable to regulatory capture by local governments. As a result, the implementation of various regulations directed by the MEP is severely hampered by so-called "local protectionism." After an administrative reform in 2018, MEP was reorganized as the Ministry of Ecology and Environment (MEE). The new MEE is much larger than its predecessor in terms of the number of personnel and has been "given increased authority over policies touching on climate change, previously the purview of the National Development and Reform Commission" (Kostka and Zhang, 2018, p.772).

Since the SASAC is the administrative agency charged with supervising SOEs, it is a crucial part of the regulatory regime of China's power sector. Seven SOEs – five power generating companies and two power grid companies – constitute the backbone of the country's electricity system. In 2010, the five generating companies – known as the Big Five – took control of half of the electricity market (Zhang, 2015, p.486). The dominance of the Big Five persists today. The two grid companies "owned over 90 percent of the total transmission and distribution assets" (Zhang, 2015, p.482). By appointing and evaluating the top SOE managers, the SASAC can exert considerable influence over the operation of the electricity industry. Before 2009, when Li Rongrong was the head of the SASAC, the evaluation system of SOEs emphasized "the total profit and the rate of return to net assets", which is strongly correlated with the size of sales or market share expansion (Liou and Tsai, 2017, pp.1070-1071). After 2009, the SASAC changed its evaluation criteria and began to emphasize profitability rather than market share. However, total capacity and electricity generation remain more important than profitability when it comes to the assessment of top managers of electric companies (Davidson, 2019, p.141). Therefore, it is not surprising that SOEs have a strong incentive to pursue capacity expansions and strive to accomplish targets set up by the SASAC.

II.Local Governments

For local governments, the key incentives for them lie in achieving two goals: increasing fiscal revenue and getting promoted. The chance of promotion is further dependent on local economic growth and social stability. These incentives play a driving force in how local officials make decisions regarding the electricity sector within their judications. Electricity shortages, which

were a pervasive problem before the early 2000s (Rawski, 2019, p.314, Figure 8.1), hurt local economic development and both fiscal revenue, thus affecting the career prospects of local leaders. As a result, local governments have strong incentives to promote large-scale investments in the power sector. In addition, the power sector employs numerous workers making continuous expansion of the industry crucial for creating more jobs and maintaining social stability.

The incentives for local governments also explain why local officials tend to favor investments in fossil fuels over renewables. Because of preferential treatment policies, "renewable energy generators can deduct half of their value-added tax and are exempted from corporate tax the first three years and at half-rate for the subsequent three years" (Davidson, 2019, p.142). Therefore, tax revenues from coal-fired power plants are much higher than those from renewable power stations (Zhao et al., 2013). For those coal-abundant regions, taxes from the coal industry constitute a pillar of local fiscal revenues. When coal prices kept increasing during the first decade of the century, local governments actively approved the exploitation of new coal mine sites and stubbornly resisted shutdown directives issued by the central government. When coal prices plummeted from 2014 on, the increasing spread between coal cost and electricity prices gave local governments stronger incentives to approve new thermal plants given that "up to 47 percent of generation capacity was owned by local administrations and affiliated entities" (Nahm, 2020, p.14). Furthermore, local governments also have stronger incentives to protect coal-fired power plants out of concerns for social stability. As the coal industry witnessed a reduction of more than 1.5 million workers between 2016 and 2018 (Shen and Xie, 2018, p.416), local officials aimed to make this transition smoother to avoid social turmoil that would adversely affect their career prospects.

On the other hand, local governments can play an important role in the development of renewable energy when it's consistent with their own incentives. For example, solar PV and wind industries are viewed as significant contributors to local employment and tax revenue for provinces endowed with rich renewable energy resources (Harrison and Kostka, 2014; Hochstetler and Kostka, 2015). Consequently, local governments in these provinces leverage their political clout to lobby the central government to promulgate generous subsidies for local PV and wind stations. For example, a recent study showed that top leaders from Qinghai province actively lobbied the central administrator – NDRC – for announcing a favorable FIT policy for electricity generated from solar PV plants in the province (Liu and Xu, 2018, pp.860-861). However, since local officials major incentives to support renewable energy investments lie in their career development and

rent-reeking opportunities, their impulse to expand wind and solar capacity inevitably distorts the electricity market. In particular, local officials are motived to prioritize generation capacity without ensuring a grid connection (Cao et al., 2016). Because local officials ignore the grid-connection issue and recklessly pursue expansions of generation capacity, curtailment becomes a severe problem and results in rampant deficiencies for renewable energy power plant projects. Although "wind curtailment rate higher than 20% would definitely lead to profit loss" (Zhu et al., 2019, 201), the rate was much higher than 20% in provinces such as Gansu, Xinjiang, and Inner Mongolia in 2016 (Cai and Aoyama, 2018, p.72, Figure 1). Note that these provinces that are afflicted curtailment issues are regions with rich renewable energy resources.

III.State-owned Generator Enterprises

The third group of pivotal stakeholders in China's power sector is the electricity generating SOEs. With the exception of solar (Brandt and Wang, 2019, p.375), SOEs play a predominant role across the coal, wind, and nuclear sectors. For instance, in the wind energy sector, "by 2010 more than 90 percent of the market was captured by domestic firms that were usually SOEs, or SOEs with controlling interests in JVs with foreign firms" (Brandt and Wang, 2019, p.375). In 2014, the top ten wind farm investors accounted for 72% of overall wind generation capacity and a majority of them were SOEs (Shen, 2017, pp.89-90). The dominance of SOEs in the power sector is associated with two general features of the electric system.

First, SOEs are driven by an impulse to expand capacity without consideration of profitability. Since SOEs have to bear policy burdens like excess employment, the government has to compensate for these policy-induced losses. However, information asymmetries prevent the government from being able to differentiate policy-related losses *from* business losses caused by poor management (Li, et al., 2009). Therefore, SOE managers are mainly evaluated by the extent to which they can accomplish *production targets* assigned by upper-level administrators. In China's power sector, as Davidson (2019, p.141) notes, "state-owned generation firms are also willing to continue to invest beyond what is privately optimal because of a stronger focus on total capacity and generation rather than profit when conducting internal assessments." Hence, the issue of overcapacity has been a recurring problem that central-level regulators have to address (Shen and Xie, 2018, pp.412-413). In addition, SOEs can continually access massive bank credits and loans even if they suffer from economic losses because the state needs to maintain these loss-making firms for social stability reasons (Kornai, 1992). Consequently, with massive state-backed

capital at their disposal, the managers of SOEs face fewer financial constraints to pursue reckless capacity expansions.

Second, SOEs are plagued by excess employment. The Chinese government deploys SOEs as a policy instrument to provide employment opportunities and thus reaps the political support of SOE employees and preempts social disturbance (Lin et al., 1998; Lin and Tan, 1999). This non-profit-seeking goal makes SOEs bear "social burdens" to maintain overstaffed employment. To put it in perspective, in 2011, China's power sector generated 15% more electricity than its US counterpart while the former "employed more than 6.5 times as many workers" (Rawski, 2019, p.347). Not surprisingly, excess employment undermines productivity growth and erodes the sector's learning capacity – namely, the reduction of production cost with cumulative installed capacity. Brandt and Wang (2019, pp.409-410) find that the learning rate of China's solar sector, which is largely composed of private firms, are five times higher than that of the SOE-dominated wind sector.

IV.Power Grid Companies

Two central SEOs are responsible for the operation of China's power grids - the State Grid Corporation of China (SGCC) and the China Southern Power Grid Corporation. Of the two, SGCC is larger and more important. In fact, it's the largest utility company in the world and "its services cover 88 percent of the country's territory" (Xu, 2017, p.28). By employing over 900,000 workers, SGCC is also one of the largest SOEs in China (Leutert, 2020). It also enjoys a considerable degree of autonomy because of its monopolistic position, information advantages, and technological expertise (Xu, 2017). The substantial discretion enjoyed by grid companies can be observed by the formulation of China's national grid planning. According to Qi et al. (2019, p.479), "from 2006 to 2015, the two large GridCOs made their own five-year grid plans separately, while NEA did not issue any unified national grid plan." Moreover, as Cai and Aoyama (2018, pp.76-77) indicate, "Grid companies have rarely been subject to penalty for evading the mandates of grid connection and integration of renewable energy, in part because the penalties for non-compliance are unspecified, and rarely imposed in reality." One illustrative example is that grid companies declined to provide detailed cost information to the then power sector regulator – the State Electricity Regulatory Commission (Rawski, 2019, p.351). The relatively autonomous role of grid companies is further strengthened by their political clout. These companies have been serving as the power base for Chinese elite families for a long time (Chen, 2010), and thus they can leverage their political connections to effectively protect their sectoral interests.

Given that renewable energy is more intermittent and volatile, Chinese grid companies are less inclined to connect electricity generated by solar PV stations and wind farms. With their political clout, grid companies can effectively resist directives from the central regulators like the NEA that prioritize the dispatch and transmission of renewables. In 2015, even after the NEA issued mandatory purchase requirements for renewables, grid companies had not been fined despite their pervasive non-compliant behavior (Davidson, 2019, p.150).

2.3 The Problem of Overcapacity and Chinese Outward Power Investments

As indicated above, the statist nature of China's electricity system encourages reckless expansion of generation capacity as it serves the interests of local governments and state-owned generators. This problem becomes more serious when the two gigantic state-owned grid companies are not able or willing to connect the excess electricity. The whole situation persists since a highly fragmented administrative structure prevents the emergence of an independent regulator and the implementation of systematic reforms.

As a consequence, China's power sector epitomizes the problem of overcapacity that afflicts the country's industry, especially the capital-intensive heavy industry. Between 2001 and 2011, China's average industrial capacity utilization (ICU) was merely around 69.3%, which lagged far behind both Germany (83.4%) and United States (76.5%). In 2018, although the ICU improved to 76.5%, the number was still much lower than other export-oriented industrialized East Asian countries like Japan (105.2%) and South Korea (102.5%) (Lai, 2021, p.7, Table 1).

The problem of overcapacity is present in both coal-fired power and renewables. Furthermore, overcapacity is inevitably associated with lower profitability and more incurred losses. Feng et al. (2018) estimate that China's excess capacity of coal power could reach around 210-260 GW in 2020 while "the total installed electricity generation capacity in Canada is 140 GW" (Kong and Gallagher, 2019, p.12). For coal-fired power plants, the average operation hours dropped from 5021 in 2017 to 4216 in 2018. Therefore, coal power industry suffered a significant loss with this enormous excess generation capacity (Kong and Gallagher, 2019, p.12). Similarly, between 2005 and 2013, China's total installed renewable energy capacity tripled. However, the renewable energy industry suffers a huge financial loss as national wind and solar energy curtailment rates are exceptionally high compared with developed countries (Qi et al, 2019, p.478, Figure 2; Liu and Xu, 2018).

As the domestic electricity market is under great strains, Chinese power generating corporations have a strong impulse to expand overseas. Put differently, domestic overcapacity constitutes the major driver of the globalization of China's power sector (Kong and Gallagher, 2019, pp.15-16). In fact, a set of government documents issued by the central government explicitly stated the linkages between concerns about domestic excess capacity and the usage of Chinese policy banks to facilitate the global expansion of the country's electric firms (Kong and Gallagher, 2019, p.15; Lai, 2020, p.9). A recent quantitative study of China's outbound energy finance to developing countries shows that overcapacity at home is a strong determinant of Chinese development finance whereas this factor does not affect Chinese foreign direct investment (Li et al., 2022, Table 1 and 2). Development finance refers to credits and loans provide by policy banks to recipient governments to build power projects. Although China's policy banks "do not directly own the projects nor are they involved in the development of the power projects" (Li et al., 2022, p.3), these projects usually are required to import equipment, labor, and engineering services from Chinese electric firms. By contrast, for foreign direct investments, Chinese power companies "directly own part or all of a project" (Li et al., 2022, p.3). This statistical finding thus echoes the aforementioned government policy – the Chinese state employs policy banks as export credits to promote commercial interests of Chinese electric firms (Kong and Gallagher, 2017).

In summary, the statist nature of China's power sector makes electric firms have a strong impulse to pursue reckless capacity expansion. A fragmented regulatory regime renders effective governance of overcapacity futile. Consequently, both coal-fired and renewable power companies start seeking to enter overseas markets to get rid of their overcapacity problems.

3. POLITICAL ECONOMY OF CHINESE ELECTRICITY INVESTMENT IN INDONESIA

3.1 Statistics of Chinese Electricity Investment in Indonesia

Subsection 3.1 provides a comprehensive depiction of Chinese involvement in the electric power sector of Indonesia. We draw on plant-level data to describe Chinese investment and financing in Indonesia at both the macro- and micro-level. For macro-level patterns such as the energy mix of Chinese-backed projects, we use aggregated data to present our findings. At the micro level, we present individual-level information on Chinese electric companies and financiers. We first identify major Chinese companies and financiers, and then rank them in terms of the electricity generation capacity of plants in which these actors have participated. This step generates a list of

the largest Chinese power companies and financiers that are involved in Indonesia's power sector. We further divide the list by technology types (i.e., coal, solar, and wind, etc.).

I.Macro-level Constellations

Before turning to micro-level patterns, we first focus on macro-level constellations. In Figure 1, we present Chinese investment and financing in Indonesia's power sector by technology mix, measured by capacity. Figure 1 clearly shows the dominance of coal-fired power regarding Chinese-backed electricity projects. It also indicates a lack of major Chinese-backed renewable power plants in Indonesia.

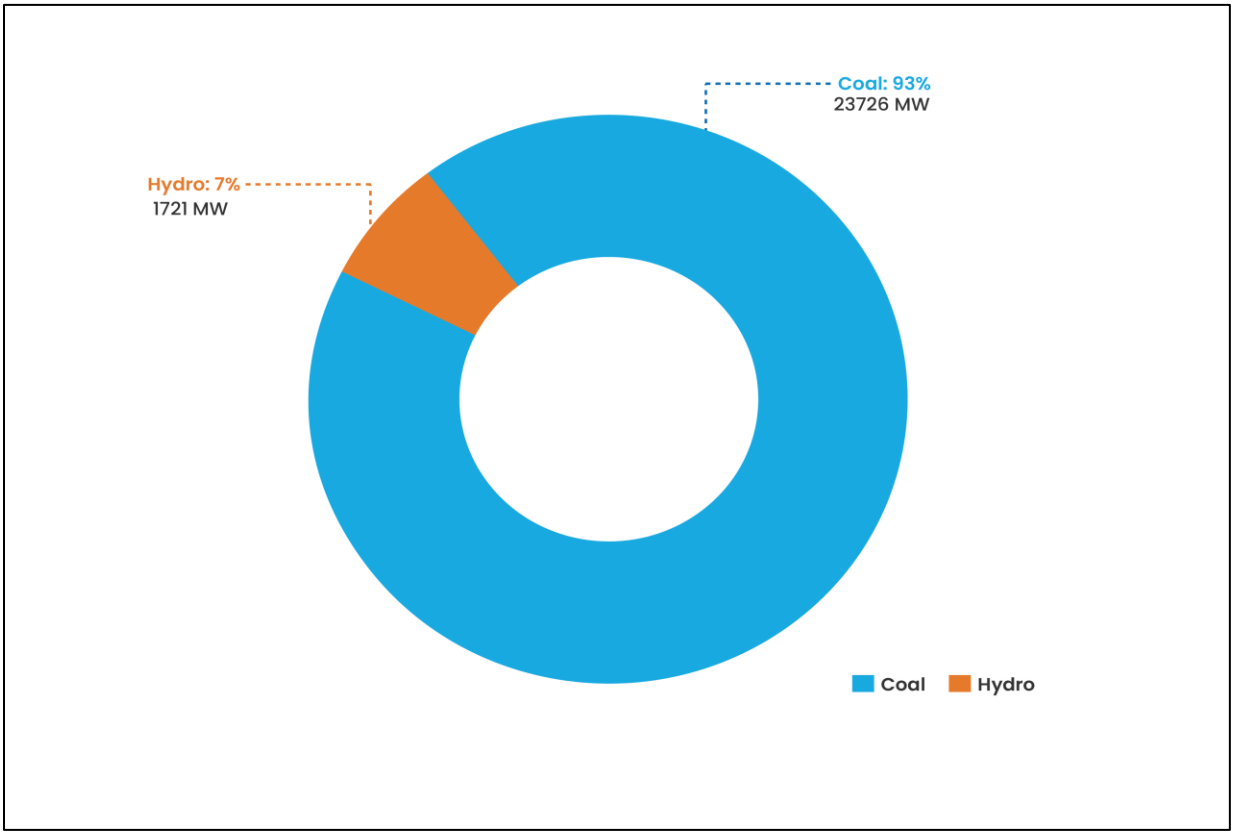

Figure 1: Technology Mix of Chinese-backed Electricity Projects in Indonesia

Moreover, China's electricity investments in Indonesia are more coal-intensive than other foreign countries. Figure 2 shows that Chinese-backed coal-fired plants account for nearly 30% of Indonesia's total coal power plants in terms of electricity generation capacity. Japanese-backed coal power plants account for 14% of Indonesia's total coal capacity, which makes it become the

second largest foreign sponsor of the country's coal power sector. Although both Japan and Korea are the main developers of coal power projects across developing countries (Xu, et al., 2020), they still lag far behind China in the Indonesia's coal power market. However, indigenous Indonesian firms contribute to nearly a half of the country's coal-fired power generation capacity, making them the largest investor of coal-fired power in Indonesia (see Figure 2).

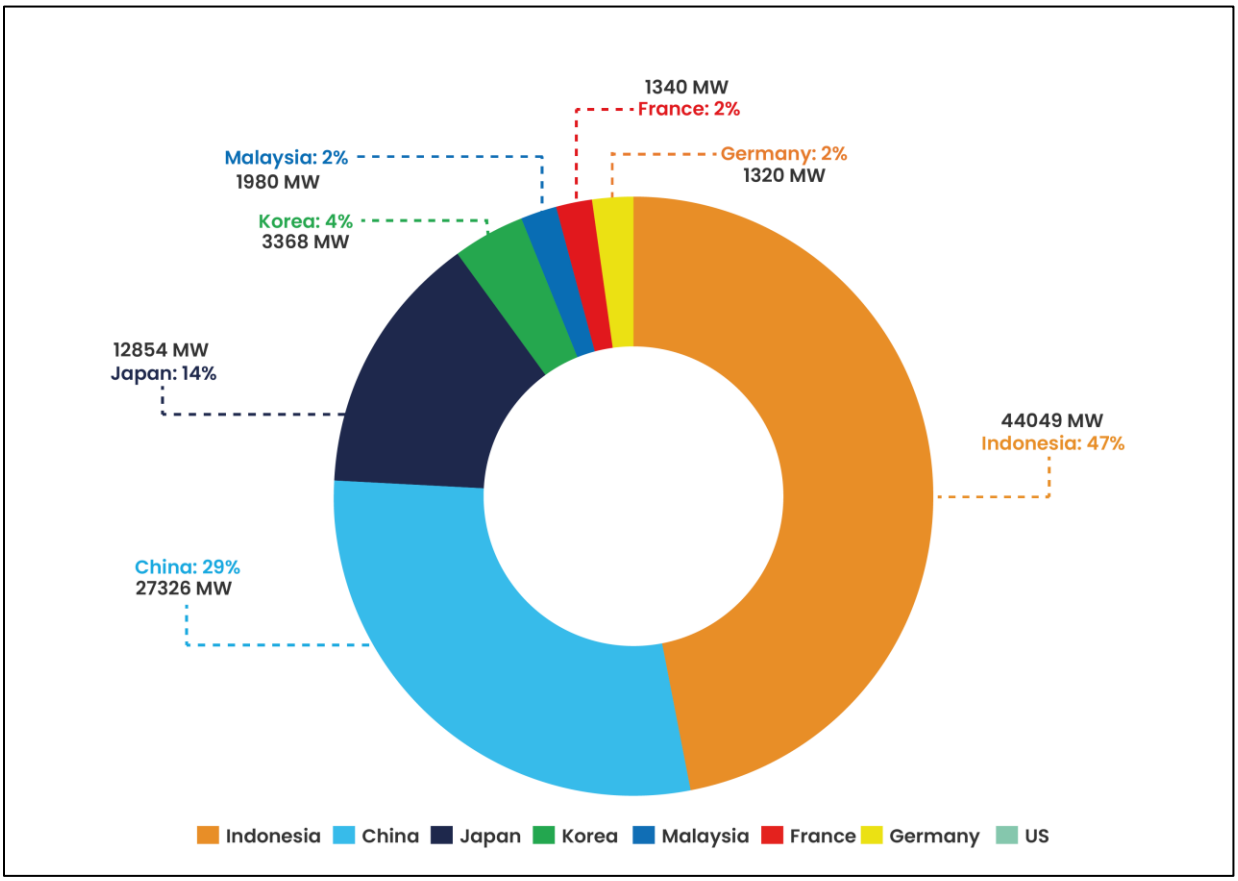

Figure 2: Nationality of Coal Power Plant Developers in Indonesia by Capacity (MW)

Figure 3 shows the technology of coal-fired plants in Indonesia.[10] According to Gallagher (2021, p.4), "Super and ultra-super-critical power plants need a lower amount of coal to generate the same account of energy compared to subcritical coal-fired power plants. Super-critical plants are

[10] The calculation is based on this source: Tritto Angela, Coal power plants in Indonesia: ownership, investments, and impacts, Harvard Dataverse, https://doi.org/10.7910/DVN/ ETNOQA

able to achieve a higher level of efficiency because their boilers operate at a higher temperature and pressure than subcritical ones." For both Japanese-backed and Korean-backed coal power plants, a majority of them are either super-critical or ultra-super-critical. In contrast, Chinese companies tend to bring lower-end of technology (i.e., subcritical power plants) to Indonesia compared to other foreign investors.

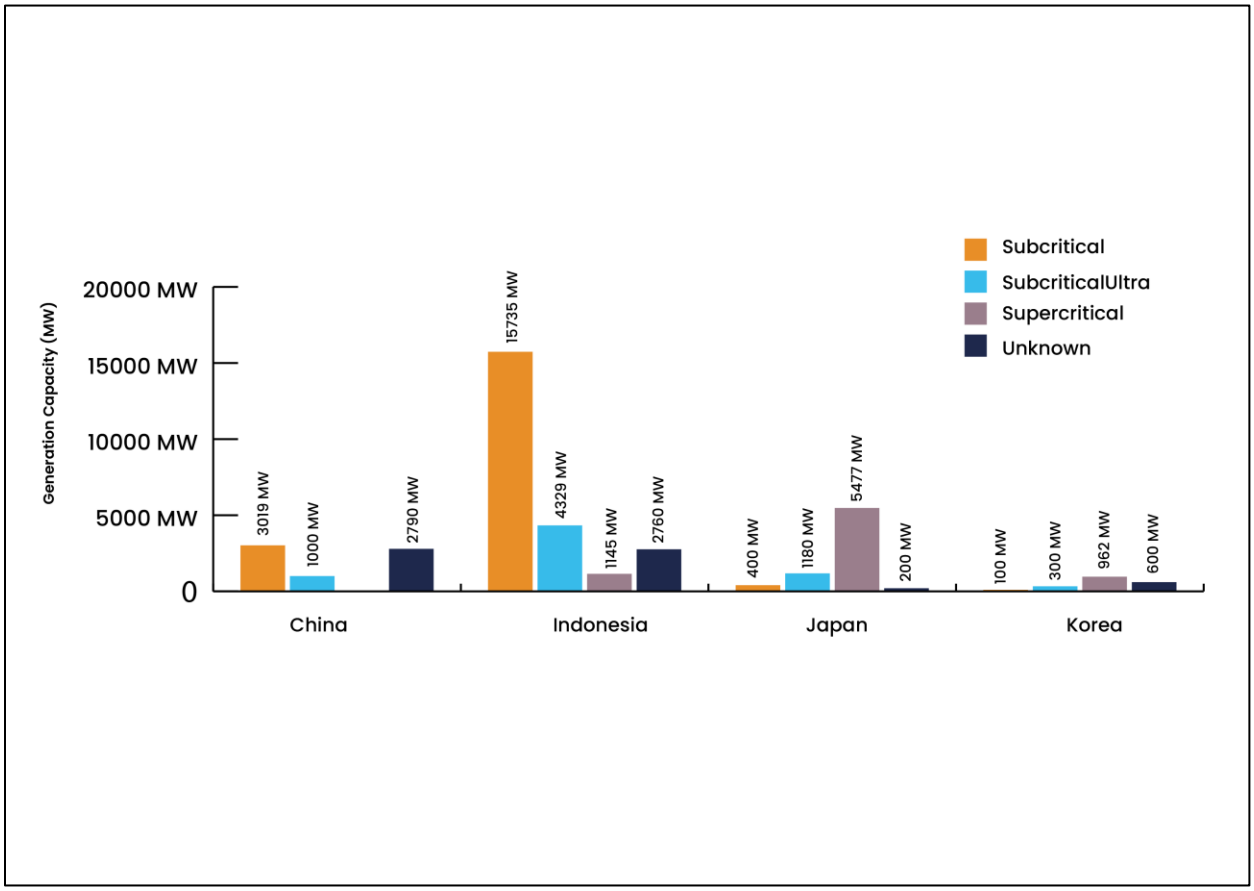

Figure 3: Technology of Coal Plants in Indonesia (2008-2018)

II.Micro-level Patterns

After a scrutiny of macro-level patterns, we now turn to micro-level variations. In Figure 4, we list the top 20 Chinese companies by generation capacity of their investment and financing in Indonesia's coal power market. Although powerful, central SOEs like Huadian and the Chinese Energy Investment Corporation are on the top of this list, private enterprises such as Jiangsu

Delong are also responsible for a substantial proportion of Chinese investment and financing in Indonesia.

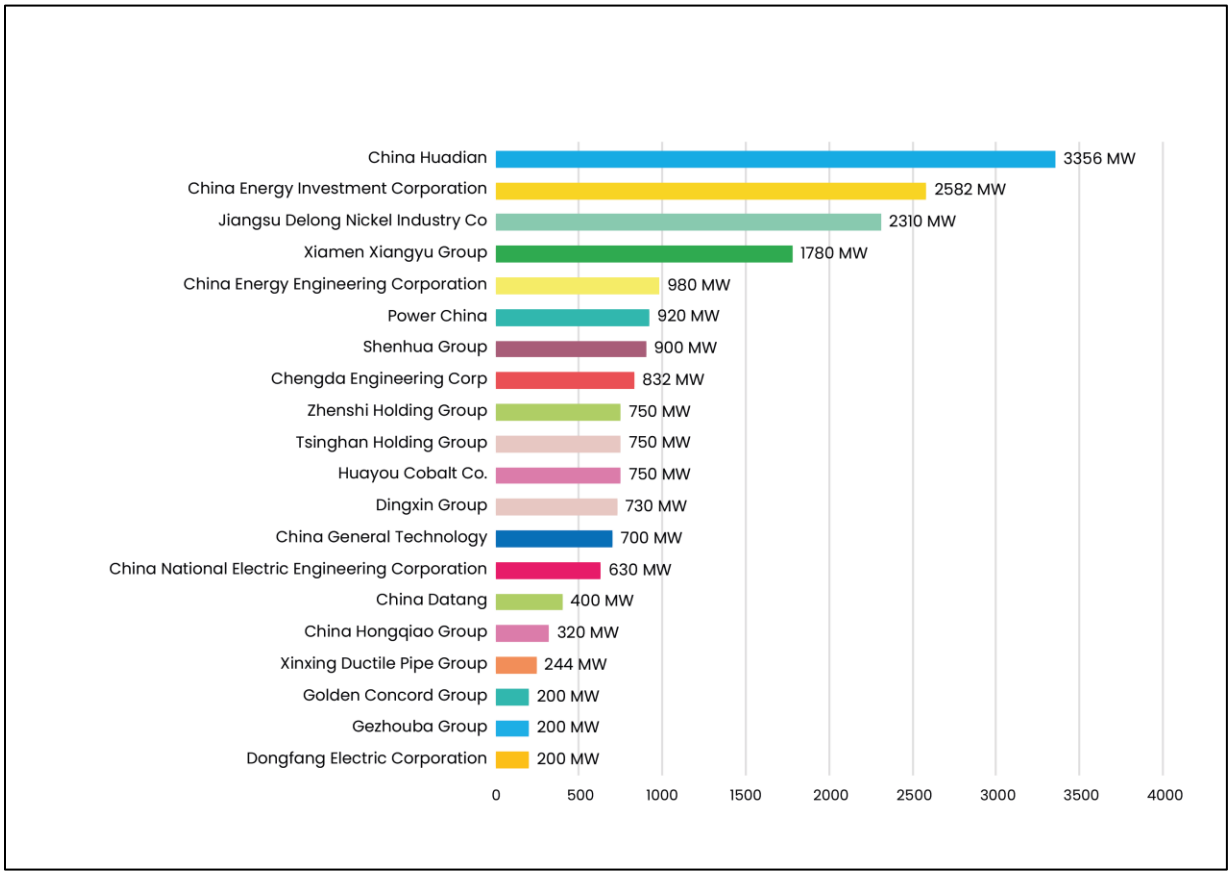

Figure 4: Top Chinese Companies in Indonesia's Coal Sector (By Capacity, MW)

Note that we use the term "investment" here to refer to foreign direct investment that takes the forms of greenfield and merger and acquisition (M&A) while using the term "financing" to mean development financing. This differentiation is crucial for a better understanding of the patterns of Chinese involvement in overseas electricity power sectors (Li et al., 2022). Regarding foreign direct investment, Chinese companies own part or all of the invested projects through their equity finance provision. By contrast, for Chinese development financing, the recipient country's government or local project developers own the power plants, Chinese companies engage in the projects as Engineering, Procurement, and Construction (EPC) contractors, and China's policy banks act as the source of financing for these power projects. An EPC contractor "will carry out the detailed engineering design of the project, procure all the equipment and material necessary,

and then construct a functioning facility or asset as specified in the EPC contract" (Wang and Li, 2019, p.2). Export credit constitutes the majority of China's official development finance (Kong and Gallagher, 2017; Chen, 2020). Here, export credit refers to "various forms of financing to facilitate and expand exports, including direct loans to foreign buyers, insurance and loan guarantees, working capital financing, and finance for large-scale infrastructure and industrial projects" (Hopewell, 2021, p.637). Host countries accept export credits provided by China's policy banks to import Chinese power equipment and engineering services to construct and operate their power plants. The forms of Chinese outbound electricity finance are associated with distinct causal mechanisms. Li et al. (2022) argue that Chinese development finance for overseas coal power is driven by the issue of overcapacity in China's domestic market. On the other hand, Chinese foreign direct investment is largely a result of a demand for new power capacity in host countries. Put differently, push factors are more important in explaining Chinese development finance whereas pull factors matter more for Chinese foreign direct investment.

Figure 5 shows the major Chinese financiers of Indonesia's coal-fired power plants. We can draw two conclusions from Figure 5. First, official development financing plays a pivotal role in the Chinese involvement in Indonesia's coal power sector. Almost half of Chinese-backed coal plants (measured by capacity) are financed only by the China Development Bank (CDB) and Export and Import Bank of China (EXIM China). This pattern is consistent with the findings by other researchers as Ma (2020, p.6) also found that policy banks serve as the largest contributor to Chinese overseas coal power generation capacity. Second, in addition to China's two policy banks, many other Chinese commercial banks finance new coal power projects in Indonesia. For instance, China's major commercial banks such as the Industrial and Commercial Bank of China and Bank of China provide bulk capital to Indonesia's coal power sector.

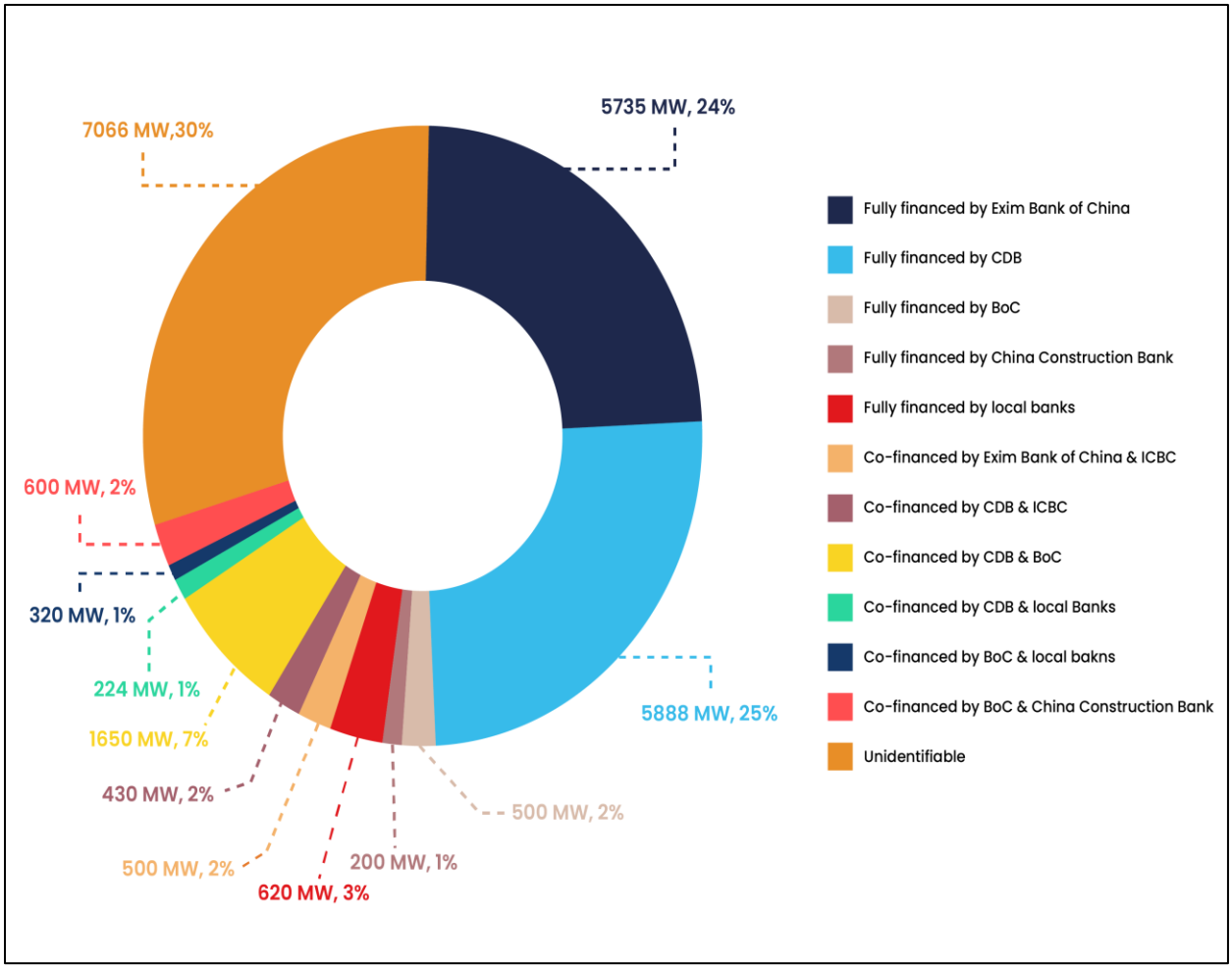

Figure 5: Financiers of Chinese Coal-fired Plants in Indonesia by Capacity (MW)

3.2 Key Actors, Institutions, and Characteristics of Indonesia's Power Sector

I.Actors and Institutions

Like Pakistan, the Indonesian government provides large subsidies to its electricity sector. In particular, the government "allocates 6-8% of Indonesia's entire annual budget outlays to electricity subsidies" (Jarvis, 2012, p.485). The subsidies, combined with fossil fuel subsidies, accounted for about 30% of total government spending in 2011 (Maulidia, et al., 2019, p.233). This policy serves as an electoral strategy that allows the Indonesian government to appeal to low-income, urban constituents and thus enhance their chance of political survival despite the fiscal burden.

The heavily subsidized electricity sector further empowers Indonesia's major electricity corporation – the Perusahaan Listrik Negara (PLN). In 2016, "PLN and its subsidies control around 79% of power generation" in Indonesia (Maulidia, et al., 2019, p.243). PLN is a state-owned enterprise (SOE) and is subject to the Ministry of State-Owned Enterprises (MSOE) rather than the Ministry of Energy and Mineral Resources (MEMR) (Maulidia, et al., 2019, p.242, Figure 12). This governance structure creates fissures between PLN and MEMR. Purportedly, MEMR is responsible for the country's energy policy and acts as the main regulator of Indonesia's energy industries. However, PLN enjoys significant *de facto* discretion over power generation, transmission, and distribution in the country (Maulidia, 2019, pp.119-149).

Given the heavily subsidized electricity price, politicians have strong electoral incentives to maintain those subsidies to gain popular support. PLN takes advantage of this opportunity and undermines the reforms that aims to dismantle PLN's monopolistic role in Indonesia's power sector. Power sector reform in the early 2000s, which was staggered by the 1997-1998 Asian Financial Crisis, included the creation of a competitive electricity market, the unbundling of PLN, and tariff reform (Jarvis, 2012, pp.483-484). Facing the threat of unbundling, PLN mobilized its labor union and other activist groups to lobby politicians against the 2002 Electricity Law – which is the hallmark of the power sector reform at the time. Because of PLN's substantial political clout and the customers' fear of rising tariffs, the Indonesian Constitution Court annulled the 2002 Electricity Law in December 2014 (Jarvis, 2012, pp.484-485).

PLN is not too keen on renewable energy development in the country. First, career incentives of PLN's top managers discourage this SOE to develop RE. Unlike MEMR, MSOE focuses on profitability rather than environmental sustainability as a key part of its criteria to evaluate the performance of PLN (Maulidia, 2019, p.134). Therefore, PLN does not prioritize the development of RE. Furthermore, PLN has a preference for large-scale infrastructure projects and is less inclined to develop small-scale RE projects (Maulidia, 2019, p.136 & p.140). PLN also prefers the extension of its grid network to off-grid renewable energy systems (Setyowati, 2020, p.8). Since developers need to get a permit from PLN for off-grid electricity generation, off-grid renewable energy developers face more entry barriers given that PLN is reluctant to give those permits (Setyowati, 2020, p.9).

Second, PLN has fewer commercial interests to promote the use of electricity generated by non-fossil-fuel energies. MEMR implemented a pro-RE policy including feed-in tariffs (FITs) regulations in 2015-2016. As a consequence, PLN had to pay higher tariffs to buy electricity

generated by REs. While the minimum FITs for solar PV and wind were USD 14.5 cents/kWh and USD 9.26 cents/kWh respectively, PLN's average generation cost was USD 6.87 cents/kWh in 2015 (Attwood et al., 2017, p.30, Table 30). In particular, "PLN's average generation cost from coal in 2014 was USD 4.10 cents/kWh" (Attwood et al., 2017, p.30). Not surprisingly, PLN preferred coal and gas-fired power plants to RE-based Independent Power Producers (IPPs). For example, in 2015, as a response to FITs for micro-hydro, "PLN openly challenged the then Ministry of Energy of not obeying the rules because the subsidy for the price gap was not provided by the government" (Maulidia, 2019, p.133).

Third, PLN's monopoly of the national power grid leads to prolonged tariff negotiations between PLN and IPPs. IPPs have no alternatives other than PLN. This dilemma deters new entrants in the market – "after almost 18 years since the first Independent Power Purchase Agreement (PPAs or IPPAs) was signed, only a few private companies have actually built power plants and supplied electricity into the grid in Indonesia" (Maulidia, et al., 2019, p.244). Because of PLN's recalcitrance, it is not surprising that many potential RE projects "have been held up for years due to difficulties in the negotiating PPAs" (Setyowati, 2020, p.7). According to Maulidia's interviews with private developers and investors in Indonesia's power sector, "the long process of PPA tariff negotiations with PLN is the biggest obstacle for RE development" (Maulidia, 2019, p.137).

In addition to PLN's monopolistic role, the country's fractured governance structure also has profound impacts on the development of Indonesia's power sector. At the level of the central government, the regulatory system of the electricity market is highly fragmented. Figure 6 visualizes how a wide array of bureaucratic agencies and PLN are related to each other in the domain of electricity governance. Take the issue of promoting RE as an example. On the one hand, the support of the MEMR is crucial for RE to thrive. On the other hand, as we have discussed above, both MOSE and PLN do not favor the development of RE (Schmidt et al., 2013). Moreover, because policy incentives to develop RE such as FITs cost the government more subsidies, the Ministry of Finance (MOF) is not a main driving force for RE. According to Attwood et al. (2017, p.32), the estimated subsidy for FITs was USD $126 million in 2015 and the cumulative subsidy between 2010 and 2015 was around USD $162 million. Therefore, whether the MEMR is supportive is pivotal for the promotion of RE. For example, "the Ministry of Energy and Mineral Resource Regulation 19/2016 introduced a Feed-in-Tariff to support the development of at least 5000 MW of solar PV powered electricity generation" (Setyowati, 2020, p.7). During 2015 - 2016, private investments in the RE thrived because of the implementation of MEMR Regulation

38/2016, which encouraged the participation of private developers in the power sector for projects located in remote, rural areas (Kennedy, 2018). However, the MEMR's new minster Ignasius Jonan, who came into power in 2016, revoked the FITs regulations implemented by the previous regime (Setyowati, 2020, p.7). Consequently, regarding Indonesia's RE projects, "foreign investors, much needed for improving Indonesia's energy supply, tend to stand back or exit from Indonesia to divert the investment to other countries deemed more favorable" (Maulidia, 2019, p.108).

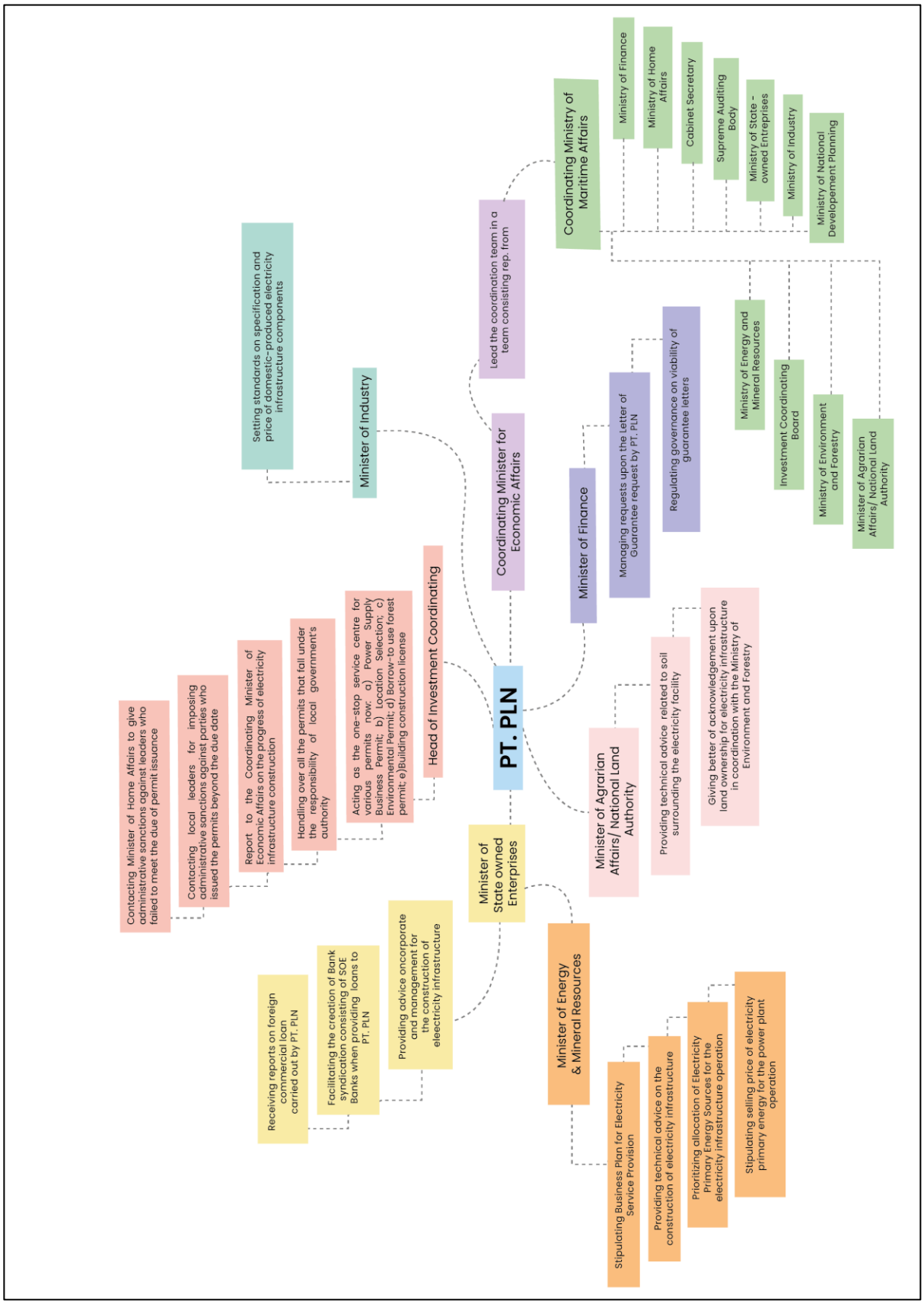
PT. PLN
Coordinating Minister for Economic Affairs
Lead the coordination team in a team consisting rep. from
Coordinating Ministry of Maritime Affairs
Ministry of Finance
Ministry of Home Affairs
Cabinet Secretary
Supreme Auditing Body
Ministry of State - owned Entreprises
Ministry of Industry
Ministry of National Developement Planning
Minister of Industry
Setting standards on specification and price of domestic-produced electricity infrastructure components
Minister of Finance
Managing requests upon the Letter of Guarantee request by PT. PLN
Regulating governance on viability of guarantee letters
Ministry of Energy and Mineral Resources
Investment Coordinating Board
Ministry of Environment and Forestry
Minister of Agrarian Affairs/ National Land Authority
Minister of Agrarian Affairs/ National Land Authority
Providing technical advice related to soil surrounding the electricity facility
Giving better of acknowledgement upon land ownership for electricity infrastructure in coordination with the Ministry of Environment and Forestry
Head of Investment Coordinating
Acting as the one-stop service centre for various permits now: a) Power Supply Business Permit; b) Location Selection; c) Environmental Permit; d) Borrow-to use forest permit; e)Building construction license
Handling over all the permits that fall under the responsibility of local government's authority
Report to the Coordinating Minister of Economic Affairs on the progress of electricity infrastructure construction
Contacting local leaders for imposing administrative sanctions against parties who issued the permits beyond the due date
Contacting Minister of Home Affairs to give administrative sanctions against leaders who failed to meet the due of permit issuance
Minister of State owned Enterprises
Providing advice oncorporate and management for the construction of eleectricity infrastructure
Facilitating the creation of Bank syndication consisting of SOE Banks when providing loans to PT. PLN
Receiving reports on foreign commercial loan carried out by PT. PLN
Minister of Energy & Mineral Resources
Stipulating Business Plan for Electricity Service Provision
Providing technical advice on the construction of electricity infrastructure
Prioritizing allocation of Electricity Primary Energy Sources for the electricity infrastructure operation
Stipulating selling price of electricity primary energy for the power plant operation

Figure 6: Electricity Governance according to Presidential Regulation 4/2016

Local governments play an important role in the implementation of energy policy. Since Indonesia has experienced a significant decentralization since the early 2000s, the construction of electricity projects in the country is subject to substantial influence from local governments. Table 1 summarizes the different roles played by central, provincial, and municipal governments regarding the management of the power sector. For instance, "district governments have been given the rights and responsibilities to issue concessions and licenses for renewable energy" (Setyowati, 2020, p.7). The support of local governments is especially significant "when public land acquisition is involved" (Marquardt, 2014, p.91). Furthermore, provincial governments are a "crucial source of data and information for potential project developers (concerning promising locations, resources, energy plans and so forth)" (Marquardt, 2016, p.161). However, according to Marquardt's interviews with experts, the district governments (*kabupatens*) are perceived as the main barrier for RE (Marquardt, 2014, p.90). This is because "they lack the capacity for and a general understanding of promoting renewables" (Marquardt, 2016, p.156). The districts' administrative power over power plant projects has been further transferred back to the provincial government since 2017. After MEMR's leadership changed in mid-2016, the role of local government is increasingly important in terms of the success of a renewable energy project. For instance, the endorsement of subnational governments is pivotal for a solar PV mini grid project in East Nusa Tenggara Province (Maulidia, 2019, pp.166-167). When local governments oppose certain renewable energy projects, it becomes much more difficult for these projects to construct and operate (Maulidia, 2019, p. 111).

Meanwhile, environmental regulations of infrastructure projects also exhibit a trend of decentralization. Based on the Law No.23 Concerning Regional Government,[11] environmental affairs are categorized as "Konkuren", which means that administrative authorities are divided between the central and regional governments. The Law No.23 clarified the division of authority over issues including reservation, infrastructure development, waste control, and environmental permits. In general, the central government controls environmental management for business activities that are cross-province or have nationally strategic importance. By contrast, provincial governments have authority over province-level environmental programs and projects with cross-

[11] Undang-undang Ri No. 23th 2014 tentang Pemerintahan Daerah, https://blogmhariyanto.blogspot.com/2015/11/pembagian-urusan-pemerintahan-konkuren.html

district impacts. For example, the national government has the authority of issuing national regulations on infrastructure resettlement, construction, and environmental impact regulations, but local governments have the power of implementation, including granting construction permits. The central government can only implement regulations for projects with national interests. For pollution control and environmental management, different levels of governments develop programs within their jurisdiction.

Note that local autonomy on environmental management has been increasingly challenged by the central government since the coming to power of the Jokowi Administration. In 2020, President Jokowi signed the "Omnibus Bills"[12] to strengthen the central government's capacity to interfere in the national economy. Under the new bill, the power of spatial planning, land & forest management, and permits for resource exploration will be concentrated in Jakarta. The central government will also be able to revoke existing local environmental regulations. This bill raised significant concerns and opposition among local officials, as it would effectively reverse the decentralization of environmental management authority since 1999. In the previous case of 2016,[13] the central government attempted to revoke more 3,000 district regulations to "remove obstacles for infrastructure development and attract more foreign investment. Most of these were investment permit regulations, and some of them related to environmental management. Local governments challenged this decision of power concentration in court and the Indonesian highest court ruled the central government's decision as unconstitutional in 2016. In 2019, President Jokowi issued a "One Data" policy[14] to assign the National Development Agency for collecting and utilizing national data. In Indonesia, both central ministries and local governments experience a serious lack of data, including data related to environmental management. This order may strengthen the central government's capacity and marginalize regional governments in environmental data access.

Table 1: Decentralizing Responsibilities on Electricity[15]

[12] ICEL in the News, 2020, Deregulation in Indonesia: Economy first, environment later. Maybe, ICEL, https://icel.or.id/en/news/icel-in-the-news/deregulation-in-indonesia-economy-first-environment-later-maybe/

[13] Ilyas Istianur Praditya, 2016, Hambat Investasi, Jokowi Minta Hapus 3.000 Perda, Liputan6, https://www.liputan6.com/bisnis/read/2418655/hambat-investasi-jokowi-minta-hapus-3000-perda

[14] ICEL in the News, 2019, Government Created A One-Data Policy, Will It Be Open To Public? , ICEL, https://icel.or.id/en/news/icel-in-the-news/government-created-a-one-data-policy-will-it-be-open-to-public/

[15] According to the Act Number 30/2009 enacted during Yudhoyono's era. Reference for English Translation https://policy.asiapacificenergy.org/sites/default/files/ELECTRICITY%20%28Law%20No.%2030%3A2009%20dated%20September%2023%2C%202009%29.pdf. Also see the Government Regulation Number 20/2014 on Electrical Power Supporting Services

Central Government	Provincial Government	Municipal Government
Setting national electricity policies	-	
Making regulations on electricity	Issuing provincial regulations on electricity	Issuing municipal regulations on electricity
Setting guidance, standards, and criteria on electricity	-	-
Issuing guidance on setting electricity prices for consumers	-	-
Making a general plan on national electricity	Making general plans for electricity at a provincial level	Making general plans for electricity at a municipal level
Setting Business area	-	-
Issuing permits for the sales and purchase of electrical power with other countries	-	-
Issuing business permits for the supply of electrical power to corporate bodies: a) whose business areas involve more than one province; b) run by a state-owned company; c) sell electrical power/ lease electricity networks to the holders of business permits engaged in the supply of electrical power set by the government	Issuing business permits for the supply of electrical power to corporate entities whose business areas involve more than one regency/municipality	Issuing business permits for the supply of electrical power to corporate entities whose business areas are located in the municipality
Issuing operation permits whose installation facilities cover more than one province	Issuing operation permits whose installation facilities cover more than one regency/municipality	Issuing operation permits whose installation facilities are located in the municipality

Setting the tariffs of electrical power for the customers of the holders of business permits engaged in the supply of electrical power set by the central government	Setting the tariffs of electrical power for the customers of the holders of business permits engaged in the supply of electrical power set by the provincial government	Setting the tariffs of electrical power for the customers of the holders of business permits engaged in the supply of electrical power set by the municipal government
Approving the selling prices of electrical power and rents of electricity networks owned by the holders of business permits engaged in the supply of electrical power set by the central government	Approving the selling prices of electrical power and rents of electricity networks owned by the holders of business permits engaged in the supply of electrical power set by the provincial government	Approving the selling prices of electrical power and rents of electricity networks owned by the holders of business permits engaged in the supply of electrical power set by the municipal government
Approving the sales of electrical power surplus from the holders of operation permits set by the central government	Approving the sales of electrical power surplus from the holders of operation permits set by the provincial government	Approving the sales of electrical power surplus from the holders of operation permits whose permits are issued by the municipal government
Issuing business permits for electrical power-supporting services conducted by a state-owned company or foreign investor/company whose majority of shares are owned by foreign investors	-	Issuing permits for electrical power-supporting services to corporate entities whose majority of shares are owned by domestic investors
Issuing permits to use electricity networks in the interests of telecommunication, multimedia, and informatics on the network owned by the holders of business permits engaged in the supply of electrical power set by the central government	Issuing permits to use electricity networks in the interests of telecommunication, multimedia, and informatics on the network owned by the holders of business permits engaged in the supply of electrical power set by the provincial government	Issuing permits to use electricity networks in the interests of telecommunication, multimedia, and informatics on the network owned by the holders of business permits engaged in the supply of electrical power set by the municipal government

Nurturing and supervising corporate entities engaged on electricity whose permits are issued by the central government	Nurturing and supervising corporate entities engaged on electricity whose permits are issued by the provincial government	Nurturing and supervising corporate entities engaged on electricity whose permits are issued by the municipal government
Appointing electricity inspectors	Appointing electricity inspectors at provincial level	Appointing electricity inspectors at municipal level
Developing the functional posts of electricity inspectors for all levels of central government	-	-
Determining administrative sanctions on corporate entities whose business permits are issued by the central government	Determining administrative sanctions on corporate entities whose business permits are issued by the provincial government	Determining administrative sanctions on corporate entities whose permits are issued by the municipal government

II. Characteristics of Indonesia's Power Sector

Vested coal interests play a prominent role in the political economy of Indonesia, including the country's electricity industry. The country is the world's largest exporter of steam coal, and Indonesian coal production experienced a significant increase between 2000 and 2016 (Cornot-Gandolphe, 2017). Figure 7 shows that coal has become the most important source for Indonesia's power sector since the late 1990s. With the explosive growth of coal mining and exporting activities, Indonesia's coal industry has been dominated by a small number of influential oligarchs (Mori, 2020, p.5). The coal industry gains considerable political power as it "is tightly connected to political elites in Indonesia, involving several big names in current national political landscape" (Arinaldo and Adiatma, 2019, p.13).

The coal industry's political clout results in a number of favorable government policies to promote the use of coal for electricity generation. For instance, in 2014, subsidies for coal production were around USD 946 million while renewables only received roughly USD 36 million (Attwood, et al.,

2017). Partly because of these massive coal subsidies, the PLN[16] had to pay higher tariffs to buy renewable-generated electricity. Since renewables are more expensive than coal power plants, PLN prioritizes the development of coal power than renewables. According to PLN's long-term plan, the coal share in Indonesia's electricity mix is expected to reach 60-65% by 2028 (Arinaldo and Adiatma, 2019, p.7).

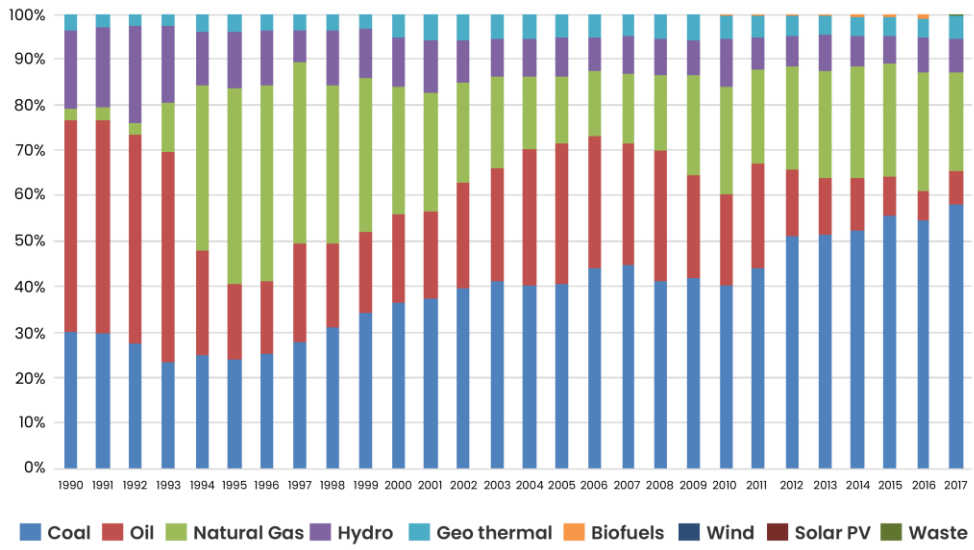

Figure 7: Technology Mix of Electricity Generation in Indonesia (1990-2017)

Although both the Indonesian government and PLN actively support the development of the country's coal industry, renewables encounter more policy hurdles in Indonesia's electricity market. In addition to providing much fewer subsidies to renewables than coal power plants, the Indonesian government also started imposing lower tariffs for RE project developers after 2016 (Halimanjaya, 2019, p.51).

[16] In 2016, "PLN and its subsidiaries control around 79% of power generation" in Indonesia (Maulidia, et al., 2019, p.243).

3.3 How Supply and Demand Factors Shape Chinese Engagement

Unlike Pakistan, the Chinese state does not view supporting China's electricity investments in Indonesia as critical its geopolitical interests. As a result, Chinese electricity companies make their decisions in Indonesia mainly out of commercial considerations. Likewise, Chinese financiers tend to finance power plants that are economically sound and are not willing to fund projects with higher business risk.

Furthermore, the governance of China-funded electricity projects in Indonesia is less institutionalized than those in Pakistan. Today, the Indonesian Coordinating Ministry for Maritime Affairs (CMMA) and other line ministries that have been discussed above concurrently manage Chinese-backed power plants. CMMA's Minister Luhut accompanied Indonesian President Widodo's in 2017 for the first Belt and Road Forum for International Cooperation in Beijing. There, Minister Luhut proposed the construction of megaprojects in North Kalimantan along with three other infrastructure proposals in Bali, North Sumatera and North Sulawesi to the Chinese audience.[17]President Widodo then appointed Minister Luhut to be the person-in-charge from Indonesia to establish a liaison team called the "Belt and Road Initiative-Global Maritime Fulcrum" (BRI-GMF) and for the Coordinating Minister for Economic Affairs, Minister of Tourism, and Minister of State-owned Enterprises to serve as Minister Luhut's vices.[18]

With regard to BRI-GMF, first, it includes both the government wing and the business wing to expedite bureaucratic approval for Chinese investments. Second, China granted Indonesia a 100-million RMB grant for setting up this task force. Third, this task force would serve a wide range of tasks from preparing necessary information for investors to addressing misperception about Chinese-backed projects among Indonesia's mass media.[19]

However, the regulation of China-funded projects by Indonesia's CMMA is less institutionalized than Joint Cooperation Committee (JCC) of the China-Pakistan Economic Corridor (CPEC) in three aspects. First, although top-level officials from *both* China and Pakistan constitute the administrative body of CPEC JCC, CMMA does not include any Chinese officials. Second, CPEC

[17] "Bertemu Presiden Xi Jinping, Presiden Jokowi Ajak Kerja Sama Bangun Proyek Infrastruktur," Sekretariat Kabinet Republik Indonesia, May 15, 2017, accessed from https://setkab.go.id/bertemu-presiden-xi-jinping-presiden-jokowi-ajak-kerja-sama-bangun-proyek-infrastruktur/

[18] "Rapat Koordinasi Program Kerja Project Management Unit (PMU) dan Belt and Road Forum (BRF)," Kementerian Koordinator Bidang Kemaritiman dan Investasi, July 22, 2017, accessed from https://maritim.go.id/rapat-koordinasi-program-kerja-pelaksanaan-project-management-unit-pmu-dan-belt-road-forum-brf/

[19] Ibid.

JCC establishes a series of specialized working committees to steer and monitor China-funded projects while CMMA is *not* solely designed for the management of Chinese-backed projects. According to Presidential Regulation Number 10/2015, CMMA is responsible for coordinating any policies on energy and mineral resources, including their implementation as well as dynamics between related government agencies. Third, whereas CPEC JCC routinizes bilateral meetings between Chinese and Pakistani stakeholders, such an institutionalized transnational channel is absent in the case of Indonesia. Consequently, Chinese and Indonesian energy officials do not meet frequently to discuss relevant issues about China's energy projects in Indonesia. For example, the MEMR only started to revitalize the Indonesia-China Energy Forum (ICEF) in 2017 after a seven-year hiatus,[20] and produced a fundamental Memorandum of Understanding (MoU) between MEMR and China's National Energy Administration to bolster bilateral cooperation.[21]

The *de facto* environmental regulation of China's electricity projects is decentralized, fragmented, and lacks transnational coordination. First, Indonesia's environmental governance regime is vertically decentralized. Since 2001, both Indonesia's Environmental Impact Assessment (EIA) system and industrial pollution control have been decentralized (Bedner, 2010, pp.43-44). With the decentralized control of AMDAL (EIA in Indonesian) and industrial pollution regulations, local governments play a pivotal role in Indonesia's environmental management (McCarthy and Zen, 2010). In many places, Chinese electricity companies act as providers of campaign funds for local Indonesian officials in exchange for local governments' approval of Chinese-backed coal power plants (Interview with a manager of an Indonesian company that provides consultancy for Chinese electricity investors, 12/27/2020). Since many provincial and district-level governments are vulnerable to the capture of Chinese coal-fired companies, they do not enforce environmental standards and ensure effective compliance of Chinese-backed projects (Interview with an Indonesian researcher, 04/07/2021). For example, nine local NGOs and international organizations submitted a file to Denpasar Administrative Court (PTUN) against the Celukan Bawang coal plant in Bali, a project invested by China Huadian Engineering. They accused the

[20] "Terhenti 7 Tahun, RI Kembali Jalin Kerja Sama Energi dengan China," *Liputan* 6, November 13, 2017.
[21] "Teken MoU, China Bakal Garap Proyek Migas Hingga Listrik di RI," *Detik Finance*, November 13, 2017. For supporting documents of the event, see https://www.esdm.go.id/assets/media/content/content-working-group-on-new-renewable-energy-and-electricity-.pdf

project of not carrying out a comprehensive AMDAL regarding its climate change impacts (Interview with an international NGO manager, 04/21/2021).[22]

Second, Indonesia's regulatory system of Chinese-backed power plants is horizontally fragmented. These plants are subject to a number of central-level Indonesian agencies, often with conflicting policy agendas. The governance regime's supervisory ability to enforce environmental sustainability is weak and ineffective. Hence, Chinese coal plants enjoy discretion to employ lower-end technology. In particular, although the Ministry of Maritime Affairs is responsible for coordinating BRI projects, PLN, as the major electricity generator and distributor, is another crucial actor in shaping the dynamics of Chinese electricity investment. PLN has strong incentives to increase profitability rather than promote environmental sustainability. This is because the Ministry of State-owned Enterprises (MSOE) supervises PLN, and MSOE overwhelmingly focuses on financial performances when it evaluates Indonesian SOEs (Maulidia, 2019, p.134). Since PLN prioritizes economic considerations, it tries to cut on costs as much as possible when building new plants. Therefore, Chinese power companies often win tenders for coal plants as they can propose low bid prices by using cheaper types of technology (Interview with a European researcher on China's electricity investment in Indonesia, 04/12/2021).[23]

Third, for Chinese-backed coal plants, the Chinese government has not tried to develop transnational supervisory mechanisms to enforce environmental standards. The regulatory effort from the Chinese side becomes critical when the host-country's governance regime is weak. However, the Chinese consortia in Indonesia rarely provide regular reports or updates about the environmental implications of their projects to Chinese regulators such as NDRC, State-owned Assets Supervision and Administration Commission, or Ministry of Ecology and Environment (Interview with an officer of Asian Development Bank, 12/22/2020. Unlike Pakistan, environmental performances of Chinese-backed coal plants are not under heavy scrutiny from both the Chinese and Indonesian government.

Consequently, the whole regulatory system suffers from the weak capacity to monitor Chinese-backed power plants and enforce environmental standards. As a consult, Chinese investors tend

[22] State Administrative Lawsuit on Cancellation of Bali Governor's Decree No.660.3/ 3985 / IV-A / DISPMPT About Environmental Permit Development of Steam Power Plant (PLTU) given to PT. PLTU CELUKAN BAWANG ON THE VILLAGE ON THE SUPPORT OF GEROKGAK DISTRICT, REGENCY OF BULELENG, see https://icel.or.id/wp-content/uploads/CCIA-Amicus-Kasus-No-2GLH2018PTUN.DPS-FINAL-EN-1.pdf

[23] By contrast, "Japan has to comply with the OECD regulations on export credit for coal power, restricting the exports of coal power plants to USC, regardless of less cost-competitiveness" (Personal communication with a Japanese researcher, 04/15/2021).

to favor environmentally more damaging technology (i.e., subcritical coal power plants) to save their costs and increase profitability rates.

I.How Supply and Demand Factors Shape Chinese Investment in Coal Power

As we have mentioned, Chinese investment and finance in Indonesia's electricity system is highly concentrated in coal-fired power plants. Many Chinese project developers build transnational alliances with local Indonesian business actors. Since the Indonesian government requires Indonesian coal miners to hold a minimum of 10% of the equity of power plants (Wijaya, 2021, p.13), a number of Chinese companies and Indonesian coal oligarchs create joint ventures as IPPs (Mori, 2020, p.5). These Indonesian coal oligarchs include "Bukit Asam, Sinar Mas/DSS Power, Intraco Penta (INTRA)" (Mori, 2020, p.5). For example, Bukit Asam, one of Indonesia's largest coal producers, formed a consortium with China Hudan Hong Kong Company to develop the PLTU Banko Tengah coal power project (Mori, 2018, p.183). In addition, many Chinese consortiums build joint venues with subsidiaries of PLN to enter the Indonesian electricity market (Mori, 2020, p.5). Wijaya (2021, pp.18-22) documents how Shenhua Energy Company Limited formed a transnational consortium with a subsidiary of PLN to develop the largest power plant in Java – Java 7 power plant.

Local governments in Indonesia also play an important role in the expansion of Chinese investments in coal power. In coal production provinces such as East and South Kalimantan and South Sumatra, the revenues generated by coal serve as a major source of rents for local governments (Mori, 2018, p.177). Therefore, they tend to support the construction of Chinese-backed pithead plants. Local elites in many other places also embrace China's coal power projects as these projects create a variety of benefits ranging from tax revenues to rent-seeking opportunities. For instance, Banten's local oligarchy – the Atut Dynasty – acts as the key actor in the formulation and implementation of the aforementioned Java 7 plant (Wijaya, 2021, pp.21-22).

After the issuance of a 2017 regulation, the Indonesian government requires the PLN hold the majority share in all foreign-invested electricity projects. Consequently, many Chinese financiers are reluctant to invest in coal-fired power plants in Indonesia. The reason is that the associated bankability risk increases when Chinese companies cannot control their overseas project. As a result, a number of Chinese coal-power project developers cannot find supportive financiers to sponsor these projects. Although many Chinese firms want to enter Indonesia's coal power

market, these companies face financing barriers. This policy shift is mainly driven by Indonesia's increasing resource nationalism which has a profound influence on the current Jokowi administration (Interview with a manager of an Indonesian company that provides consultancy for Chinese investors, 12/27/2020).

Despite facing the new regulation on the shareholding structure of power plants, a set of major Chinese companies like Shenhua Group/CHN ENERGY still keep actively investing in Indonesia. This is because these Chinese corporations have established a partnership with Indonesian coal miners for a long time, and thus it is commercially reasonable that their business partners - the Indonesian coal oligarchs - can use their control of local natural resources to gain the majority share of joint ventures (Interview with a manager of an Indonesian company that provides consultancy for Chinese investors, 12/27/2020). Such transnational partnerships "enable Chinese investors to protect their vested interests from policy changes as major Indonesian coal miners have acquired political power under the democratic decentralization regime" (Mori, 2018, p.183).

However, the Indonesian government still allows a variety of foreign firms to acquire a majority share of local electricity projects: these companies are often concentrated in certain extractive industries and they build instrumental coal power plants (Interview with a manager of an Indonesian company that provides consultancy for Chinese investors, 12/27/2020). As Tritto (2021, p.7) indicates, these instrumental plants are "plants that provide electricity for another investment (i.e., aluminum factory or stainless-steel production)." For example, Jiangsu Delong is a developer of one of Indonesia's largest Chinese-involved coal-fired power plants. Delong is a private Chinese company focusing on the nickel industry. Since Sulawesi has rich nickel reserves, Delong builds a mining subsidiary in the region. Because the nickel industry is highly energy-intensive and Delong cannot rely on the local electricity supply, it has built its own electricity generation capacity in Sulawesi (Interview with a journalist with extensive knowledge of Indonesia's clean energy development, 12/24/2020).

Compared with Japanese and Korean development finance institutions, Chinese policy banks take a lead in financing coal-power plants in Indonesia (Chen et al., 2000, p.497, Figure 4). According to Mori (2020, p.7), for Japanese developers, this is partly because "its declining international competitiveness in bidding for full turnkey projects that call for supply for financial capital, engineering expertise, and EPC, operation and maintenance services in a package." For Korean developers, although they are able to form joint IPPs with Indonesian oligarchs, some of their projects faced massive protests due to the poor environmental performance and thus delayed

their business operation (Mori, 2020, p.7). It is easier for Chinese SOEs to finance their overseas projects through policy banks, while Chinese private corporations suffer from significant disadvantages in financing their coal-power projects abroad (Interview with a journalist with extensive knowledge of Indonesia's clean energy development, 12/24/2020). Under this circumstance, only certain types of private companies are inclined to invest in coal-fired power plants in Indonesia. The Delong case above illustrates that those private Chinese manufacturers often have a strong motive to secure their upstream supply chains.

Finally, in Indonesia, many Chinese companies are transforming themselves from contractors of engineering, procurement, and construction (EPC) projects to developers of build-operation-transfer (BOT) projects (Mori, 2020, p.5). This transformation is a direct result of Chinese corporations' profit motive. The profitability of participating in Indonesia's EPC projects is too low because of increasing competition (Interview with a manager of an Indonesian company that provides consultancy for Chinese investors, 12/27/2020). It is worthwhile to note that for energy and infrastructure projects, the Indonesian government prefers the usage of Public-private partnership (PPP) to minimize financial risk as they do not need to issue sovereign guarantees. By contrast, Chinese investors do not like PPP given its higher uncertainties and risks (Interview with a manager of an Indonesian company that provides consultancy for Chinese investors, 12/27/2020).

II. How Supply and Demand Factors Shape Chinese Investment in Renewable Power

For Chinese investors, the development of clean energy in Indonesia suffers from unfavorable ownership and pricing policies by the Indonesian government (Interview with a journalist with extensive knowledge of Indonesia's clean energy development, 12/24/2020; Interview with a manager of an Indonesian company that provides consultancy for Chinese investors, 12/27/2020). In terms of ownership structure, MEMR's Reg. 12/2017 limits "foreign ownership to 49% for projects between 1 and 10MW" (Kennedy, 2018, p.4). The Reg.50/2017 by MEMR further requires foreign developers to "transfer ownership of the project facility to PLN upon completion of the contract" (Kennedy, 2018, p.4). This regulation discourages market entry of potential Chinese RE project developers (Interview with a journalist with extensive knowledge of Indonesia's clean energy development, 12/24/2020). Many Chinese solar companies are still waiting for possible policy changes of Indonesia's electricity regulations (Interview with a journalist with extensive knowledge of Indonesia's clean energy development, 12/24/2020;

Interview with a manager of an Indonesian company that provides consultancy for Chinese investors, 12/27/2020; Interview with an international NGO manager, 04/21/2021).

Another obstacle is the pricing of electricity generated by renewable energy. According to Reg.12/2017, "the price payable by PLN for electricity from new solar PV projects cannot exceed 85% of the existing average cost of generation on the relevant local grid" (Kennedy, 2018, p.4). This price cap is also applied to wind power although geothermal and hydropower are exceptions (Setyowati, 2020, p.7). As Setyowati (2020, p.7) indicates, "this regulation is widely regarded as discriminatory against renewable sources as non-subsidized renewable energy must compete with subsidized fossil fuel power generation." Such discriminatory regulation on renewable sources persists after Reg.12/2017 was replaced by Reg.50/2017 (Kennedy, 2018, p.4). Under this pricing framework, an inhospitable investment climate discourages the entry of Chinese RE investors. For example, largely out of concerns about ownership and pricing policies, China Huadian Corporation, one of the largest Chinese electricity generation companies, has adopted a "wait and see" strategy when it comes to renewable energy investment in Indonesia (Interview with an international NGO manager, 04/21/2021).

In terms of its natural endowments, Indonesia is not an ideal place for wind power (Interview with an officer of an international environmental NGO, 12/28/2020). All existing wind farms are in southern Sulawesi. One farm is funded by the Asian Development Bank, and the other is supported by a Singaporean SOE. The two wind farms have not yet connected to local grids (Interview with a journalist with extensive knowledge of Indonesia's clean energy development, 12/24/2020). Some Chinese investors have conducted feasibility studies of Indonesia's wind power industry, but they did not proceed with the plans of developing wind farms there. For example, a research institute affiliated with the State Power Investment Corporation carried out a feasibility study for developing wind farm projects in Indonesia, but the project plan was later shelved (Interview with a manager of an Indonesian company that provides consultancy for Chinese investors, 12/27/2020).

In contrast, many Chinese investors regard developing solar power in Indonesia as more suitable. For instance, a Chinese private company from Yangjiang, a city in China's Guangdong Province, is actively seeking to enter Indonesia's solar power sector (Interview with a journalist with extensive knowledge of Indonesia's clean energy development, 12/24/2020). However, because of Indonesia's restrictive policies on foreign electricity investment, it pushes developers to prioritize large-scale centralized generation facilities (Kennedy, 2018). This strategy allows these

RE companies to take advantage of economies of scale to reduce operation costs. For example, 10 cents/kWh is a usual tariff for a solar project to make profits in Indonesia, but a solar project in U.A.E. only receives 5.8 cent (Interview with a journalist with extensive knowledge of Indonesia's clean energy development, 12/24/2020). To make sure a project will not lose money, solar projects tend to concentrate in more industrialized regions like western Java even though solar energy is more appropriate for energy consumption in more peripheral regions. Compared to business groups in developed countries like Singapore and France that enjoy more advanced and mature technologies to develop large-scale solar plants, China's solar companies have only achieved a limited progress in Indonesia's RE market.

3.4 Project-level Case Studies

We choose the Celukan Bawang coal-fired power plant and South Sumatera coal-fired power plant – 1 for our project-level case studies. As indicated earlier, Chinese actors did not participate in Indonesia's renewable power sector between 2000 and 2020, therefore we limited our focus to coal-fired power plants. There are three reasons for choosing PLTU[24] Celukan Bawang and Sumsel-1 as our cases studies. First, the two projects differ in terms of location, participants, and contractual theme through which Chinese electricty corporations engage in the projects. This allows us to better capture the heterogeneity within Chinese investments in Indonesia's electric sector. Second, because both plants generate a significant amount of power for their regional electricity markets respectively and it makes them salient to the issue of Chinese investment in Indonesia. Third, both PLTU Celukan Bawang and Sumsel-1 have encountered a variety of controversies that are common to Chinese-backed projects. A scrutiny of the two cases thereby illustrates the typical environmental and social issues arising from Chinese-invested coal power plants. An in-depth investigation of the two electricity projects provides demonstrative evidence for how major stakeholders from China and Indonesia interplay during the BRI process, and how these interactions shape the environmental and social consequences of Chinese-backed coal-fired power plants. In particular, our research shows the importance of both PLN and local governments with regard to the formulation and implementation process of Chinese-backed electricity projects. Moreover, our case study of PLTU Celukan Bawang reveals how the strength of the governance regime strongly influences environmental outcomes of Chinese-backed plants.

3.4.1 Celukan Bawang Coal-Fired Power Plant (PLTU Celukan Bawang)

[24] Pembangkit Listrik Tenaga Uap (Indonesian: Electric Steam Power Plant).

This project-level case study first introduces basic information about PLTU Celukan Bawang, especially its context, importance, and technology. Then we describe its project life cycle and both the Chinese and Indonesian actors that have been involved in the formulation and implementation of the plant. Finally, we discuss both environmental and social consequences of PLTU Celukan Bawang on local communities.

I. Background Information

PLTU Celukan Bawang (1x380 MW) is located in Bali. Bali had experienced several waves of electricity crises in 2007,[25] 2009,[26] and 2011,[27] forcing the local tourism industry to rely on self-owned generators. Moreover, an additional demand of 112 Megawatts (MW) was also waiting in line with thousands of new customers as of early 2015.[28] To fill the gap, PT. General Energy Bali sought the help of Chinese electricity corporations to construct a 380 MW coal-fired power plant in the Northern part of Bali.

PLTU Celukan Bawang is particularly important for Bali's local economy. Despite being sixty miles away from the capital of the island, the plant is close to a port where Bali receives a majority of cruise tourists. The power plant is also close to two famous tourist spots: The West Bali National Park (32 miles to the West) and the Lovina Beach (13 miles to the East). With the generation capacity of 380 MW, PLTU Celukan Bawang serves as a leading in-house power plant and contributes to more than 25% of the total electricity supply in Bali.

PLTU Celukan Bawang is using ultra-super critical technology,[29] which requires less coal per megawatt-hour. However, the plant requires numerous partner companies from other regions to

[25] "Krisis Listrik, Hotel di Bali Gunakan Genset Bergilir," [Electricity Crisis, Hotels in Bali used generators], Detik Finance, June 21, 2007, accessed from https://bit.ly/3BSMIM5

[26] The root causes were because the interconnecting cable was hit by a lightning and the transmission also experienced disruption after facing a surge in its burden. "Transmisi Kena Petir, Bali Black Out Lima Jam," [Transmission got hit by thunder, Bali black out for five hours], Viva, June 1, 2009, accessed from https://bit.ly/3tp0vH7/. Look also: "Pemadaman Masih Ancam Bali 2010 Ini," [Black out still threatened Bali in 2010], Viva, January 29, 2010, accessed from https://bit.ly/38S1R3Y' and "Bali Krisis Listrik," [Bali Electricity Crisis], Kompas, April 8, 2010, accessed from https://bit.ly/3hdcXow

[27] "Krisis Litstrik Kembali Melanda Bali," [Electircity Crisis Hits Bali again], Tempo, March 22, 2011, accessed from https://bit.ly/3topqL2

[28] "26.800 Pelanggan Masuk Daftar Tunggu PLN Bali," [26,800 Consumers waiting in line for electricity services in Bali], Metro Bali, February 25, 2015, accessed from https://bit.ly/2WZxbuX

[29] "PLTU Celukan Bawang Bantu Atasi Krisis Listrik Bali," [PLTU Celukan Bawang addressed electricity crisis in Bali], Liputan 6, August 11, 2015, accessed from https://bit.ly/3jRzSYg

supply coal given that Bali lacks rich coal deposits. Among these coal companies are PT. Adaro Indonesia and PT. Abadi Sempurna, both of which extract coal supplies from Kalimantan.[30]

II. Project Life Cycle and Key Actors

The idea to construct PLTU Celukan Bawang emerged following the electricity crises in Bail in October 2006.[31] The Power Purchase Agreement (PPA) between PT. PLN and PT. General Energy Bali was signed during the first term of President Yudhoyono (2004-2009).[32] Then, the groundbreaking ceremony took place during Yudhoyono's second term (2009-2014).[33] The commercial operation date started a year after President Widodo came into power in 2014. Looking at the National Electricity Supply Business Plans (RUPTLs) in different years, PLTU Celukan Bawang has experienced delays at least four times in 2009, 2010, 2011, and 2013.

There are two major reasons for the delays. First, a protracted bureaucratic approval process makes it difficult to proceed with the project. Prior to the issuance of Presidential Regulation Number 4/2016 on Expediting Electricity Infrastructure Development, the construction of power plants in Indonesia had no certainty regarding the permit process.[34] The project developer had to gain permits from multiple ministries that are responsible for the environment, energy, manpower, and public works, respectively, as well as the tax office and the local governments.[35] At that time, a permit by an agency alone needed almost 120 days,[36] and no sanctions had been

[30] "Laporan Kinerja Tahun 2018," [Performance Report 2018], (Jakarta: Ministry of Energy and Mineral Resources, 2019), accessed from https://bit.ly/3heKEGe. Look also: "Home," PT. Bintang Abadi Sempurna, n.d., accessed from https://bit.ly/3DVnK0l

[31] Look at the Ministerial Decision Number 482-12/40/600.2/2006 on Decision over regions suffered from electricity crisis, Ministry of Energy and Mineral Resources, 2006, accessed from https://bit.ly/3DQh97z

[32] The scheme for this PPA is apparently BOT (Build – Operate – Transfer), Look at the interview between ANTARA journalist with management of PT. General Energy Bali, who said that the plant could be negotiated and retaken after 30 years: "Tiongkok Bangun PLTU Atasi Krisis Listrik Bali," [China helped building coal-fired power plant to address electricity crisis in Bali], Antara, July 2, 2015, accessed from https://bit.ly/3tkqq2Q. Look for the PPA date: "Presiden Saksikan Penandatangan Proyek Kelistrikan dan Batubara," [President witnessed the signing of electricity and coal projects], Ministry of Energy and Mineral Resources, March 21, 2007, accessed from https://bit.ly/3tmvGTz. Permit for PT. General Energy Bali is The Ministerial Decision Number 1475/K/34/MEM/2005 – Ministry of Energy and Mineral Resources. It was extended by the Ministerial Decision Number 331-12/20/600.3/2007. Access the decision: https://bit.ly/3AVbhIs.

[33] "Investor China Bangun PLTU Senilai 7 Triliun di Buleleng," [China built 7 Trillion-worth PLTU in Buleleng], Antara News, October 19, 2010, accessed from https://bit.ly/2X5CLw3

[34] "Annual Report PT. PLN 2013," PT. PLN, accessed from https://cdn.indonesia-investments.com/bedrijfsprofiel/409/perusahaan-listrik-negara-annual-report-2013-pln-laporan-tahunan-company-profile-indonesia-investments.pdf

[35] "IPP Procurement Division," PT. PLN, accessed from https://bit.ly/3l98e8N

[36] Presidential Regulation Number 71/2006 on Designating PT. PLN to expedite development of coal-fired power plants.

given to those companies that failed to stick with their initial schedules.[37] In addition, PT. PLN did not consistently support the development of PLTU Celukan Bawang. As recorded by RUPTL 2010-2019, PT. PLN suddenly prioritized building an expensive undersea cable to transfer electricity supply from Java to Bali,[38] instead of promoting the planned power plant.

Second, there was a problem with a participant of the project - Shanghai Electric Power Construction. Although a PPA was signed in 2007, the project did not make any progress up to 2011. It was possibly because Shanghai Electric Power Construction was hurt badly by the 2008 financial crisis.[39] As a result, PT. General Energy Bali could not resolve the land settlement issue. Hundreds of households in Celukan Bawang repeatedly filed complaints[40] against PT. General Energy Bali as they did not receive proper compensation for their lands. On many occasions, local residents also blockaded road access and sieged the power plant, which also prolonged the construction process.

The turning point was in 2010 when a Chinese state-owned enterprise, China Huadian Engineering Corporation (CHEC), decided to take over the delayed project. The chief manager of CHEC at that time said that PLTU Celukan Bawang was going to be the biggest coal-fired power plant built by CHEC outside of China.[41] The China Development Bank served as the main financier for the project providing a $473 million loan - equal to 70% of the total expected cost of the project.[42]

With regard to key actors involved in PLTU Celukan Bawang, PT. General Energy Bali is an independent power producer and thus the owner of the project. Although there is not any official information about PT. General Energy Bali, there is one district court decision[43] that provided a brief background about the company. PT. General Energy Bali (GEB) is a partially foreign-owned

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[37] Now, the government could impose a sanction against the company who failed to meet its initial commercial operation date. This is regulated by the Ministerial Decision Number 10/2017, Ministry of Energy and Mineral Resources.
[38] "Rencana Usaha Penyediaan Tenaga Listrik PT. PLN 2010-2019," [National Electricity Supply Business Plan PT. PLN 2010-2019], (Jakarta: PT. PLN, 2010)
[39] *Ibid.,* ""Tiongkok Bangun PLTU Atasi Krisis Listrik Bali,"
[40] A local media *Metro Bali* recorded at least three times: February 29, 2012, May 4, 2013, August 31, 2013. Another local news agency *ANTARA Bali* also recorded the protest on July 13, 2012, August 1, 2012, September 16, 2012, November 4, 2012, and December 8, 2013.
[41] *Ibid.,* "Investor China Bangun ... Look also: https://bit.ly/3r1oBXe
[42] "Coal-fired Power Plant in Bali, Indonesia (Phase I)," China Development Bank, December 20, 2015, accessed from https://bit.ly/3hg169c. The total investment was more than $600 million. Look the resource: https://bit.ly/3yHH6Tm
[43] "Putusan PN Bekasi 334/PDT.G/2014/PN.BKS," [Decision of District Court of Bekasi], Mahkamah Agung Republik Indonesia, February 3, 2016, accessed from https://putusan3.mahkamahagung.go.id/direktori/putusan/674c3a8dbfeea212a643cbcc31605344

private company[44] in Indonesia that focuses its business line on electricity service provision. CHEC participates in the project in the form of an EPC like Shanghai Electric Power Construction, and it also operates and maintains the power plant.[45]

PLTU Celukan Bawang has been operating since 2015. Since then, PT. General Energy Bali has proposed to build another 2x330 MW coal-fired power plant as the second phase of the project with a 1.5 trillion rupiah investment from China Huadian Engineering (51%) and Singapore Merryline International (38.49%).[46] The initial plan was to continue using coal for the second phase.[47] However, this idea faced strong oppositions from both local communities and environmental NGOs. They filed lawsuits against both the former governor of Bali and PT. General Energy Bali through the Administrative Courts of Denpasar[48] and Surabaya.[49] Yet, the judges in both courts dismissed the request since the losses claimed by the residents were viewed as only potential. Even when the plaintiffs appealed to the Supreme Court, they received rejections with similar arguments.[50] However, when the current Governor of Bali came to power, he threatened to cancel the permit if the second phase of PLTU Celukan Bawang continued to use coal.[51] Following this decision, the expansion shifted into a gas-fired power plant with the capacity of 2x350 MW and $1.3 billion-worth of investment from the Shanghai Electric Group Corporation.[52]

III. Environmental and Social Impacts of PLTU Celukan Bawang

[44] Check the law: "How to Establish a Foreign Company (PT. PMA) in Indonesia, Indonesia Investments, n.d, https://www.indonesia-investments.com/id/business/foreign-investment/establish-foreign-company-pt-pma/item5739?
[45] "Case Study: PT. General Energy Bali," EACP, http://www.eacp.asia/PT.php
[46] "Proyek PLTU Celukan Bawang Tahap II Senilai Rp 1,5 Triliun," [PLTU Celukan Bawang Expansion worth 1.5 Trillion], Bisnis Bali, January 25, 2018, accessed from https://bit.ly/2VtcGGy
[47] "Pihak PLTU Celukan Bawang Tetap Ingin Gunakan Bahan Bakar Batu Bara," [PLTU Celukan Bawang still wanted to coal-fired power plant], Nusa Bali, February 16, 2019, accessed from https://bit.ly/3hdWdgR
[48] "Putusan PTUN Denpasar 2/G/LH/2018/PTUN.DPS," Supreme Court of Indonesia, January 24, 2018, accessed from https://bit.ly/3toDu7e
[49] "Putusan PTTUN Surabaya 221/B/LH/2018/PT.TUN.SBY.," Supreme Court of Indonesia, December 26, 2018, accessed from https://bit.ly/3zYoobg
[50] "Putusan Mahkamah Agung 224 K/TUN/LH/2019," Supreme Court of Indonesia, April 11, 2019, accessed from https://bit.ly/38PnTnL
[51] "Ancaman Gubernur Bali pada PLTU yang Tak Ramah Lingkungan," [Governor of Bali threatened not sustainable coal-fired power plant], Liputan 6, October 3, 2018, accessed from https://bit.ly/2WZnRXY. Look also: https://bit.ly/3xF7YTS, https://bit.ly/3k9Y3lu, https://bit.ly/3hYON0O
[52] "Proyek PLTG Akan Dibangun di Bali," [Gas-fired power plant would be constructed in Bali], Berita Satu, November 14, 2019, accessed from https://bit.ly/3jZJBvX. Look also: https://bit.ly/3yR8a2n. The government of Bali designated local office on energy and mineral resources to coordinate the construction of 2nd Phase of Celukan Bawang. The good part of it is the power plant would be no longer be fired by coal. Instead, it would use gas as mandated by the Gubernatorial Regulation number 45/2019 on Clean Energy Bali

According to the report released by Greenpeace Indonesia, air and water pollution from PLTU Celukan Bawang's activities undermine the well-being of residents nearby the power plant. It reduced the fishermen catch's from 300 buckets daily to only 10-15 buckets while also shrinking the yields of coconut farmers from 1,000 pieces/harvest to only 100 pieces.[53] Data collected by the Central Statistics Agency (BPS) may also corroborate this claim. Production of hybrid coconuts in Gerokgak district, where PLTU Celukan Bawang is located, witnessed a dramatic decrease from 2014-2018. Along with that, local media outlets covered how the power plant's waste contaminated the water in the area.[54]

These negative environmental consequences are associated with the fact that the project developers have not appropriately implemented environmental standards. The 2016 Working Report from the Buleleng Environmental Agency disclosed that PT. General Energy Bali has yet to regularly submit updates on the implementation of their environmental permit, water monitoring results, and emission monitoring results.[55]

In addition to environmental concerns, PLTU Celukan Bawang also drew public attention because of the appearance of Chinese workers. Local media outlets regularly reported how the local immigration office convicted[56] and deported[57] Chinese workers affiliated with PLTU Celukan Bawang. The disparity between Chinese and local workers also provoked controversies in Bali. Whereas Chinese employees held strategic and substantive positions over the project, local employees largely occupied supporting positions, such as security or cleaning services.[58]

3.4.2 South Sumatera Mouth Mine Coal-Fired Power Plant - 1[59]

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[53] "PLTU Celukan Bawang Meracuni Pulau Dewata," [PLTU Celukan Bawang poisoned the island of goddess], *Greenpeace,* April 16, 2018, accessed from https://bit.ly/38QJo7O

[54] "Mangku Wijana Cemas Kubangan Besar di Dekat PLTU Celukan Bawang Keluarkan Gelembung Air," [Mangku Wijana worried about big holes near PLTU Celukan Bawang, it generated water bubble], Tribun Bali, January 21, 2017, accessed from https://bit.ly/3l45Dgj. Look also: https://bit.ly/3xzv9yW

[55] "Laporan Akuntabilitas Kinerja Instansi Pemerintah (LAKIP) Tahun Anggaran 2016," [Performance Accountability Report — 2016], Local Agency on Environment in Buleleng, accessed from https://bit.ly/3BTQHIa

[56] "Panggil Kontraktor PLTU Celukan Bawang, [Calling the developer of PLTU Celukan Bawang], Antara Bali, November 30, 2012, accessed from https://bit.ly/3l8ctB8

[57]. "Imigrasi Tahan Paspor Pekerja PLTU Celukan Bawang," [Immigration Bureau withheld Passports of PLTU Celukan Bawang workers], Antara Bali, October 26, 2013, accessed from https://bit.ly/3zYFx4r. After too many cases with Chinese workers, the local government of Buleleng enacted the Local Regulation Number 4/2014 on Retribution from Extending Permits to work Foreigners

[58] "Sidak Komisi IV DPRD Buleleng, Tenaga Kerja Lokal Hanya Tempati Satpam dan Cleaning Service," [Commission on Energy from Local House of Parliament in Buleleng's inspection: Local workers only served as security and cleaning service officers], Metro Bali, July 23, 2017, accessed from https://bit.ly/2YCTB5X. Look also: https://bit.ly/3k0bDYu, https://bit.ly/3hU6xKF

[59] Herein after referred as PLTU Sumsel-1

As a home for the second-richest coal reserves in Indonesia, South Sumatra (Sumsel) provides a convenient ground for the growth of coal-fired power plants (PLTU). As of May 2021, there are at least 4 operational PLTU(s), 3 ongoing constructions, and 2 projects with signed power purchase agreements in the province.[60] Among these projects, this report focuses on PLTU Sumsel-1 as our second project-level case study. This subsection first introduces basic information about the power plant, including its location and technology. Then we describe key actors involved in PLTU Sumsel-1, and the process of project formulation and implementation. Finally, we conclude with a detailed discussion on the environmental and social implications of PLTU Sumsel-1.

I.Background Information

PLTU Sumsel-1 is a coal-fired power plant project that covers the South Sumatra area of Indonesia known as Sumsel. This province has a land area of approximately 91,592 km² and is well-known for its extensive fossil fuel resources, including 22.4 million tonnes of potential coals (38.5% of the national reserves),[61] 757.6 million stock tank barrels (MMSTB) of crude oil (6.97% of the national reserves), and 24,179 billion standard cubic feet (BSCF) of potential natural gas.[62] With these rich deposits, South Sumatra was even named by former President Yudhoyono as "*Lumbung Energi Nasional,* or the "national energy reserve centre", in 2004.[63]

However, not every region in South Sumatra is endowed with this natural gift. According to the Local Agency on Energy and Mineral Resources,[64] Muara Enim is the region with richest fossil fuel resources (see Table 2). This explains why Muara Enim hosts numerous major power plants despite being a hundred miles away from the capital of South Sumatra. PLTU Sumsel-1 project is located in Muara Enim. Project developers aim to build a new coal-fired power plant with the

[60] Note: operational PLTU(s) include: PLTU MT Simpang Belimbing (2x113), PLTU MT Keban Agung (2x 112 MW) , PLTU MT Sumsel-5 (2x150 MW), PLTU MT Banjarsari (220 MW). Ongoing constructions include PLTU MT Sumsel-1, PLTU MT Sumsel-8, and PLTU MT Sumbagsel 1 (2 x 150 MW). PPA includes PLTU MT Banyuasin and PLTU MT Sumsel-6. Look at PT. PLN's record: https://bit.ly/3s3lYF2

[61] Calorific Value of Coal in South Sumatera: 4.200-7.185 Cal/gr, moisture level: 4,40-41%, volatile matter: 32,4-43,5%, total carbon: 40,63%. High-rank coal (6.100-7.100 Cal/gr) only 2% of the South Sumateran Reserves, medium-rank coal (5.100-6.100 Cal/gr) only 49%, and (> 5.100 Cal/gr) around 49%. Look at the Master Plan.

[62] "Master Plan Provinsi Sumatera Selatan Sebagai Lumbung Energi Nasional Tahun 2006-2025," [Master Plan of South Sumatra to be the National Energy Reserve Center 2006-2025], (Palembang: Government of South Sumatera, 2006), https://bit.ly/3kVWWEH. Referring to the previous study, *lumbung energi* could also be understood as 'national stock'. Please look at: Heri Apriyanto,"Skenario Kebijakan Pengembangan Provinsi Sumatera Selatan Sebagai Lumbung Energi Nasional," *Jurnal Sains dan Teknologi Indonesia*, Vol. 10, No. 1, (2008), doi: 10.29122/jsti.v10i1.789.

[63] "Laporan Kinerja Instansi Pemerintah Provinsi Sumatera Selatan Tahun 2009," [Performance Accountability Report of the Government of South Sumatera, 2009], Local Government of South Sumatera, (2010), accessed from https://bit.ly/3yCAmWs

[64] "Data dan Informasi Statistik 2010-2019," [Data, Information and Statistics 2010-2019], Local Agency on Energy and Mineral Resources, (2020), accessed from https://bit.ly/38JxFHS

capacity of 2x300 MW in the middle of five neighboring villages: *Tanjung Menang, Cekdam, Belimbing, Belimbing Jaya,* and *Darmo Kasih*.[65] The project is a mine-mouth[66] to take advantage of abundant coal reserves in the region, as well as to reduce the transportation cost.[67]

Table 2: Regencies & Cities with Extensive Fossil Fuel Resources
Source: Local Agency on Energy and Mineral Resources, 2020

	Crude Oil Total (MSTB)	**Natural Gas** Reserves (BSCF)	**Coal** Reserves (MSTB)
Banyuasin	17,466	146	17,466
Lahat	22,942	1,425	22,942
Muara Enim	347,872	10,270	347,872
Musi Banyuasin	299,129	4,546	299,129
Musi Rawas	63,467	2,424	63,467
Ogan Ilir	11,921	1116	11,921
OKU	30,392	213	30,392
Prabumulih	19,769	N/A	19,769

Although no information[68] on its technology has been publicly disclosed, anecdotal evidence indicates that the plant might not use sub-critical boilers. Shenhua Energy Company, as the project developer, installed three power plant simulators at Universitas Indonesia, and the virtual PLTU Sumsel-1 used a supercritical unit for simulation.[69]

II.Key Actor and Project Life Cycle

The idea to construct PLTU Sumsel-1already appeared in the National Electricity Supply Business Plan (RUPTL) 2011-2020. The document initially designated PT. PLN to build a new plant with 2x400 MW-capacity and the commercial operation date was scheduled to be between 2019-2020.[70] There are two motives underlying the proposal of this project: 1) to take advantage of

[65] "PT Shenhua Guo Hua akan Bangun Proyek Listrik 2x300 MW di Muara Enim," [PT. Shenhua Guo Hua would build a electricity project 2x300 MW in Muara Enim], Kabar Serasan, September 7, 2016, accessed from https://bit.ly/3tc9H1H
[66] Mine-mouth according to RUPTL 2011-2020: a coal-fired power plant that is located with the low-rank coal mining and does not have proper supporting transportation infrastructure that would enable the coal to be transported to the market in a large amount, therefore making the low-rank coal becomes untradeable.
[67] "Jonan: Kedepan Di Sumatera Tidak Ada Pembangkit yang Dibangun selain di Mulut Tambang," [Minister Jonan: In the Future, No Power plant built in Sumatera other than in the mine-mouth area], Ministry of Energy and Mineral Resources, July 21, 2017, accessed from https://bit.ly/3BIKzT0
[68] In the introduction from GTN Network written in Chinese, it was explicitly stated that the power plant would adopt supercritical technology. They also open job opportunities related to environmental impacts such as: fuel ash removal, chemical environmental protection. Look at: "Introduction," Shenhua Guohua (Indonesia) Tianjianlang Power Generation, accessed from https://bit.ly/3gl2yHd
[69] "Fasilitas Teknik UI Miliki Power Plant Simulator," [Faculty of Engineering UI owned Power Plant Simulator], Universitas Indonesia, November 11, 2019, accessed from https://bit.ly/3jIbUPf
[70] "Rencana Usaha Penyediaan Tenaga Listrik PT. PLN 2011-2020," [National Electricity Supply Business Plan PT. PLN 2011-2020], (Jakarta: PT. PLN, 2011)

South Sumatra's rich coal deposits, and 2) to address increasing electricity demand in Indonesia's most populous island — Java.[71]

Nevertheless, the plan of building a new coal-fired power plant encountered a number of setbacks along the way. In RUPTL 2013-2022, PT. PLN abandoned the idea of being the developer for PLTU Sumsel-1 due to its limited internal funding.[72] The stalemate lasted until the 2014 Presidential Election when the newly elected President Widodo revitalized the proposal of developing PLTU Sumsel-1. He incorporated it into his 35,000 MW's signature program, and even listed it in the Committee on Accelerating the Provision for Prioritized Infrastructure.[73] As a result, RUPTL 2015-2024 stipulated PLTU Sumsel-1 to be constructed with 2x300 MW-capacity and with an independent power producer (IPP). It is expected to operate between 2020-2021.[74]

Unfortunately, there is scant information about the subsequent tender process.[75] The only accessible clue is in the PT. PLN Annual Report 2015. The report reveals that PT. PLN has entered the power purchase agreement with PT. Shenhua Guohua Lion Power Indonesia (SGLPI) for a thirty-year-period.[76] With regard to the ownership of the electricity project, China Shenhua Energy Co. possesses approximately 75% of total shares while the Indonesia's Lion Power Energy hold the remaining.[77] As this is a mouth-mine power plant, the Indonesian regulators allow the domestic partner to have fewer shares. With regard to the contractual scheme, while China Shenhua Energy Co. reported that PLTU Sumsel-1 would use the build, own, operate (BOO) scheme,[78] PT. PLN decided to open up the possibility to change the scheme into build, operate, transfer (BOT) in another progress report.[79]

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[71] *Ibid.,* Look also: RUPTL 2010-2019
[72] Rencana Usaha Penyediaan Tenaga Listrik PT. PLN 2013-2022," [National Electricity Supply Business Plan PT. PLN 2013-2022], (Jakarta: PT. PLN, 2013)
[73] "PLTU Mulut Tambang," Komite Percepatan Penyediaan Infrastruktur Prioritas, n.d., accessed from https://bit.ly/3yJdB3V
[74] Rencana Usaha Penyediaan Tenaga Listrik PT. PLN 2015-2024," [National Electricity Supply Business Plan PT. PLN 2015-2024], (Jakarta: PT. PLN, 2015)
[75] Sometimes it could be varied from the price, technology, the availability of the land. But in certain cases, PT. PLN also considers track records of the country and also the balance of foreign countries' participation in constructing the power plant.
[76] Thirty year: 2020-2050. "Annual Report of PT. PLN," The reports of different years can be accessed here: https://bit.ly/3fWAdXd
[77] "Overseas Regulatory Announcement: China Shenhua Energy Company Limited Announcement Regarding the Progress of the Tendering for the Sumsel-1 IPP Project in Indonesia," China Shenhua Energy Company Limited, November 20, 2015, accessed from https://bit.ly/2WSFEjV
[78] *Ibid.,* "Overseas Regulatory Announcement …",
[79] "Laporan Progress Unit Induk Pembangunan Pembangkit Sumatera, [Progress Report Core Development Unit for Sumatera Region], PT. PLN, 2018, accessed from https://bit.ly/3tiwDwh

China's Shenhua Energy group is one of the largest coal mining enterprises in the world. The corporation was able to secure USD$528 million-worth funding for PLTU Sumsel-1 from three major commercial banks in China (Bank of China, China Construction Bank, Industrial and Commercial Bank of China).[80] During the COVID-19 pandemic, China's Shenhua Energy group also carried out wide-ranging corporate social responsibility programs to target residents near PLTU Sumsel-1. In the health sector, the company handed over more than 200,000 medical masks and 1,000-litre of disinfectant.[81] In the education sector, the company provided construction materials to build an elementary school in one village.[82] Regrettably, there is no official information about Lion Power Energy. The only publicly available relevant information is that the company has mining-business licenses (IUP) to explore and produce coal in South Sumatra for the period of 2010-2027.[83] The difficulty in finding reliable information about BRI projects indicates that the regulatory system suffers from a lack of transparency. This finding resonates with our previous discussions on a less institutionalized BRI process in Indonesia and the resultant weak governance regime over BRI projects.

Despite prioritization of PLTU Sumsel-1 by the current presidency and a private developer already being selected, its ground progress is still sluggish. According to PT. PLN's latest update in May 2021, the plant is around 39% complete and expected to be operational in late 2023.[84] Many Indonesian stakeholders accused PT. PLN for deliberately causing this kind of delay.[85] Likewise, the former Minister of Energy and Mineral Resource highlighted PT. PLN's fear of losing its dominance over the electricity business in Indonesia when being increasingly challenged by independent power producers.[86]

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[80] *Ibid.,* "Sumsel 1," World Bank. Respectively each bank provided loan around 176.2 million USD.
[81] "Bakti Sosial dan Sosialisasi Pandemi Gencar di lakukan PLTU Sumsel 1 SeKecamatan Rambang Niru," [Social Activities and Socialization of Pandemic massively organized in PLTU Sumsel-1 around Rambang Niru county], Lencana Publik, June 14, 2021, accessed from https://bit.ly/3ABhGYk. Look also: https://bit.ly/37HCfpG, https://bit.ly/3ALs4Nv
[82] "PLTU Sumsel 1 Kembali Beri Bantuan Kepada Sekolah Negeri di Desa Darmo Kasih Kabupaten Muara Enim," [PLTU Sumsel 1 gave assistance to leader of public schools in Darmo Kasih village], Lencana Publik, August 2, 2021, accessed from https://bit.ly/3AGGKNP
[83] "Profil Perusahaan Lion Power Energy," Minerba One Data Indonesia, n.d., see https://modi.esdm.go.id/portal/detailPerusahaan/4596
[84] "Lampiran Summary Report Status Mei 2021," [Attachment to the Summary Report Status May 2021], PT. PLN, June 13, 2021, accessed from https://bit.ly/3s3lYF2
[85] "Gubernur Sumsel Gusar, Proses Tender Enam PLTU Mangkrak," [Governor of South Sumatera Angry, Tender Process for 6 PLTUs stuck], Republika, November 8, 2015, accessed from https://bit.ly/2YmJYbh
[86] Another source mentioned the anxiety came from the revised RUPTL which only mandated PT. PLN to construct 10,000 out of Jokowi's 35,000 MW signature, therefore there was a tendency to 'slow down' the tender since PT. PLN is also the one who decides the IPP for each tender. It is about how to divide 'the cake'. Look further: "Menteri ESDM Minta PLN Ikhlas Kerja Sama Dengan Swasta," [Minister of Energy demanded PT. PLN to be more sincere in working

In addition to PLN, the local government of South Sumatra plays an important role in attracting Chinese investments in coal by actively participating in the Indonesia-China Energy Forum (ICEF).[87] In 2006, South Sumatra's former governor joined the Indonesian delegation for the 2nd ICEF in Shanghai, together with the former minister of energy and mineral resources, the former minister of state-owned enterprises, the former leading members of parliament (DPR) who were in charge of the energy sector, and other governors.[88] After presenting South Sumatra as the "national energy reserve center" in front of hundreds of Chinese investors and officials, the former governor of South Sumatra then announced intentions to host the 3rd ICEF in 2008.[89] These efforts of local government eventually led to greater levels of China's investment in the region.[90] Ever since, China has been strengthening its rapport with the local leaders in South Sumatra. Table 3 shows that China's Consulate General for Sumatra has regularly met the Governor of South Sumatra over the past few years.

Table 3: Meetings between China's Consulate General with Governors of South Sumatra
Source: compiled by the authors

Years	**Chinese counterpart**	**Indonesia Counterpart**		**Topics mentioned**
		President	**Governor**	
15 Sep 2014	Con. Gen. Mr. Zhu Honghai	Joko Widodo (1st Period)	Alex Noerdin	Tanjung Api-Api Exclusive Economic Zone, Energy, Construction
14 Jan 2016	Con. Gen. Mr. Zhu Honghai	Joko Widodo (1st Period)	Alex Noerdin	Supporting infrastructure for Asian Games 2018

with private], Tribun Bisnis, July 22, 2016, accessed from https://bit.ly/3tjo2t7. "Menteri ESDM Peringatkan PLN Permudah Syarat Tender Pembangkit Swasta," [Minister of Energy warned PLN to ease the requirements for IPP], Katadata, June 27, 2016, accessed from https://bit.ly/3h7EJmC

[87] According to the Ministry of Energy and Mineral Resources, ICEF is a bilateral forum between Chinese and Indonesian government and business actors to coordinate policies, regulation, economic, technology in order to enhance development on economic and mineral resources in both countries. Established in 2002 during the leadership of former President Megawati. Look at: 'Bulletin Ketenagalistrikan," [Bulletin on Electricity], Ministry of Energy and Mineral Resources, Vol. XIII, (Dec. 2017), accessed from https://bit.ly/3DSbT3d

[88] "Sumsel Tuan Rumah RI-Cina Energy Forum III," [South Sumatera would host the 3rd ICEF], Ministry of Energy and Mineral Resources, October 13, 2013, accessed from https://bit.ly/3yOQG6G

[89] Ibid.,

[90] "PT. GH EMM Indonesia Dalam Perang Melawan Pandemi Virus Corona," [PT. GH EMM Indonesia in Battle Against COVID-19 pandemic], Tribun Sumsel, April 17, 2020, accessed from https://bit.ly/3xHOmov

8 Sept 2017	Con. Gen. Mr. Sun Ang	Joko Widodo (1st Period)	Alex Noerdin	Tanjung Api-Api EEZ, Sport, Asian Games 2018
4 Sept 2019	Con. Gen. Ms. Qiu Weiwei	Joko Widodo (2nd Period)	Herman Deru	Education, Health, Forest Fire, Agriculture and Plantation

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Since PLTU Sumsel-1 is still under the construction, a full-fledged assessment of its environmental impact is beyond the scope of this report. Instead, we look at environmental issues that have been covered by local media. The construction of a power plant blocked a traditional river flow in Tanjung Menang, which caused a flood that damaged neighboring palm oil and rubber farms.[91] In fact, another power plant built by Shenhua Energy Group, PLTU Simpang Belimbing (2x150 MW), also triggered the same problem to another river flow.[92] Another problem is the land conversion for PLTU Sumsel-1 has disturbed the habitat of endangered faunas, like the Sumatran tiger, pangolin, porcupine, and deer.[93] Unfortunately, no specific policies have been announced to address these problems.

PT. Shenhua Guohua Lion Power Indonesia, as the developer, did not engage well with PLTU Sumsel-1's neighboring villages.[94] One of them is Tanjung Menang village. Residents from this village repeatedly rallied[95] nearby the power plant demanding the company to prioritize hiring local workers and procuring from local vendors. The tension heated up when local residents discovered that the company employed workers from China even for low-skilled jobs.[96] At the same time, PLTU Sumsel-1 got pushback after mistreating their employees, namely giving a below standard salary, not paying extra for additional work, no holiday, insurance, and terminating

[91] "Pembangunan PLTU Sumsel 1 Mencemari Kebun Sawit dan Merusak Anak Sungai," Sripoku, January 9, 2018, accessed from https://bit.ly/3snBL1G
[92] Problem with Sungai Penimur in 2017. The evidence could be seen from the following articles: https://bit.ly/3ABgbJM, https://bit.ly/3gl4GPd, https://bit.ly/2XqHmsC.
[93] "PT. SGLPI Tidak Hiraukan Ajakan LSM Dashat Lestarik Lingkungan Wujdkan Go Green," Bhayangkara Utama, Janauary 21, 2021, accessed from https://bit.ly/3m15mN6
[94] There are five villages nearby: Tanjung Menang, Air Cekdam, Belimbing, Belimbing Jaya, and Darmo Kasih.
[95] The demonstration took place on December 21, 2019: https://bit.ly/2UeKqXs, February 5, 2020: https://bit.ly/3AE4br0, September 26, 2020: https://bit.ly/3jRLcCC.
[96] "Warga Tanjung Menang Tolak Tenaga Kasar Asal Asing di PT. SLPI," Radar Nusantara, February 6, 2020, accessed from https://bit.ly/3xNa6rX

workers without advance notice.[97] After a strike by more than 100 workers in March, another rally of a hundred people also took place in late August 2020.[98] It already attracted Muara Enim regent's attention. In September 2020, residents from Tanjung Menang village caught the company sneaking two groups of Chinese workers into PLTU Sumsel-1 during the night without any advanced coordination both with the village and Muara Enim's government.[99] Although the disputing parties resolved the matter, one scabbed sheep is enough to spoil a flock. It prolongs the list of 'workforce problems' surrounding BRI project at least in the eyes of the locals.

4. POLITICAL ECONOMY OF CHINESE ELECTRICITY INVESTMENT IN PAKISTAN

4.1 Statistics of Chinese Electricity Investment in Pakistan

Subsection 4.1 presents statistics on China's electricity projects in Pakistan. Like Indonesia, we look at Chinese investment and financing in Pakistan at both the macro- and micro-level. Macro-level patterns refer to the nationality of project developers and the technology mix for power plants. At the micro level, we pay attention to individual actors – Chinese electricity corporations and financiers – that participate in Pakistan's electric sector.

I.Macro-level Constellations

Before turning to micro-level patterns, we first focus on macro-level constellations. In Figure 8, we present the technology mix of Chinese-backed electricity projects, measured by capacity. Figure 8 shows that the portfolio of China's electricity projects is more diverse than that of Indonesia. Although coal-power accounts for nearly half of total Chinese investments, Chinese electricity corporations and banks have been actively supporting the development of wind and solar power in Pakistan.

As Figure 9 indicates, China is the largest foreign investor of coal-fired power in Pakistan given that Chinese-backed coal power plants account for around 60% of Pakistan's total coal-fired power generation capacity. The share of Chinese-backed projects is even larger than domestic Pakistani investors – the latter only contributes less than 30% of total generation capacity. China's

[97] "Kelompok Lingkungan Dukung Pemogokan Buruh PLTU Sumsel 1," Buruh, March 9, 2020, accessed from https://bit.ly/2VLfobD
[98] "Pemuda Pancasila Sesalkan PLTU PT. SGLPI Kab. Muara Enim Pekerjakan 38 TKA," Sumatera News, October 1, 2020, accessed from https://bit.ly/3yKF9G1
[99] "Warga Hadang Kendaraan yang ditumpangi TKA," Enim Ekspress," September 29, 2020, accessed from https://bit.ly/3xPmwzn

engagement plays a more influential role in the growth of coal power sector of Pakistan than that of Indonesia (see Figure 2 and 9).

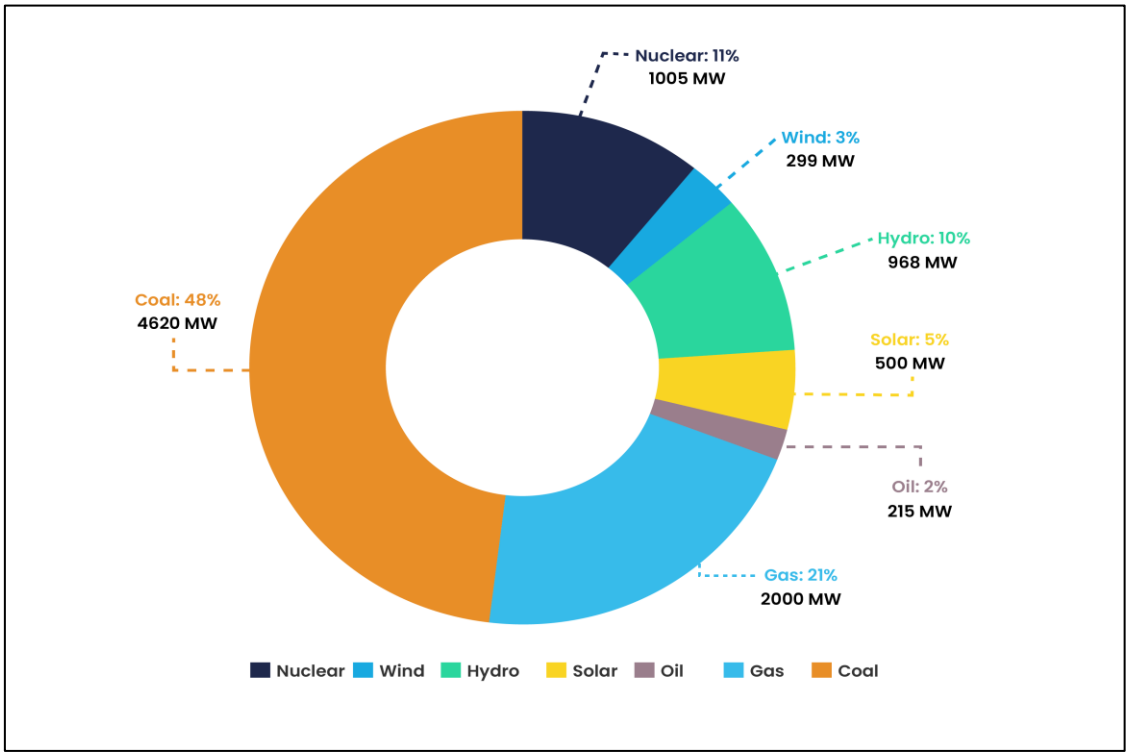

Figure 8: Technology Mix of Chinese-backed Electricity Projects in Pakistan

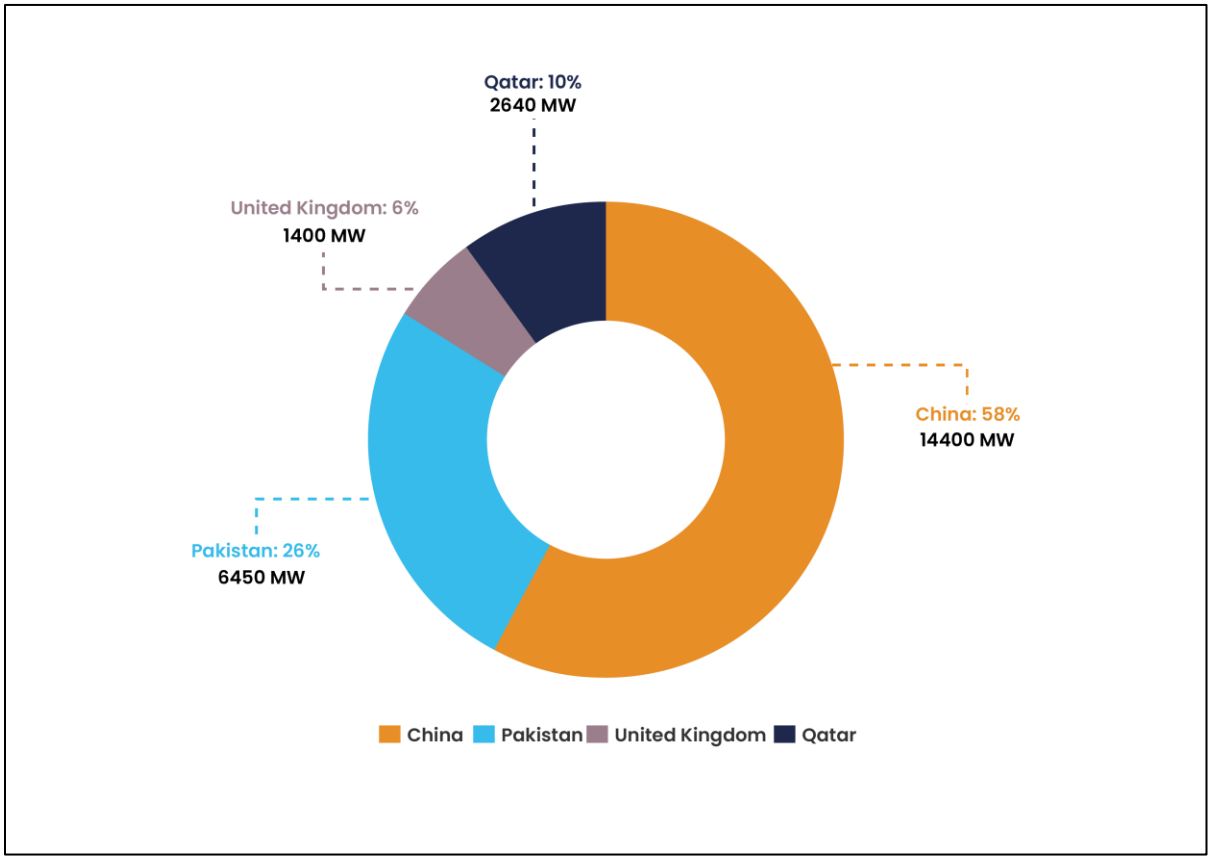

Figure 9: Nationality of Coal Power Plant Developers in Pakistan by Capacity (MW)

Figures 10 and 11 illustrate the relative importance of Chinese involvement in Pakistan's wind and solar power sectors compared to other foreign investors. Although renewables account for an *insignificant* percentage of China's total electricity investment and financing in Pakistan (measured by capacity, see Figure 8), China is the most important foreign sponsor of Pakistan's wind and solar power industries. More specifically, as Figure 10 shows, Chinese involvement in Pakistan's wind power is three times larger than that of the United States – the second largest foreign wind power investor in the country. More strikingly, China alone accounts for nearly 90% of Pakistan's total solar power generation capacity (see Figure 11). These figures demonstrate Pakistan's substantial dependence on external financial and technological support from China for its renewable energy sectors.

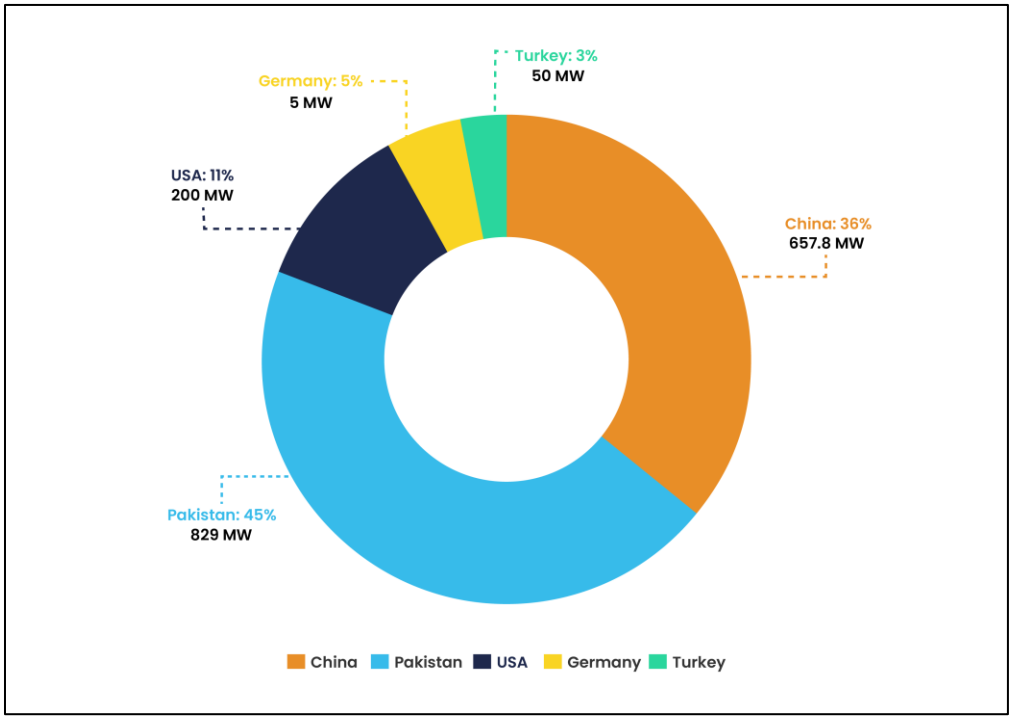

Figure 10: Nationality of Wind Power Plant Developers in Pakistan by Capacity (MW)

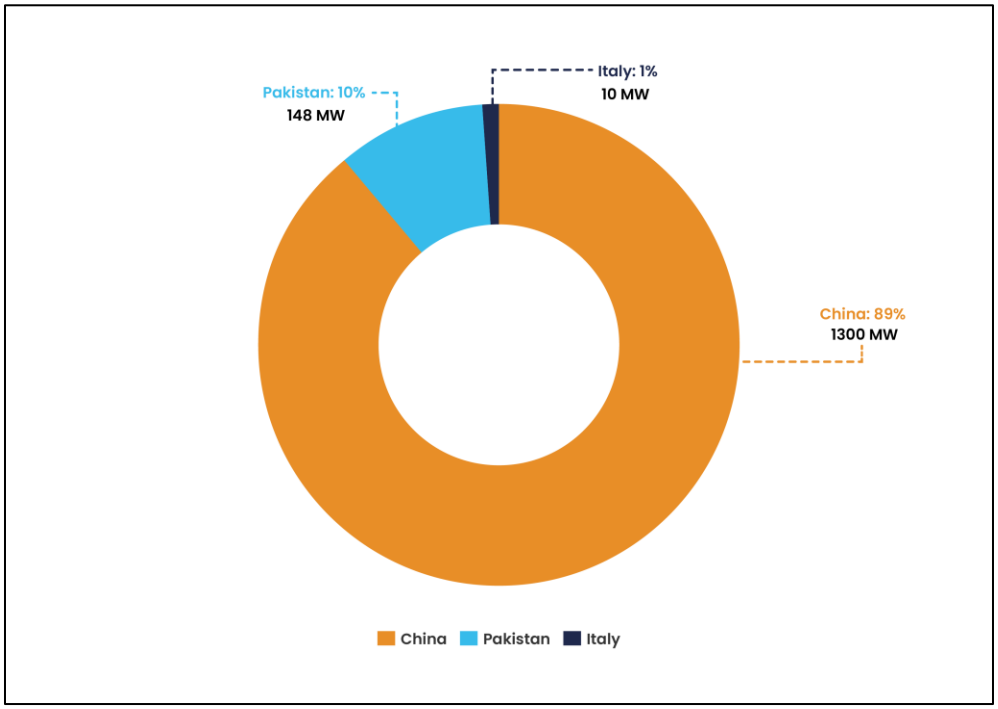

Figure 11: Nationality of Solar Power Plant Developers in Pakistan by Capacity (MW)

Figure 12 shows the technology of coal-fired plants in Pakistan, grouped by the nationality of project developers. In contrast to the case of Indonesia, a majority of China's electricity projects are super-critical. That means, Chinese companies tend to bring higher-end technology to Pakistan whereas they are inclined to employ less environmentally friendly technology for their invested power plants in Indonesia.

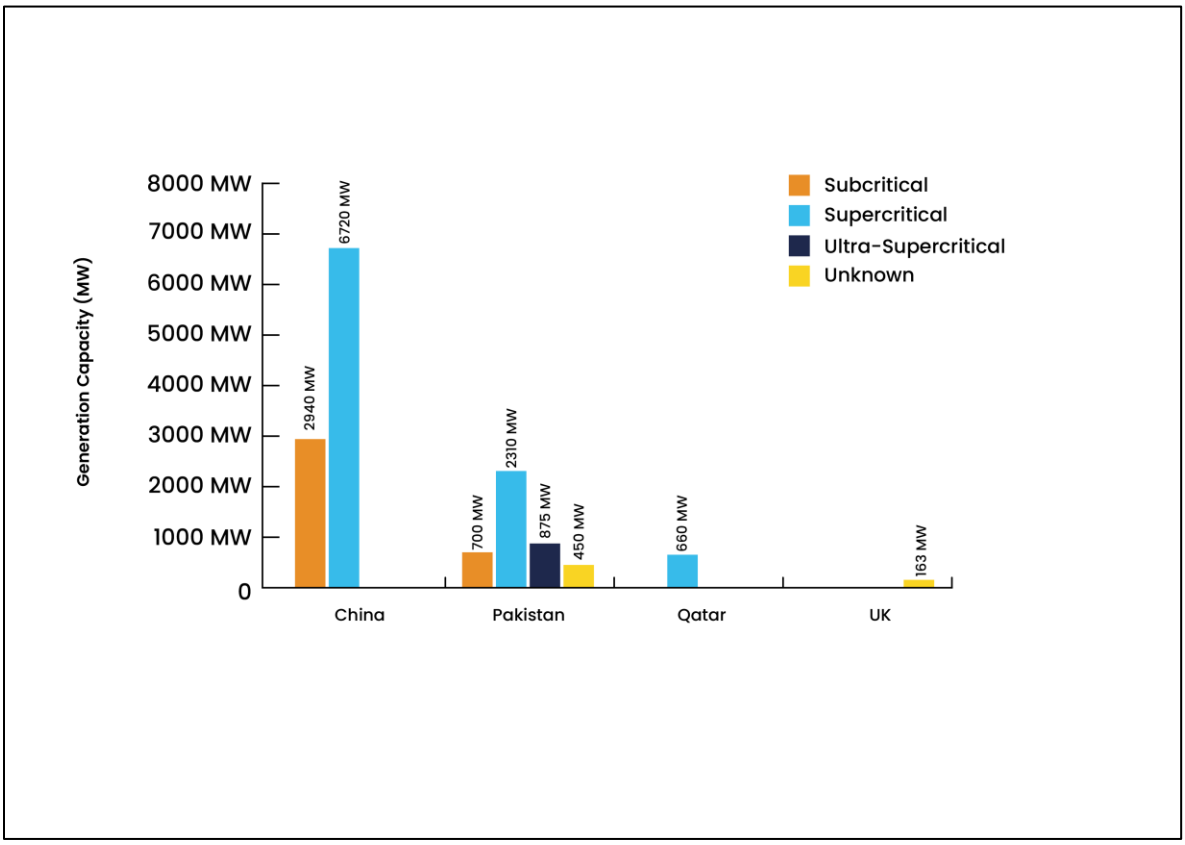

Figure 12: Technology of Coal Power Plants in Pakistan by Investors (2000-2021)

II.Micro-level Patterns

As Figure 13 shows, among the Chinese companies involved in Pakistan's coal power sector, those with the most investment and finance tend to be SOEs. For instance, the State Energy Investment Corporation, China Huaneng Group/China Huaneng, and the China Machinery Engineering Corporation are SOEs. Shandong Ruyi Technology Group, one of the top 3 Chinese companies in Pakistan's coal power industry, is not a SOE, however. It is not a domestic private enterprise but

a Chinese-foreign equity joint venture. Unlike Indonesia, the scale of installed generation capacity by China's private enterprises is much smaller in Pakistan.

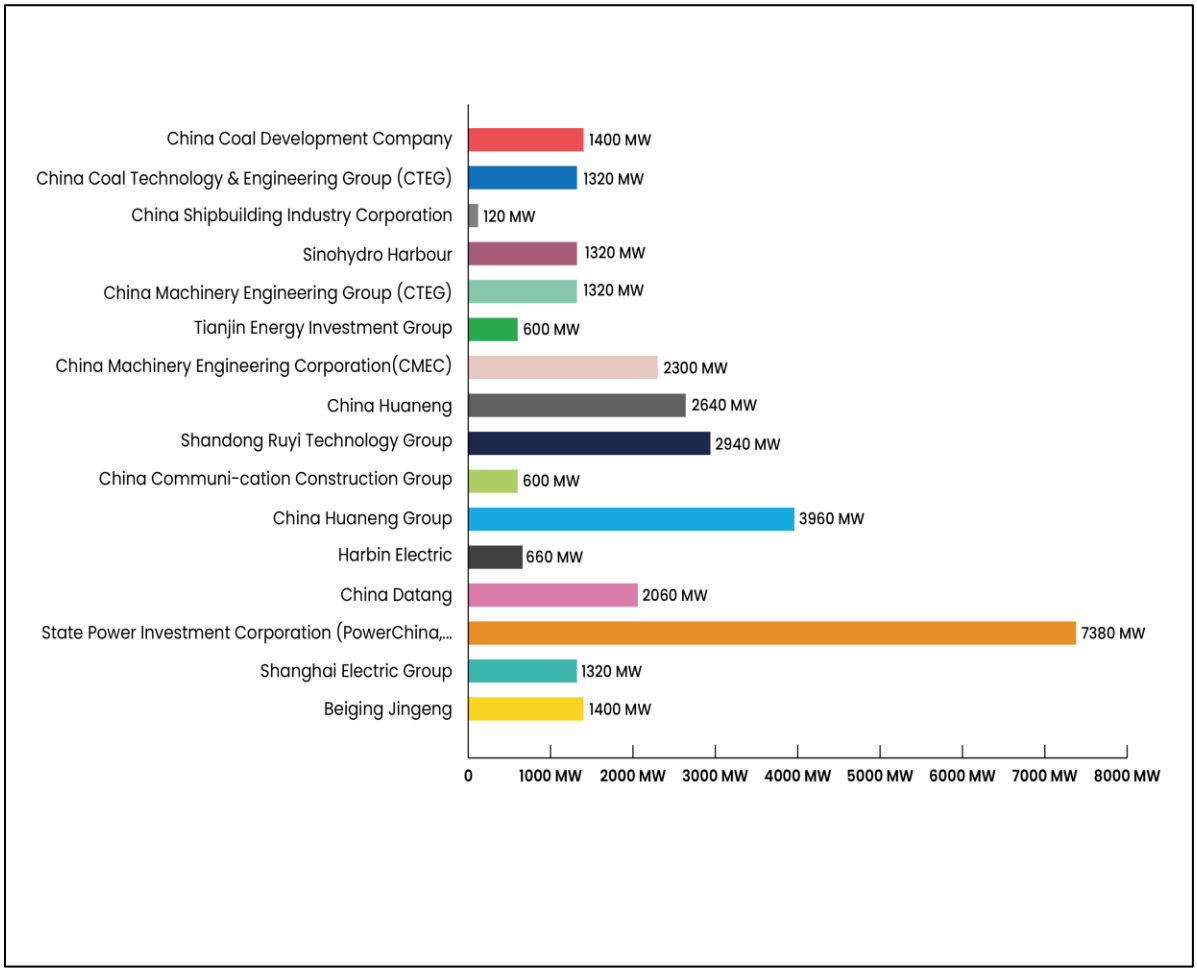

Figure 13: Top Chinese Companies in Pakistan's Coal Sector (By Capacity, MW)

Figure 14 shows coal-fired power capacity generation by Chinese financiers in Pakistan. EXIM China provides the largest amount of export credits to support construction and operation of Pakistani coal power plants. In contrast to Indonesia, Chinese commercial banks are largely absent in financing Pakistan's coal power sector. Since Chinese commercial banks are mainly motivated by economic profits while policy banks need to serve China's strategic overseas interests, our findings here indicate that Chinese-backed coal power projects in Pakistan are more

subject to political mandates that are formulated by the top leadership and are less driven by bottom-up business interests than their counterparts in Indonesia.

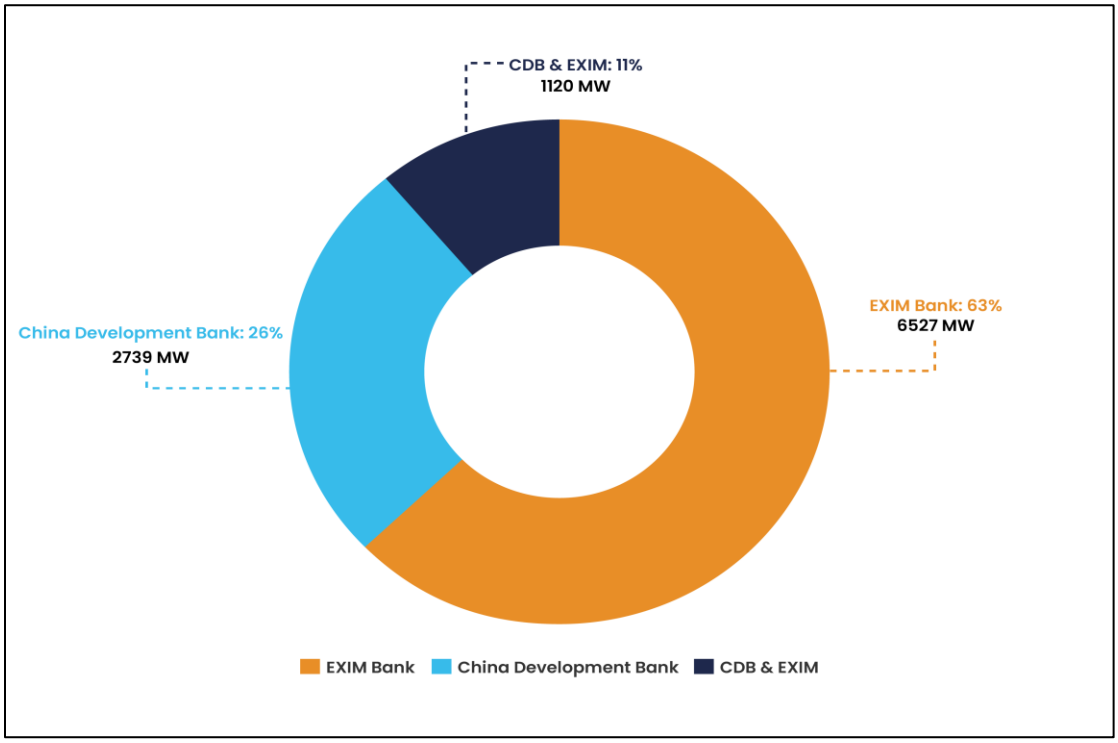

Figure 14: Financiers of Chinese-backed Coal Plants in Pakistan by Capacity (MW)

As we have discussed above, the portfolio of Chinese overseas electricity involvement in Pakistan is more diverse than that in Indonesia (see Figure 1 and 8). In addition to investing and financing coal power plants, Chinese power companies and financiers also participate in the renewables sector in Pakistan. In fact, Chinese private enterprises play an even more active role in the development of Pakistan's renewables sector than coal. For example, United Energy Group, a Hong Kong-based Chinese private enterprise, has the most investment in Pakistan's wind power industry (see Figure 15). Likewise, TBEA Xinjiang, another Chinese private power company, has entered the fray and invested in Pakistan's solar power market (see Figure 16).

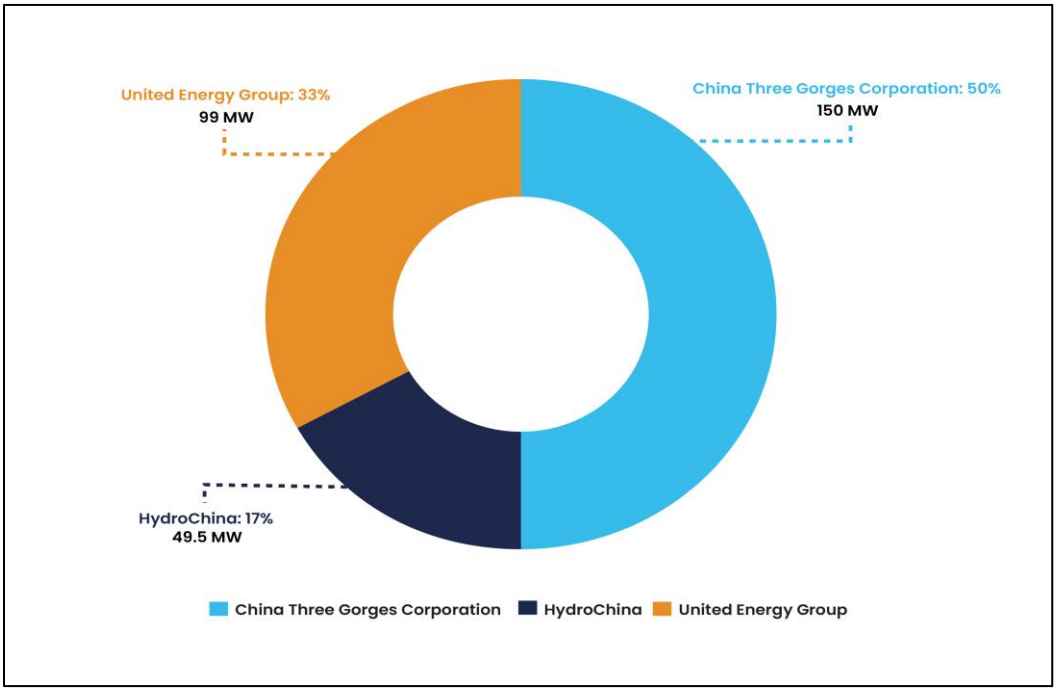

Figure 15: Top Chinese Companies in Pakistan's Wind Power Market by Capacity

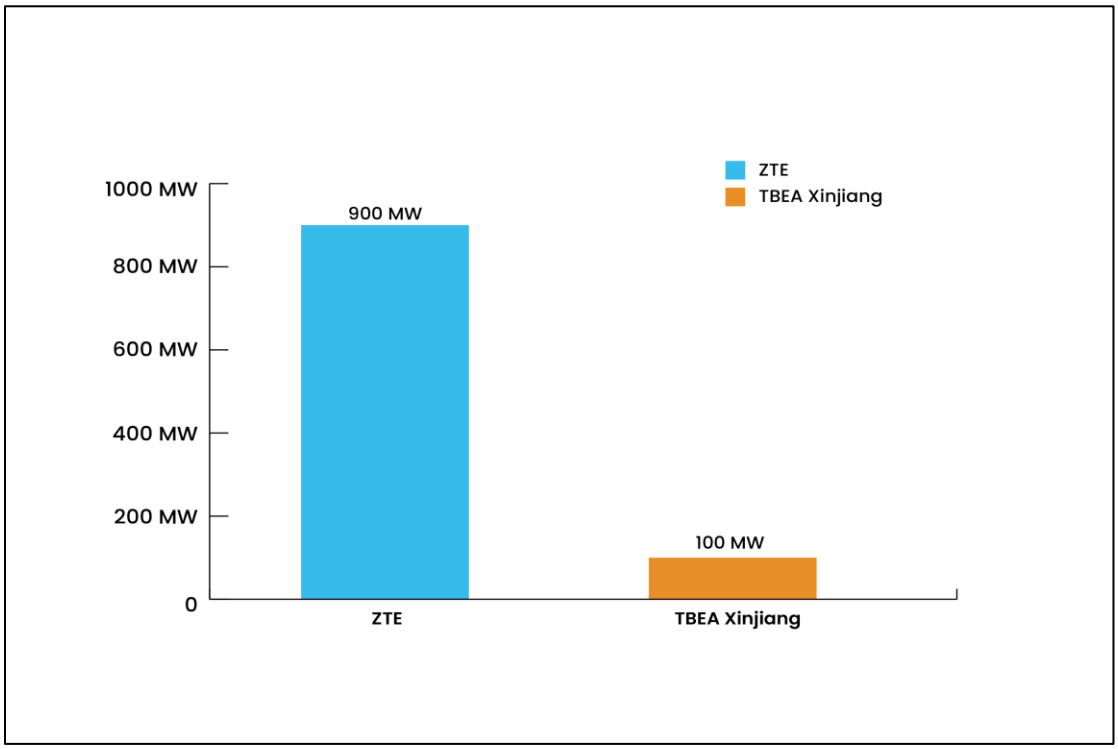

Figure 16: Top Chinese Companies in Pakistan's Solar Power Market (By Capacity, MW)

4.2 Key Actors, Institutions, and Characteristics of Pakistan's Power Sector

I.Actors and Institutions

Before the sector was reformed in the 1990s, the Pakistani government owned all of the electricity industry. Under the purview of the Ministry of Power and Water, two vertically integrated state-owned entities, the Water and Power Development Authority (WAPDA) and Karachi Electricity Supply (KE), were responsible for electricity generation, transmission, and distribution (Bacon, 2019, p.11). With the reform of the electricity industry, Pakistan's power market was now open to private investors. At the same time, WAPDA and KE, the two vertically monopolistic enterprises, experienced large-scale unbundling and privatization. The unbundling of WAPDA in the 1990s resulted in 12 state-owned corporations including several generating companies, one National Transmission and Dispatch Company (NTDC) and a set of regional distribution companies (DISCOs) (Bacon, 2019, p.14). Later, NTDC's Central Power Purchase Authority (CPPA) was in charge of new Power Purchase Agreements (PPAs) and acted as a single buyer of purchasing power from various generating companies and then sold the electricity to the DISCOs. KE was privatized in 2005 by being sold to the private sector (Bacon, 2019, p.15).

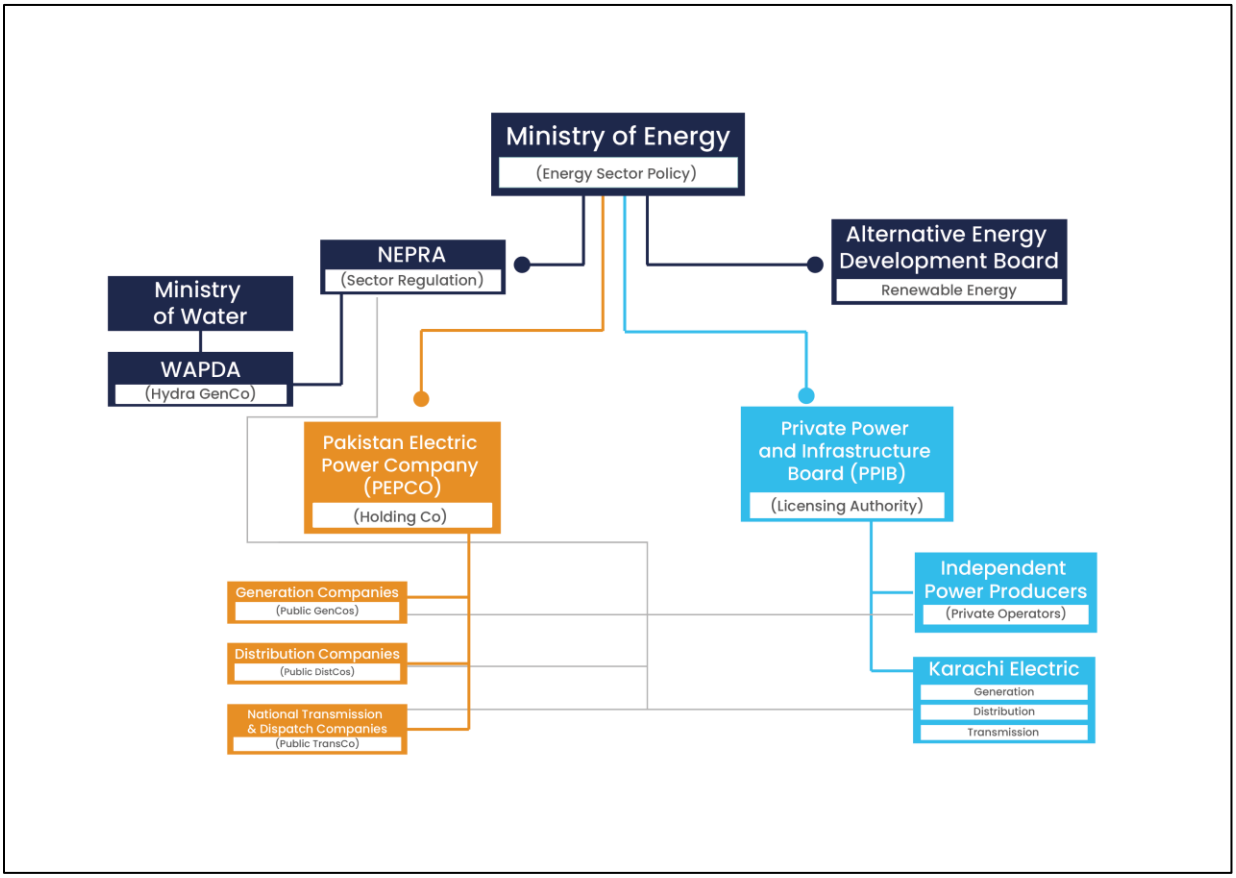

Figure 17: Organization Structure of Pakistan's Power Sector, 2017
(Source: Bacon, *2019*, p.22)

Meanwhile, a new regulatory institution – the Private Power and Infrastructure Board (PPIB) – was created to accomplish a wide array of functions ranging from providing "guarantees to private investors for the performance of government entities" to negotiating "the implementation agreement" and assisting "the regulatory authority in determining and approving tariffs for new private power projects" (Bacon, 2019, p.12). The authority of PPIB is specific to independent power producers (private operators) and KE. After the establishment of the PPIB, a sector-level regulator – the National Electric Power Regulatory Authority (NEPRA) – was then created in 1997. NEPRA was responsible for "granting licenses for generation and distribution" and the task of "calculating generation, transmission and distribution tariffs on a revenue requirement basis" (Bacon, 2019, p.14). Note that the tariff calculated by NEPRA is higher than the one charged by DISCOs, and DISCOs are subject to the decision of the Ministry of Water and Power (MOWP) (Bacon, 2019, p.20). Again, it demonstrates Islamabad's tactic of using subsidies as an exchange for political popularity. In addition to PPIB and NEPRA, a third regulator – the Alternative Energy

Development Board (AEDB) – was created in 2003 to manage renewable electricity projects. Finally, in 2017, "a separate Ministry of Water Resources was created and WAPDA was placed under it while all aspects of power are now under the Ministry of Energy" (Bacon, 2019, p.21). Figure 17 visualizes the current organizational structure of the governance system of Pakistan's power sector.

An introduction to Pakistan's electricity system would be incomplete if we overlook how electricity projects are regulated by the country's environmental agencies. After the 18th Constitutional Amendment passed in 2010, both federal and provincial governments concurrently manage environmental affairs. At the federal level, the Ministry of Climate Change (MoCC) is responsible for handling the environment. In particular, "climate-related policies and frameworks are constituted by the MoCC at the federal level and from there drop down to the provincial and district level" (World Bank, 2019, p.37). The Pakistan EPA (PAK-EPA) is under the administrative control of MoCC. This federal agency acts as the "technical, legal, and enforcement arm" of MoCC. After 2010, Pakistan devolved environmental regulatory authority to provincial EPAs, while Pak-EPA's authority is limited to the Capital Administration Division (World Bank, 2019, p.37). As most responsibilities of environmental management were handed to provincial EPAs, this reform has introduced considerable variation in the level and quality of environmental regulation across provinces (World Bank, 2019).

Both PAK-EPA and provincial EPAs suffer from inadequate administrative capacity and are exposed to external political interference. For PAK-EPA, this is evident from its budget allocation from the central government. The share of the federal budget going to the environmental division averaged around 0.1% between 2010 and 2018 (World Bank, 2019, p.41). According to the civil society group Heinrich Böll Foundation, the lack of capacity within provincial EPAs makes procedural delay a prevalent problem. For instance, "there may be nearly 2500 EPAs pending decision with the Punjab government" (Heinrich Böll Foundation, 2017). As a result, these regulators struggle with effective enforcement of environmental regulations. For example, a 2019 World Bank report notes a "lack of political will to regulate industry or to do any form of compliance monitoring" (World Bank, 2019, p.45) as well as a generally permissive EIA process: "Due to EPA's technical deficiencies, there are some critical inefficiencies in the system that makes project proponents—both public sector and private—to go through a weak EIA process that grants approval to low quality reports and the implementation of inadequate EMPs" (World Bank, 2019, p.43). The report goes on to observe that while the most projects do submit EIAs in order to

receive Notices of Commencement (NOCs) from the EPA, the "absence of follow-up monitoring is one of the most important reasons behind the low level of implementation of the EIA/IEE reports" (World Bank, 2019, p.47). Likewise, a 2015 United Nations Environmental Programme report indicates, "in most of the cases Environment Protection Departments (EPD)/EPAs do not conduct any monitoring after the award of a punishment … in most cases, if any Government Agency is involved, EPD/EPAs do not bring the case in the ET (Environmental Tribunals)" (Khan, D.M., 2015, p.194).

II.Characteristics of Pakistan's Power Sector

Pakistan has been inflicted by a grave electricity crisis since the late 1970s (Khan, D.M., 2015, p.180). To date, around one-fourth of Pakistan's population has no access to electricity. In addition, blackouts are pervasive - electricity supply would be turned off for 12-14 hours in cities and load shedding occurs for 16-18 hours in rural areas (Arshad and O'Kelly, 2018, p.158). The electricity blackouts have had a deep negative impact on the country's economic growth (Khan, D.M., 2015, p.181) and caused violent protests in 2011, 2012, and 2013 (Bacon, 2019, p.17). In the 2013 election, the issue of electricity shortages became one of key discussion topics among the contestants for prime minister. Using the slogan "Bright Pakistan", Sharif won the 2013 election by blaming the previous administration's failure to overcome the power shortages and promised to resolve the energy crisis (Downs, 2019, pp.13-14).

Pakistan's energy crisis is rooted in the country's political economy structure and partial reforms of the power sector which further exacerbated an already dismal situation. First and foremost, the Pakistani government employs subsidized electricity provision to appeal to the popular support, just like Indonesia. In particular, electricity prices charged by DISCOs are lower than "the cost recovery tariff as calculated by NEPRA" (Bacon, 2019, p.16). However, unlike Indonesia, the Pakistani government usually does not enjoy adequate fiscal capacity to pay for these subsidies. These subsidy payment arrears result in the so-called "circular debt" – The Central Power Purchasing Agency (CPPA) cannot pay power supply companies. These generators in turn cannot pay for fossil fuel suppliers. Prevalent load shedding is a direct result of this serious circular debt problem. For example, in 2012, tariff and subsidy issues accounted for 26.84% (234.2 billion rupees) of the total circular debt (872.4 billion rupees) (Bacon, 2019, p.17, Table 1).

Subsidy payment arrears are caused by the Pakistani government's inability to raise revenues. In other words, Pakistan's weak state capacity renders an extremely fragile fiscal system that cannot

afford a subsidized electricity provision. The taxation system is plagued by tax evasion and fraud. For example, in 2009, corruption of the Internal Revenue Service alone cost the government more than US$ 6 billion, which was higher than "the combined losses of the entire state-operated-enterprise sector" (Khan, D.M., 2015, p.190). This fragile tax system is also vulnerable to capture by elites. Many Pakistani legislators, members of cabinet, and presidents did not pay any income tax at all. In fact, between 2009 and 2012, only 270,000 out of the entire population (180 million) paid taxes to the federal government (Khan, D.M., 2015, p.189).

Second, the energy crisis in the power sector is also aggravated by the extensive use of imported oil to generate electricity since the 1990s. For instance, as Figure 18 shows, in 2014, oil comprised almost 39% of all electricity fuels in Pakistan and it cost the country US$ 14.7 billion to import (Valasai et al., 2017, p.737). In contrast, coal only constituted 0.2% of total electricity generation in 2013-2014 (Mirjat et al., 2017, p.114). However, the cost of electricity generated by oil is much higher than that of coal. During the fiscal year 2014, "the average generation cost of electricity produced from residual fuel oil was four times higher than that of coal" (Downs, 2019, pp.18-19). The dominance of imported oil in Pakistan's electricity generation mix originated in the mid-1990s when the Pakistani government initiated a partial reform of the stagnant power sector (Bacon, 2019, pp.12-13). To mitigate against severe power shortages that emerged in the 1980s, the government turned to an expedient approach to reform the power sector. In particular, the 1994 National Power Policy created a set of policies to encourage the participation of private investors into the closed power sector. Among these policies, the one with the most far-reaching consequences is one which allowed these new entrants to choose the fuel for the power plant (Bacon, 2019, pp.12-13; Downs, 2019, pp.12-13). Given the low international price of oil in the mid-1990s and "the policy favored developers who were willing to build plants that could be brought online first" (Bacon, 2019, p.13), many developers built oil-based plants. This 1994 reform led to an oil-heavy power generation mix that has persisted until today. Although increased private investments resulted in almost 45,00 MV additional generation capacity, the heavy dependence on imported oil makes the electricity generation much more expensive than coal-based projects.

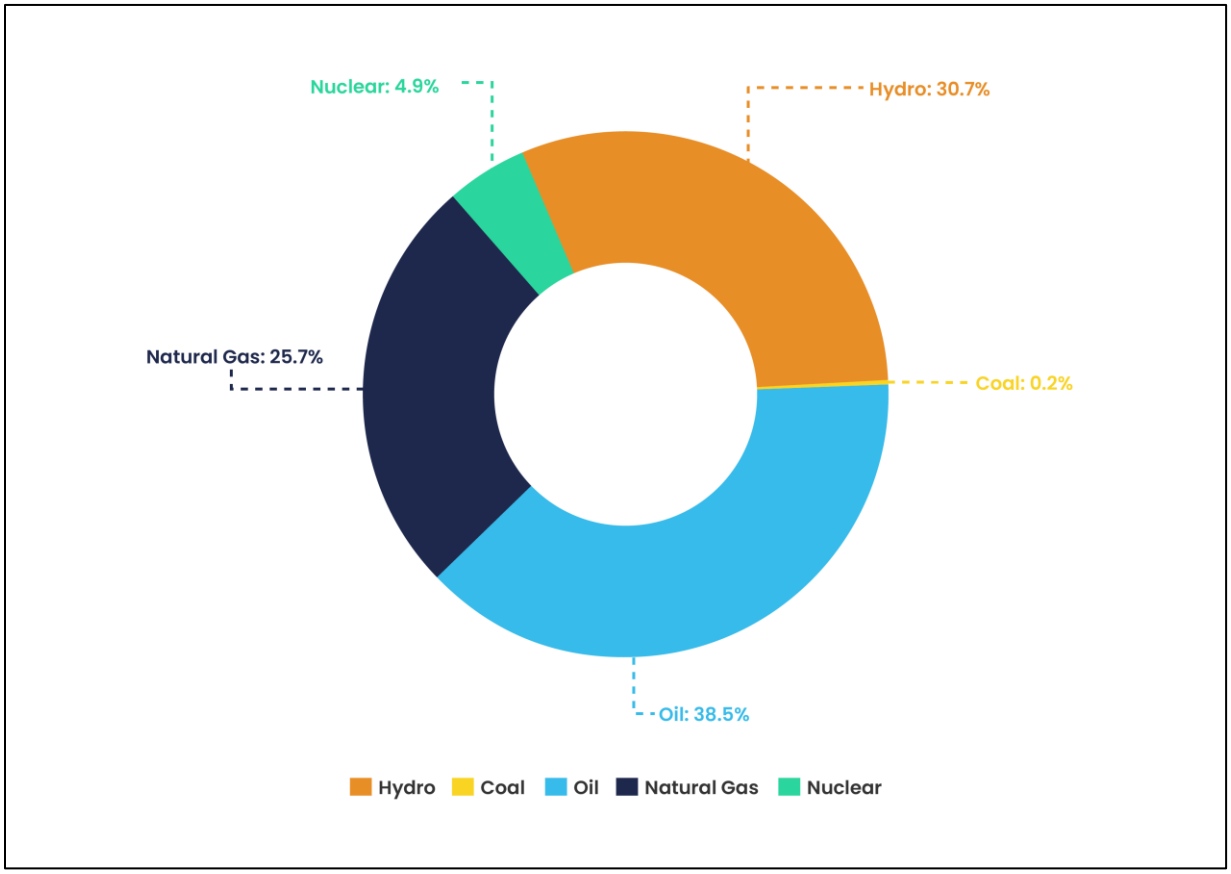

Figure 18: Technology Mix of Electricity Generation in Pakistan (2014)

Third, non-collection or unpaid bills from customers is an important cause of the electricity crisis in Pakistan. In 2012, non-collection comprised 11.54% (100.7 billion rupees) of the total circular debt (872.4 billion rupees) (Bacon, 2019, p.17, Table 1). These unpaid bills are not limited to private entities. For example, in fiscal year 2012-2013, of the total non-collection from customers (PKR 330 billion), 40.3% of them came from the public sector (Khan, D.M., 2015, p.186). Furthermore, it seems that this non-collection issue is also relevant to commercial efficiency of the distribution companies. While some companies are able to maintain a high percentage of bills collected, others suffer from a low recovery percentage (Bacon, 2019, p.37, Table 12).

4.3 How Supply and Demand Factors Shape Chinese Engagement

Compared to Indonesia, the formulation and implementation of China's electricity projects in Pakistan are more politically driven and better institutionalized. These two features largely reflect the nature of China-Pakistan relations. As Adeney and Boni (2021, p.10) note, "China's relations

with Pakistan were primarily channeled through the Pakistan military, and the security relationship was the backbone of China-Pakistan relationship writ large." From the perspective of the Chinese government, the Sino-Pakistan axis is crucial for achieving three strategic goals: counterbalancing the influence of India (Small, 2015, pp.47-65), strengthening China's control over its restive borderland – Xinjiang (Small, 2015, pp.67-91), and ensuring a permanent maritime facility in the Indian Ocean (Miller, 2019, p.178; Markey, 2020, p.48).

However, China was never a major *economic* investor in Pakistan before 2014-2015. Instead, Chinese engagement with Pakistan was mainly through foreign aid. According to Rafiq (2017, p.49), "Pakistan was the second-largest recipient of pledged assistance from China" from 2001 to 2014. Only with the advent of the China-Pakistan Economic Corridor (CPEC) did China become the country with the largest foreign investments in Pakistan (He, 2019, p.77). After 2013, Beijing decided to pour vast amounts of money on infrastructure projects in Pakistan both to promote economic development as well as to further their security interests. Even if many of these investments are not economically sound, the Xi Jinping administration views CPEC as politically appealing. CPEC projects are branded as the "flagship" of the BRI, and therefore the Chinese side is willing to bear high risks and unanticipated costs associated with these mega-projects. In fact, for a majority of Chinese SOEs under the purview of the State-owned Assets Supervision and Administration Commission, they suffer losses when doing business in Pakistan. However, a common mindset of these SOEs is to make fewer losses rather than earn more money since participation in CPEC is a mandate imposed by the Chinese state (Interview with a Chinese expatriate official journalist in Pakistan, 12/25/2020). According to Miller (2019, p.176), "government officials working on the Belt and Road project privately admit they expect to lose 80% of their investments in Pakistan."

The dynamics of CPEC involves constant contestations, negotiations, and coordination between a host of actors in both China and Pakistan, making CPEC a moving target (Adeney and Boni, 2021). Simply put, the CPEC life cycle entails three stages. In the first stage, Chinese-backed projects mainly concentrate in roads, highways, and railways. In the second stage, CPEC's investment priority turns to large-scale energy projects, including power plants. In the third stage, industrial parks tend to attract more Chinese investments than other types of projects. This dynamic is not predetermined by a well-planned grand strategy formularized at the top leadership level. In contrast, the whole process is shaped by unexpected events and constant power struggles

between a variety of domestic and transnational actors (Interview with a researcher affiliated with the Chinese Academy of Social Sciences, 12/21/2020).

Power plants account for the bulk of CPEC's earlier projects as Pakistan suffers from chronic electricity shortages. More specifically, during CPEC's first phase, "of the total $46 billion initially projected by Pakistani officials, $34 billion was slated for power projects" (Markey, 2020, p.57). After Sharif's victory of the 2013 election, he immediately turned to China to seek their investment in Pakistan's power sector (Downs, 2019, pp.13-14) which Beijing was willing to sponsor due to the aforementioned geopolitical and security interests (Interview with a Chinese Academy of Social Sciences researcher, 12/21/2020; Interview with a Chinese expatriate official journalist in Pakistan, 12/25/2020).

China's electricity projects are under more institutionalized regulatory authority in Pakistan than in Indonesia. As CPEC projects serve China's geopolitical interests, Beijing coordinates with Islamabad to design, steer, and oversee them. In particular, CPEC's Joint Cooperation Committee (JCC) – "a joint consultative and planning process between China's National Development and Reform Commission and Pakistan's Ministry of Planning, Development, and Reform" (Markey, 2020, p.48) – is established to manage China-funded megaprojects. Below CPEC-JCC, there are several specialized bilateral joint working groups. According to Rafiq (2017, p.32), "at the bilateral level is coordination and consultation between Pakistani and Chinese companies, both state owned and private. In December 2016, all of Pakistan's provincial chief ministers were included at the China-Pakistan JCC meeting." In addition, there are regular meetings between ministry-level officials from both countries to discuss a variety of project-related issues. This routinized cross-national exchange of information strengthens the supervisory capacity of government-level stakeholders (Interview with a Pakistan's PPIB official, 10/02/2020).

CPEC-JCC can include or exclude projects from a list of actively promoted projects (Safdar, 2021, p.18). As Rafiq (2017, pp.18-19) documents, many power plants such as one in Gadani and another in Jhelum were removed from the list because of excess cost, logistics issues, and feasibility studies. Under this transnational coordination, there are a host of policies implemented by the Pakistan government to facilitate Chinese investments in Pakistan's power sector. For instance, NEPRA offered a dollar-indexed return ranging from 17% to 20% for new power plants in 2014 (Safdar, 2021, p.17). The Finance Ministry "is obligated to create a revolving fund equal to 22 percent of the monthly invoicing for CEPC electricity projects to ensure seamless repayment of Chinese independent power producers" (Rafiq, 2017, p.45).

The more institutionalized regulation of Chinese-backed projects in Pakistan deeply shapes how they operate, especially regarding their choices of plant technology. Chinese project developers have discretion in choosing which type of technology (i.e., sub-critical versus super-critical) would be used for their coal power plants (Interview with a Pakistan environmental NGO manager, 04/16/2021; Interview with a Chinese expatriate manager who worked for a major Chinese electricity project in Pakistan, 04/16/2021). The choices of these developers are to a certain degree determined by two factors that are closely related to the transnational governance system of Chinese power projects in Pakistan.

First, Beijing makes substantial efforts to enforce environmental standards on its projects, unlike in Indonesia. Chinese overseas power companies need to go through the approval processes in *both* Pakistan and China when it comes to get environmental impact evaluations for their proposed projects. The Chinese standards are even more stringent than the World Bank and IFC (Interview with a Pakistan's Private Power and Infrastructure Board (PPIB) official, 10/02/2020). Chinese developers in Pakistan thus have a stronger motive to adopt more environmentally friendly technologies since the Chinese government imposes more stringent environmental standards on them (Interview with a Chinese expatriate manager who worked for a major Chinese electricity project in Pakistan, 04/16/2021). In fact, Chinese coal-fired plants are required to install an automatic digital monitoring system on daily air pollution emissions although local environmental regulatory offices in many places often lack technological capacities to effectively keep track of this data (Interview with a Chinese environmental NGO manager, 12/28/2020).

To improve its capacity in overseeing electricity projects in Pakistan, Beijing also maintains an institutionalized channel to acquire information from the Pakistani side. In particular, there is "a joint consultative and planning process between China's National Development and Reform Commission and Pakistan's Ministry of Planning, Development, and Reform" (Markey, 2020, p.48M). In addition, there are regular meetings between ministry-level officials from both countries to discuss a variety of project-related issues. This routinized cross-national exchange of information strengthens the supervisory capacity of government-level stakeholders (Interview with a Pakistan's PPIB official, 10/02/2020). Under closer scrutiny by the Chinese government, Chinese companies pay more attention to their environmental performance in Pakistan.

Second, a Chinese coal plant is more likely to apply less environmentally damaging technology when its generation capacity is larger than a certain threshold (Interview with a Chinese expatriate manager who worked for a major Chinese electricity project in Pakistan, 04/16/2021).

The employment of these technologies becomes economically sound only for mega-projects. For example, ultra-super-critical technology requires an installed capacity of no less than 600MW (Personal communication with a Japanese researcher, 04/15/2021). A more institutionalized transnational governance system facilitates the construction of large-scale coal power plants by reducing transaction costs associated with these projects. In particular, the Chinese and Pakistani government coordinate with each other to streamline the review and approval process of CPEC power plant projects (Interview with an AEDB official in Pakistan, 10/09/2020). Moreover, Islamabad provides a government guarantee to ensure commercial returns of CPEC projects and the Chinese side requires Sinosure to issue state-backed insurances to these CPEC projects (Interview with a Chinese environmental NGO manager, 12/28/2020). As a result, Chinese companies are more willing to invest in massive infrastructure projects in Pakistan and Chinese coal-power developers are more willing to install more environmentally friendly technologies.

I.How Supply and Demand Factors Shape Chinese investment in Coal Power

Downs (2019) provides ample evidence of how the Pakistani government proposed a number of coal-fired power plants projects and actively sought China's financial assistance to construct these projects. These efforts eventually resulted in the dominance of coal in the energy generation mix of power plants affiliated with CPEC.

Before the official announcement of CPEC in April 2015, Pakistan's energy policymakers had already attempted to attract international capitals to invest in coal power plants and exploit the country's abundant coal reserves in the Thar Desert (Downs, 2019, p.18). For instance, in then Pakistan Prime Minister Sharif's 2013 election manifesto, he proposed an idea of "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 year" (Downs, 2019, p.14). In July 2013, during Sharif's visit to China, he explicitly encouraged Chinese financiers including CDB and CHEXIM to sponsor the construction of coal power plants in Pakistan (Downs, 2019, p.14). According to Downs (2019), there is a set of pull factors in Pakistan that account for its preference for coal-fired plants. First, compared with oil, which was the most widely used fuel to generate electricity in the country, coal is much cheaper. For example, the generation costs for coal were around one-fourth of residual fuel oil in 2014 (Downs, 2019, p.19, Table 3). Second, the conversion of oil-fired power plants to coal-fired ones can save significant amounts of foreign currency reservation given that fuel oils are more expensive to import. Third, Pakistan suffers from an underdeveloped power grid to absorb intermittent electricity generated by solar and wind power stations. This challenge

is further exacerbated by a lack of adequate fiscal capacity to promote more costly renewable energy.

After the first comprehensive formulation of CPEC by both countries in 2013, between 2014 and 2016, the Pakistan government carried out two types of preferential policies to attract Chinese investments into the country's coal power sector. First, they issued sovereign guarantees to Chinese-involved power plants for "payments from the country's sole buyer of electricity – the Central Power Purchasing Authority (CPPA)" (Downs, 2019, p.35). Second, for PPAs, the Pakistan government set up favorable tariff policies for CPEC power plants. In particular, the Pakistan government adopted a two-part tariff system: the lump-sum fee and the per-unit charge. The lump-sum fee is capacity-based where Chinese project developers receive this part of the tariff regardless of whether the power plant has generated electricity or not. However, after 2016, the Pakistan government had suggested to revoke the two-part tariff system (Interview with a former officer of an international environmental NGO, 12/28/2020).

With these preferential arrangements, some Chinese-backed coal power plants are able to make money. For example, Port Qasim Coal Power Plant, which is constructed by PowerChina and Al Mirqab Group, earns money after operation (Interview with an expert on China's overseas electricity financing and investment, 12/27/2020). China's central SOEs enjoy significant advantages over private enterprises in securing their supply chains. In Pakistan, newly built coal power plants need to import coal from Indonesia and Australia and central SOEs can sign up for long-term purchasing contracts with coal suppliers. With these contracts, SOEs can buy coal at a lower price. However, only SOEs have capital, credit, and established business connections to get the deals done with foreign coal suppliers (Interview with a former officer of an international environmental NGO, 12/28/2020).

Although the Port Qasim Coal Power Plant is able to earn money, a majority of these CPEC projects are loss-making. However, supporting these projects is a political mission for central SOEs, thus their objective is not to maximize profits but minimize losses. Most SOEs under the supervision of SASAC were required to participate in CPEC projects in Pakistan (Interview with a Chinese journalist with long-term experiences with Chinese-backed projects in Pakistan, 12/25/2020). In addition, the Chinese state mobilized several central-level bureaucratic agencies to facilitate Chinese investments in CPEC projects. Sinosure provides state-backed insurance to CPEC power plants (Interview with a former officer of an international environmental NGO, 12/28/2020). NDRC plays a key role in coordinating with Chinese central SOEs and the Pakistani

side (Interview with a researcher affiliated with the Chinese Academy of Social Sciences, 12/21/2020). Technocrats from the National Energy Administration and Electric Power Planning Design General Institute have participated in the formation of Pakistani energy plans (Interview with a former officer of an international environmental NGO, 12/28/2020). The involvement of Chinese technocrats had a profound influence on the evolution of Pakistan's electricity sector after 2013. For example, the Pakistan government initially attempted to entice capital and technology from China to develop electricity projects that had been planned by the Pakistani side for many years. During this process, the Chinese side vetoed some coal-fired power projects proposed by Pakistan for economic and technical considerations (Interview with a former officer of an international environmental NGO, 12/28/2020).

CPEC experienced a new change under the current Khan administration. Prime Minister Imran Khan officially announced Pakistan would stop new coal power and that this policy would apply to CPEC projects. Our interview subjects indicated several reasons underlying this new energy policy. According to a researcher who is familiar with China's energy governance and climate policy, this shift is a part of China's efforts to promote carbon neutrality – which mainly serves the diplomatic interests of the Xi administration (Interview with a researcher affiliated with Tsinghua University, 12/16/2020). On the Pakistani side, it is suggested that the current Khan administration does not benefit directly from Chinese-sponsored coal-fired power plants. In particular, ruling families and oligarchs associated with the Khan administration mainly control other sectors of the Pakistani economy rather than the electricity sector (Interview with a Chinese journalist with long-term experiences with Chinese investments in Pakistan, 12/25/2020). Another interview subject notes that Pakistan's decreasing economic growth leads to a lower electricity consumption rate, which hinders further expansion of coal power investments. In addition, the opposition of local NGOs also plays an important role in the country's coal power exit (Interview with an officer of an international environmental NGO, 12/28/2020).

II. How Supply and Demand Factors Shape Chinese Investment in Renewable Power

Despite the dominance of coal in CPEC power plants' technology mix, over 25% of generation capacity is renewable power – 14% is hydro and 12% is wind and solar (Downs, 2019, p.16, Figure 1). Evidence shows that Pakistan turned to China for solar and wind power in the first place. For example, in 2012, then Pakistani Prime Minister Yousaf Raza Gillani suggested Chinese enterprises invest in wind power in Pakistan (He, 2019, p.106). In 2013, then Pakistani Prime

Minister Nawaz Sharif encouraged Chinese solar power companies to invest in Pakistan (He, 2019, p.110). Our interview subjects unanimously emphasize the key role of Pakistan's elites in formulating these renewable projects.

From Pakistan's perspective, Islamabad has strong incentives to promote the development of the RE sector because of the country's severe shortage of foreign exchange reserves (Interview with a Pakistan environmental NGO manager, 04/16/2021). As discussed above, Pakistan's electricity industry is mainly fueled by imported oil from the Persian Gulf. For instance, in 2014, oil comprised almost 39% of all electricity fuels of Pakistan and it cost the country US$ 14.7 billion to import (Valasai et al., 2017, p.737). The heavy reliance on oil imports causes a chronic underbalance of international payments. Moreover, this trade deficit further exacerbates Pakistan's foreign debt problem. In fact, "Pakistan drew on IMF funds in fourteen of the twenty-one years between 2000 and 2020" (Wingo, 2020, p.395). Different Pakistani governments periodically sought Beijing's financial support to "reduce the scale and urgency of another IMF bailout" (Markey, 2020, p.55).

The development of the RE sector had not been viewed by Pakistan as a way to save the country's reserve assets until 2010 (Interview with a Pakistan environmental NGO manager, 04/16/2021). Although Pakistan was eager to promote RE to reduce its excess reliance on imported fossil fuels, it still faced daunting barriers to attract investments in renewables at that time. As shown above, Pakistan does not enjoy a particularly favorable business environment for RE and foreign investors are quite hesitant to enter the country's RE market. Under this circumstance, Islamabad courted Chinese backers for financing RE projects given that the Chinese state prioritizes its geopolitical influences over concerns about commercial risks (Interview with an AEDB official in Pakistan, 10/09/2020). For example, when Beijing and Islamabad formulated CPEC between 2013 and 2015, several wind farms in Pakistan were re-branded as a part of CPEC since it is easier for CPEC projects to receive loans and insurances by Chinese financers than non-CPEC projects (Interview with an AEDB official in Pakistan, 10/09/2020).

Given the peripheral position of Pakistan's coal sector, the formulation of the country's first RE policy in the late 2000s did not encounter fierce political resistance from domestic energy production groups (Interview with an Alternative Energy Development Board (AEDB) official in Pakistan, 10/09/2020). Instead, the biggest challenge to promoting the RE sector lied in attracting domestic and international investors given considerable commercial risks associated

with RE investments (Interview with a Pakistan environmental NGO manager, 04/16/2021). As mentioned above, Pakistan eventually turned to China for sponsorship of these RE projects.

Unlike Indonesia, Pakistan opened its domestic electricity market to foreign investors and allowed external actors to hold a majority of shares (He, 2019, 7.15). One of Pakistan's major clean energy projects developed by China's ZTE, the Quaid-e-Azam Solar Park, is losing money after its operation in 2016. This naturally discourages the entry of other Chinese solar power project developers (Interview with an expert on China's overseas electricity financing and investment, 12/27/2020). The Quaid-e-Azam Solar Park is losing money despite the strong policy support of the local Punjab government, for example the appropriation of land for park construction. (Interview with an officer of an international environmental NGO, 12/18/2020).

China's investment volume in Pakistan's wind farms is much smaller than that of the solar park. For example, for the Dawood Wind Power Project, it costs around $115 million while the Quaid-e-Azam Solar Park is expected to cost investors $1.5 billion. As a result, although many wind farms can either attract funds from Chinese commercial banks (for instance, the Dawood Wind Power Project is financed by the Industrial and Commercial Bank of China) or capital from private institutions (e.g., the UEP wind farm borrows money from the United Energy Group and Orient Group Investment Holdings), China's two major policy banks provide financial support for the solar park.

It should be noted that none of these clean energy projects is contracted with Chinese companies as Engineering, Procurement, and Construction (EPC) projects. In contrast, Chinese actors either use equity investment or Build-Own-Operate (BOO)/ Build-Operate-Transfer (BOT) as the contract modality. In general, Chinese electricity investors prefer EPC to BOO/BOT or equity investment since the former is less risky than other types of business deals (Interview with an officer of an international environmental NGO, 12/19/2020).

4.4 Project-level Case Studies

We chose the Port Qasim coal-fired power plant and Quaid-e-Azam Solar Park (QASP) for our project-level case studies. The reasons are threefold. First, this approach enables us to capture differences between coal-fired and renewable power plants in Pakistan. With a detailed comparison between the two, we are able to have a better understanding of the heterogeneous dynamics within Chinese-backed BRI projects. Second, both cases constitute important components of Pakistan's electric sector. The Port Qasim power plant is one of the largest coal-

fired power stations in the country while QASP hosts three of Pakistan's four largest solar farms. Third, the project processes of the two cases involve distinct constellations of Chinese and Pakistani actors, thereby supplying factual information on the diverse preferences and strategies of these BRI stakeholders.

Our project-level case study shows cross-country differences between Indonesia and Pakistan with regard to how major stakeholders from China and recipients' interplay with each other during the BRI process. First is the level of governmental support. On the one hand, national leaders from China and Pakistan indicated their support for Port Qasim coal-fired power plant and QASP. On the other hand, official endorsements from the central government are absent in the two cases of Indonesia. This distinction implies that geopolitical interests play a more vital role in Chinese electricity investments in Pakistan. Second, Pakistan is a more active player in the development of solar power than Indonesia. Moreover, we also observe that the Chinese developer of QASP is willing to incur financial costs even if the tariff policy by the Pakistani regulator is not particularly encouraging. Third, although Indonesia's domestic vested interests in coal (e.g. local mining companies and PLN) exert influential impacts on BRI projects such as PLTU Sumsel-1, we do not witness the presence of such interest groups in formulation and implementation of coal-fired plants in Pakistan.

4.4.1 Port Qasim Coal-Fired Power Plant

In this project-level case study, we first introduce background information about the Port Qasim power plant with a focus on why this project is important for Pakistan's electric sector. Then we describe how this project was formulated and implemented and the key actors who participated in the project from both China and Pakistan. Finally, we discuss both environmental and social concerns associated with the power plant.

I.Background Information

Port Qasim power plant is a 2 x 660MW (1.32GW) coal-fired plant. It is located approximately 37km southeast of Karachi in the Sindh Province. The project is under the CPEC framework - a

flagship megaproject of BRI.[100] The Port Qasim Power plant is in fact one of the biggest energy projects under CPEC.

The plant is using super critical technology (Downs, 2019, p.33), and it relies on high-quality coal imported from other countries. Since domestic coal from the Thar Desert contains too much sulfur and lime, these coals are difficult to meet the quality standards for using the super critical technology. The coal used to fuel the plant is mainly imported from Indonesia (sub-bituminous, 50%), South Africa (bituminous, 25%), and Australia (coking and thermal coal, 25%) (Khayyam and Nazar, 2021).

The Port Qasim plant plays a key role in Pakistan's energy industry. First, it generates a considerable amount of electricity to satisfy growing the demand in the country. The total amount of electricity generation in 2020 is over 9 billion kWh, with the cumulative generating capacity exceeding 20 billion kWh since it was connected to the national grid in 2017.[101] The amount of generated electricity by the power plant can support more than four million local families' daily power consumption. Therefore, this project is particularly important given the prevalent energy supply shortage in Pakistan, especially during the COVID-19 pandemic.

Second, the Port Qasim plant plays a central role in Pakistan's electricity system. According to PowerChina Resources Chairman Sheng Yuming, the amount of annual power generation of Qasim Power Plant accounts for one-tenth of the total capacity of Pakistan's national grid, and it is designed to operate for at least 30 years.[102] With the increase of local electricity supply, the tariff for power purchasers and the price for end users (8.12 US dollar cents as NEPRA approved) in Pakistan can be reduced. A price reduction in the tariff would also facilitate more sustainable economic and social development in the country.

Thirdly, the Port Qasim plant created more than 6,500 jobs in its construction phase, and 1,278 jobs in the operational phase (Muzammil Zia, Waqar, and Rashid, 2018). Consequently, the plant

[100] A bushy-bearded Pakistani who serves Qasim power plant -- CPEC role model, 2021, http://pk.chineseembassy.org/eng/zbgx/t1886116.htm

[101] The CPEC Portal, May 27, 2020, Port Qasim power plant's generating capacity increases amid COVID-19, accessed from http://cpecinfo.com/port-qasim-power-plants-generating-capacity-increases-amid-covid-19/

[102] Staff Reporter, May 10, 2019, Port Qasim power plant added 10bn units to national grid in one year, *Daily Times*, https://dailytimes.com.pk/391317/port-qasim-power-plant-added-10bn-units-to-national-grid-in-one-year/

had a strong positive impact on the local economy.[103] Since 2016, the plant has hired more than 150 Pakistani university graduates and there are more than 600 local employees working to maintain and operate the power plant, accounting for more than 60% of the plant's total workers.

During the COVID-19 pandemic, the precautionary measures taken by the Port Qasim power plant is a model to follow. There hasn't been a single case as of June 2020, and the operator provides employees with free PPE such as masks and sanitizers.[104]

II. Project Life Cycle and Key Actors

As early as 2013, China and Pakistan formulated the idea of building the Qasim Port project, which was then listed on the "China-Pakistan Economic Corridor Early Harvest List". It was one of the few projects that had been given the priority under CPEC. In April 2015, President Xi Jinping made an important state visit to Pakistan to elevate China-Pakistan relations to an "all-climate strategic partnership". There were three agreements signed during that visit that were specific to the Port Qasim power plant: the Implementation Agreement, the Power Purchase Agreement, and the Land Lease and Port Service Agreement. These landmark agreements were reached after China conducted comprehensive research with experts at home and abroad and engaged in intensive negotiations with the Pakistani side.[105]

The onsite construction of the Port Qasim power plant started in May 2015 after the approval from both China and Pakistan in the same year. The whole project was completed two months ahead of schedule (Unit 1 in Fall 2017 and Unit 2 in Summer 2018). The original plan of connecting to the national grid encountered small twists and turns. In the early stage of the project, the progress was slow when it came to connecting the plant with the Matiari substation 180 km north. The project took an alternative approach - to connect with the Hubco Station 50 km northwest - to get synchronized with the national grid.

[103] Power Technology, May 22, 2020, Port Qasim Coal-Fired Power Plant, Karachi, https://www.power-technology.com/projects/port-qasim-coal-fired-power-plant-karachi/

[104] Kaswar Klasra, June 11, 2020, Outbreak poses no impediment to power plant, *China Daily*, http://obor.nea.gov.cn/detail2/13027.html

[105] 中国政府采购网, June 21, 2017, 巴基斯坦卡西姆港燃煤电站PPP项目, accessed from http://www.ccgp.gov.cn/ppp/gj/201706/t20170621_8410859.htm

The Qasim plant has been operational since early 2018.[106] It is operated by a jointly financed greenfield company called Port Qasim Energy Holding on a "Build-Own-Operate" (BOO) basis.[107] The plant is jointly owned by China's Power Construction Corporation (51%) and Qatar's Al-Mirqab Group (49%)[108]. China's Power Construction Corporation, shorted as PowerChina, is one of the biggest state-owned companies in China. It's involved in over 100 countries for energy, construction and infrastructure projects.[109] Al-Mirqab Group is an investment firm in Qatar, privately owned by Hamad bin Jassim bin Jaber Al Thani, Qatar's former prime minister, and his family members.[110]

Chinese companies not only engage in the financing and operation of the Port Qasim power plant, but also participate in the supply of hardware equipment and other services. For example, the boilers were supplied by Harbin Electric, while the generators were provided by Dongfang Electric Corporation (DEC). Also, several Chinese companies were awarded subcontracts.[111]

- Site selection and site survey: SEPCO III Electric Power Construction (SEPCO III) and Hebei Electric Power Design and Research Institute (HBED)
- The engineering, procurement and construction (EPC) contract for the coal unloading jetty and channel: Sinohydro Harbour
- Management consulting (supervision) services contract for the coal unloading jetty: Consultant and Construction Supervision (a subsidiary of CCCC Second Harbor Consultants

Financing was approximately US$2.085 billion with a 25:75 equity to debt ratio. The loan was provided by the Import-Export Bank of China (China EXIM Bank). The project achieved a financial closure of $1.9 billion in December 2015. Note that the Pakistan government agreed to

[106] CPEC Authority, Energy Projects under CPEC, accessed from http://cpec.gov.pk/progress-update

[107]Global Energy Monitor Wiki, Port Qasim EPC power station, accessed from https://www.gem.wiki/Port_Qasim_EPC_power_station#cite_note-12

[108]Power Technology, May 22, 2020, Port Qasim Coal-Fired Power Plant, Karachi, https://www.power-technology.com/projects/port-qasim-coal-fired-power-plant-karachi/

[109] Power Construction Corporation of China Ltd. (POWERCHINA, accessed from

https://www.devex.com/organizations/power-construction-corporation-of-china-ltd-powerchina-64594

[110] Al Mirqab Capital, see https://www.dubaibeat.com/firms/al_mirqab_capital/

[111]Power Technology, May 22, 2020, Port Qasim Coal-Fired Power Plant, Karachi, https://www.power-technology.com/projects/port-qasim-coal-fired-power-plant-karachi/

set up a reserve account from its revenue to guarantee 25% of the payables, ensuring that the Qasim plant can operate even if the electricity price drops.

III.Environmental and Social Impacts of Qasim Coal-Fired Power Plant

The Sindh Environmental Protection Agency (SEPA) approved the environmental impact assessment for the plant in June 2014.[112] PowerChina claimed that their plant is one of the greenest energy projects in Pakistan, and it was even awarded the Pakistani Environmental Protection Excellence Award in 2018.[113] The Qasim power plant applies some international standards such as sea water desalination, noise control, wastewater treatment, desulfurization and dust removal.[114] It also pays attention to the protection of mangroves. The area of transplanted and planted mangroves is equivalent to 5 times the area removed.[115]

While an article from the official Chinese Embassy website claims that public hearings and advanced environmental protection technology protects local residents' interests, the reality is more complicated. There are both environmental and social concerns on the Qasim power plant.

With regard to the environmental impacts on local communities, citizens have expressed their worries about health problems caused by the operation of the power plant. Air pollutants from the stack are of primary concern and include respirable particulate matter (PM10 and PM2.5) , nitrous oxide (NOx), and sulfur dioxide (SO2). An evaluation of health impacts of localized air pollution shows that the emissions from the Qasim power plant without fully operational pollution control technologies could cause additional attributable mortality from strokes, ischemic heart disease, and chronic obstructive pulmonary disease (Radford, et al., 2021).

Second, some local environmental NGOs and fishermen voiced their opposition to this project. According to its public report, the Qasim power plant does not have an ash disposal system, and the coal leakage could hurt the coastal ecosystem heavily, which negatively affects the fishing

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[112] He Shiyou, October 1, 2018, Port Qasim Coal-fired Power Project Special Report on CPEC Projects (Energy: Part 7), see http://pk.chineseembassy.org/eng/zbgx/CPEC/t1627103.htm

[113] Staff Reporter, May 10, 2019, Port Qasim power plant added 10bn units to national grid in one year, *Daily Times*, https://dailytimes.com.pk/391317/port-qasim-power-plant-added-10bn-units-to-national-grid-in-one-year/

[114] 中国人民大学重阳金融院, 2016, 中巴经济走廊实地调研报告, p.10, http://www.rdcy.org/upfile/file/20170628160932_94303.pdf

[115] 中国政府采购网, June 21, 2017, 巴基斯坦卡西姆港燃煤电站PPP项目, accessed from http://www.ccgp.gov.cn/ppp/gj/201706/t20170621_8410859.htm

activity near Port Qasim. [116] According to the EIA report, the Qasim power plant could generate about 310,061 tonnes of fly ash and 54,871 tonnes of bottom ash annually. However, SEPA approved all the procedures within one month without requiring further documentation, future environmental studies, or suggested resolutions.

Third, the large amount of greenhouse gas (GHG) emissions may contribute to global climate change. In 2016, an environmental law attorney named Qazi Ali Athar filed a petition to oppose the construction of coal-fired plants like the Qasim power plant because of CO_2 emissions and their resultant environmental damage.[117]Although the emission factor of sub-bituminous coal is lower than most coal, it only makes up for 50% of the coal burnt at the plant. Calculations shows that the Qasim power plant is emitting 11,755.8 metric tons CO_2 per year, accounting for nearly 85% emissions among the coal-fired plants in Pakistan. If the Qasim power plant continues to operate like the other coal-fired plants, Pakistan may become one of the major CO_2 contributors in Asia (Khayyam and Nazar, 2021). It is worth noting that because of the COVID-19 outbreak, the import of sub-bituminous coal is more difficult than usual, and the alternative coal source to keep the power plant operating is domestic coal which is dirtier. The emission factors could be larger than it was pre-pandemic and the GHG emission could be worse.

In terms of social concerns, there were land acquisition and water supply disagreements about the Qasim plant project between the central government and the Sindh government in early 2016[118]. The land is made from a reclamation and the two governments had a dispute over the ownership and right of use of the land.[119] The Sindh government argued that unless the central government transferred part of the ownership to the Sindh government (or give some amount financial reimbursement), it could take back the right of use of the land anytime from the central government. On the other hand, the central government believed it had the right of use according to the 1973 constitution. The Sindh province insisted that the right only includes the Qasim Port

[116] Faiza Ilyas, July 7, 2014, Sepa ignores environmental concerns, approves coal power projects, *Dawn*, accessed from https://www.dawn.com/news/1117516/sepa-ignores-environmental-concerns-approves-coal-power-projects

[117]The Supreme Court of Pakistan, Rabab Ali *versus* Federation of Pakistan & Another, see http://climatecasechart.com/climate-change-litigation/wp-content/uploads/sites/16/non-us-case-documents/2016/20160401_Constitutional-Petition-No.-___-I-of-2016_petition-1.pdf

[118] Syed Irfan Raza, February 2, 2016 Centre, Sindh at odds over Port Qasim coal plant, *Dawn*, https://www.dawn.com/news/1236954

[119]中华人民共和国商务部, 卡西姆燃煤电站项目租地问题仍未解决, see https://coal.in-en.com/html/coal-2326836.shtml

not the power plant itself. After a long negotiation the issue was resolved before construction started.[120]

In addition, an overcapacity crisis for Pakistan has drawn increasing attention from the country's policymakers. According to Tabish Guahar, the special assistant to Prime Minister Imran Khan for the power sector, it is estimated that Pakistan could have as much as 50% too much electricity supply by 2023.[121] The Pakistan government agreed on contractually purchasing the electricity generated by the Qasim power plant at 8.12 US dollar cents per unit for 30 years after negotiation between NEPRA and the Qasim Power Plant Holding company.[122] This price is 47% higher than the current normal household electricity price in Pakistan.[123]

The Pakistan government is the only buyer and it needs to pay the Qasim power plant even if the electricity supply is way more than what is needed. This is a huge potential financial burden for the Pakistan government, especially with other similar power plants under construction. Also, as the Qasim power plant is connected to the national grid, the transmission and distribution quality is another issue to ultimately deliver the electricity generated. With limited infrastructure and an ineffective dispatch of electricity (Ullah, 2013), the power generated by the Qasim power plant is not the perfect solution to Pakistan's energy issue as blackouts are not disappearing.

4.4.2 Quaid-e-Azam Solar Park

This project-level case study first introduces basic information about the Quaid-e-Azam Solar Park (QASP), including its background, importance, and technology. Then we describe its project life cycle and how Chinese and Pakistani actors participated in the formulation and implementation of QASP. Finally, we discuss both the environmental and social consequences of QASP.

I.Basic Information

[120]中国人民大学重阳金融院, 2016, 中巴经济走廊实地调研报告, p.11, http://www.rdcy.org/upfile/file/20170628160932_94303.pdf

[121] Faseeh Mangi, January 27, 2021, Nation Plagued by Power Shortages Suddenly Has Too Much Electricity, *Bloomberg*, https://www.bloomberg.com/news/articles/2021-01-27/pakistan-struggles-to-tackle-an-unfamiliar-glut-of-electricity

[122]Power Technology, May 22, 2020, Port Qasim Coal-Fired Power Plant, Karachi, https://www.power-technology.com/projects/port-qasim-coal-fired-power-plant-karachi/

[123] Pakistan electricity prices, see https://www.globalpetrolprices.com/Pakistan/electricity_prices/

As discussed above, Pakistan's domestic energy demand is largely dependent upon imported oil. Consequently, this energy dependence leads to imbalanced trade, which creates a daunting challenge for the country's foreign exchange reserves. Under this circumstance, the Pakistani government has a strong incentive to encourage the development of the domestic RE sector. With the support of then Chief Minister Nawaz Sharif, Quaid-e-Azam Solar Park was initiated by the Government of Punjab to reduce excessive reliance on imported oil in electricity generation. This initiative also aimed to mitigate Pakistan's looming energy crisis.[124]

QASP is located in Lal Sohanra, Cholistan, in Bahawalpur. It is located at an altitude of 118m above sea level, with the coordinates of 29.394° N (latitude) 71.664° E (longitude).[125] The solar park's advantageous location in the Bahawalpur region exposes it to 3,201 hours of sunshine and 6,408MJ/m2 of radiation, annually. The vast expanse of flat desert helps the area receive 13 hours of sunlight every day. Moreover, the park's capital and operational expenses along with the construction period are considerably lower than thermal or hydropower projects of the same capacity. With a span of over 2,630 hectares (6,500 acres) and a total installed capacity of 1,000 MW, it is one of the world's largest solar power plants.[126] The project consists of three phases: Phase I - 100 MW, Phase II - 300 MW, and Phase III - 600MW. Phase I has been in operation since 2015. Phase II was connected to the grid in June 2016, and Phase III of the project is currently under construction.[127] QASP was the country's first solar power plant to be connected to the national grid. As a part of CPEC, QASP is also directly linked to China's BRI. The construction of the solar park project involved around 400 Chinese workers and over 2,000 laborers.[128]

Table 4: Installed capacities of the largest solar sites in Pakistan

Name of the Project	**Capacity (MW)**	**Location**	**Date of Completion**

[124] APP, January 29, 2016, Quaid-e-Azam Solar Park to get 900MW upgrade, *Tribune*, accessed from https://tribune.com.pk/story/1036656/a-shinier-future-quaid-e-azam-solar-park-to-get-900mw-upgrade

[125] The World Bank. July 2016. "Solar Resource Mapping in Pakistan", Site Evaluation Report, retrieved from https://documents1.worldbank.org/curated/en/797001468191331696/pdf/99418-REVISED-ESM-PUBLIC-Pakistan-Solar-Mapping-Site-Evaluation-Report-QA-SolaR-ESMAP-2014-06.pdf

[126] Belt and Road Initiative, Nov 12, 2018, "Quaid-e-Azam Solar Park", accessed from https://www.beltroad-initiative.com/quaid-e-azam-solar-park/

[127] In 2017, Zorlu Enerji Holding, a Turkish developed showed interest in developing an additional 100 MW solar site at the Quaid-e-Azam Solar Park. The interest was matched with a LOI issued by the government, that gave a go-ahead from project development.

[128] Belt and Road Initiative, Nov 12, 2018, "Quaid-e-Azam Solar Park", accessed from https://www.beltroad-initiative.com/quaid-e-azam-solar-park/

QA Solar Pvt. Ltd.	100	Quaid e Azam Solar Park, Bahawalpur	15th July, 2015
Appolo Solar Pakistan Ltd.	100	Quaid e Azam Solar Park, Bahawalpur	31st May, 2016
Crest Energy Pakistan Ltd.	100	Quaid e Azam Solar Park, Bahawalpur	31st July, 2016
Best Green Energy Pakistan Pvt. Ltd.	100	Quaid e Azam Solar Park, Bahawalpur	31st July, 2016
Harappa Solar Pvt. Ltd	18	Sahiwal	14th October, 2017
AJ Power Pvt Ltd.	12	Pind Dadan Khan	13th December, 2017

Optimum yield of photovoltaic systems mainly depends on installation parameters like altitude, tilt, orientation as well as geographic location like solar insolation and latitude of instillation site.[129] Studies have found that dust has significant influence on PV systems performance in terms of efficiency and performance, and the climate of the QASP covered by Cholistan desert makes it complicated for solar power generation.[130] The area of the solar park location has many large sand domes, and the environmental changes and rapid blasts of air storms that occur in summer time affect the performance of the photovoltaic systems and reduce the efficiency of the operating systems (Abbas et al., 2017, p.77). Continuous dust accumulation on the photovoltaics modules increases the loss of power output and module efficiency (Abbas et al., 2017, p.76). There is a noticeable difference between production of clean and dirty modules (Abbas et al., 2017, p.73). An experiment found the densities of dust accumulation on the surface of the photovoltaic module for June, July and August as 0.786 mg/ cm2, 0.681 mg/cm2 and 0.601 mg/cm2 respectively (Abbas et al., 2017, p.73). Accordingly, the average power output decreased by 22% for June, 16% for July and 18% (Abbas et al., 2017, p.79). Because rain is scare, the module cannot rely on rain

[129] Asad Khaliq, Ikram Ali, and Salman Muhammad. "Quaid-e-Azam solar power park: Prospects and challenges." In *2015 Power Generation System and Renewable Energy Technologies (PGSRET)*, 1
[130] Ibid.

to clean them, and regular cleaning must be done to minimize efficiency loss (Abbas et al., 2017, p.78).

Today, QASP houses the top four solar sites in Pakistan (see Table 4).[131] Since its inception, the solar power park has been in good operating condition due to the high quality of its facilities. The realized outcomes of QASP's electricity generation were consistently above the National Electric Power Regulation Authority's targets in 2015, 2016, 2017 and 2018.

II.Project Life Cycle and Key Actors

1. Initiation and Development of Phase I

The Punjab government opted to start with a 100 MW pilot project (Phase I) before constructing the complete capacity of 1,000 MW in Bahawalpur. Engineering Consultancy Services Punjab (Pvt) Ltd conducted the first feasibility study for the solar park and pilot plant. ILF Consulting Engineers of Germany served as technical consultants and the owner's engineer for the project. On behalf of the Bank of Punjab, Ingenieurpartnerschaft Obst & Ziehmann of Germany was hired as a technical consultant and engineer. Haidermota & Co. provided legal counsel and Grant Thornton provided financial advice. PV Lab - Germany evaluated all solar panels and inverters independently for quality and specifications at the production facilities and again at the Bahawalpur solar site, and TÜV SÜD Czech was appointed to check transformers and switchgears separately at the manufacturing plants prior to shipment.

A rigorous technical, commercial, and financial evaluation of foreign engineering, procurement and construction (EPC) contractors was completed in accordance with the Public Procurement Regulatory Authority (PPRA) guidelines. The analysis resulted in the pre-qualification of twelve major international EPC companies for bidding. The contract for Phase I construction of the 100 MW project was granted to the lowest qualified bidder, TBEA Xinjiang SunOasis Co. Ltd.. They received an EPC contract price of $131.15 million and a 25-year maintenance contract price of roughly $73 million - a total of $215 million. On April 4, 2014, the Letter of Acceptance was given, and the EPC and operation and maintenance (O&M) contract was signed on June 2, 2014. The contract provided a nine-month period to complete construction of Phase I. QASP was finally inaugurated by then Prime Minister Muhammad Nawaz Sharif on May 5, 2015, in a well-publicized ceremony in Bahawalpur. Not only was the project's construction and commissioning

[131] Alternative Energy Development Board, CURRENT STATUS OF SOLAR PV POWER PROJECTS, accessed from https://www.aedb.org/ae-technologies/solar-power/solar-current-status

completed on time and on budget, but there were no cost overruns. With no extra costs or delays, the overall cost remained within the contract price of $131.15 million.

As indicated above, a Chinese company, TBEA Xinjiang SunOasis Co. Ltd., participated in Phase I for EPC as well as O&M. TBEA is a growing leader in high-end power transmission and transformation equipment manufacturing. The company is committed to sharing China's modern electrical construction knowledge with the rest of the globe, as part of BRI. More than 70 countries, including the United States, Russia, Brazil, Mongolia, Tajikistan, Kyrgyzstan, Pakistan, and others, have received green technology and smart environment-friendly, stable, and efficient energy equipment from the company, which has provided turnkey project and systematic solutions ranging from survey to design, construction, installation, and debugging, as well as training, operation, and maintenance to promote the construction of green and efficient power supplies. TBEA SunOasis was qualified for the contract after a bidding process with 12 pre-qualified companies. Phase I's project was owned by Quaid-e-Azam Solar Power Limited (QASPL) (Waheed and Rana, 2020, p.3) QASPL is a public-sector-for-profit company, which was established in 2013 and wholly owned by the government of Punjab. Phase I was financed by the government of Punjab and the Bank of Punjab.[132]

The 100 MW Phase I layout consists of 392,160 solar panels that cover around 500 acres of land. The JA Solar Company was responsible for the production of the panels. The entire region is divided into 100 sections, each of which generates 1 megawatt of electricity. There are 13 rows of panels in each part, as well as a 1000 kVA rated power pad mounted transformer and two 500 kW capacity inverters. Ten rows have eight tables each, while the remaining three rows have six tables each. A table is a 40-panel configuration (2 strings of 20 panels). In order to join 16 or 12 strings in parallel, a combiner box is used. The power plant has an on-grid direct current (DC) system, where DC power from the solar panels is converted to alternating current (AC) power before injecting it into the national grid at a 132 kV grid station. This phase has the capacity to generate 150 GW/h every year - enough to light up 100,000 homes. The solar plant is under the supervision of the Punjab Power and Development Board (PPDB) and Alternative Energy Development Board.

2. Development of Phase II, legal issues, and controversies

[132] Belt and Road Initiative, Nov 12, 2018, "Quaid-e-Azam Solar Park", accessed from https://www.beltroad-initiative.com/quaid-e-azam-solar-park/

After the Phase I was completed, the construction of Quaid-e-Azam Solar Park was further divided into two more phases: Phase II – 300 MW and Phase III – 600 MW. Both remaining phases were developed by Zonergy Company Ltd, which acts as an EPC contractor. Zonergy is a Chinese energy conglomerate engaged in the development of solar and biomass energy and the cultivation of palm oil. Zonergy aims to put its resources towards a cleaner and greener Pakistan by ensuring the use of abundant natural resources available to generate energy that is sustainable and doesn't harm the environment. Zonergy Company Limited is a Chinese state-owned high-tech company created in 2007 with a registered capital of 1.29 billion RMB. Zonergy is well-known for its global expertise both in the renewable energy sector and outside of it. Its expertise includes solar PV modules, energy conservation and emission reduction, competitive advantages in green cloud computing, overseas agriculture, equity investment, biomass energy, palm oil, technical strength, and professional services. Many Zonergy branch offices and locally registered corporations can be found in provinces around China, Asia, and Africa. Although Phase II involved a significant controversy which is discussed in more detail below, this phase successfully installed three out of four largest solar sites of Pakistan. China EXIM Bank and China Development Bank provided funds for the development of the Phase II and III. A total of 3.125 billion Chinese Yuan was invested for the project.

Zonergy Limited promised to complete the Phase II project by June 2016. However, the deal was heavily criticized by the Water and Power Development Authority (WAPDA), which claimed that the deal was "shrouded in mystery" since the Letter of Intent (LOI) issued on behalf of the Punjab government was given without any process of transparent selection and competitive bidding.[133] On claims of the LOI violating the bidding protocol, WAPDA requested the court to cancel the LOI issued.[134] The petitioners' claims were based on two reasons –

- Incorrect bidding pathways – The project was being developed after bypassing Public Procurement Regulatory Authority (PPRA) rules which do not allow any public procurement without competitive bidding.
- Technical issues – The national grid would not be able to handle the integration of a 900 MW plant due to the fluctuating frequency of solar generation.

[133]Ahmad Faraz Khan, September 27, 2014, Punjab govt goes for 'dubious' power deal, *Dawn*, accessed from https://www.dawn.com/news/1134642
[134] Staff reporter, November 15, 2014, Award of solar park contract to Chinese firm challenged, *Dawn*, accessed from https://www.dawn.com/news/1144652/award-of-solar-park-contract-to-chinese-firm-challenged

Parallel to the issue of the LOI, the Punjab Energy Department sent a summary to the chief minister requesting that Zonergy Limited to be granted a lease of 6,000 acres to build the plant.

Based on documents demanded by the Supreme Court of Pakistan, the Punjab Power Development Board issued a letter to ZTE on September 23, 2014 to conduct a feasibility study of the 900MW solar energy project. Although a number of solar energy firms approached the state government, they were ignored for unknown reasons.[135] The Supreme Court of Pakistan exonerated the Punjab government and authorized Zonergy to proceed with the investment after a thorough assessment of the case.

3. Subsequent Progress of Phase III

Phase II and III was intended to be completed by 2016 and had an executive office appointed by the prime minister to oversee the development progress.[136] [137] Prior to the development of the first two phases, NEPRA agreed on a tariff of 14.15 cents per unit excluding taxes and reached an agreement on associated conditions and the project implementation schedule. This tariff was reported to be significantly lower than the market standard, as NEPRA's tariff at the time was 16.2 cents per unit, but the Chinese developer accepted it due to the project's economies of scale.[138]

The turning point was in December 2016, when NEPRA decided to go against the previously agreed unit prices by proposing to buy solar electricity from 14.15 cents to 9.25 cents per unit, citing falling costs for solar panels and other equipment. The decision came at a time when Zonergy finished 200 MW out of 300 MW of Phase II.[139] The price cut prompted multiple claims and questions from the Chinese developer, resulting in litigation over the reduction of the tariff which delayed completion of the project. Phase II was completed in June 2016, however construction on Phase III was stalled due to unforeseen legalities.[140]

III. Environmental and Social Impacts

[135] Tribune's Correspondent, October 14, 2014, Letter of interest: Punjab hiring IT firm for solar Project, *Tribune*, http://tribune.com.pk/story/773170/letter-of-interest-punjab-hiring-it-firm-for-solar-project
[136] Web Desk, June 27, 2015, Bahawalpur solar power park project to be completed by 2016: Punjab CM, *Tribune,* accessed from https://tribune.com.pk/story/910732/bahawalpur-solar-power-park-project-to-be-completed-by-2016-punjab-cm
[137] Staff reporter, July 1, 2015, Ahad assigned energy sector task, *Dawn*, https://www.dawn.com/news/1191552
[138] Zafar Bhutta, November 11, 2015, Tariff revision poses threat to solar power Project, *Tribune*, https://tribune.com.pk/story/988924/tariff-revision-poses-threat-to-solar-power-project
[139] Aamir Saeed, September 19, 2016, Solar scale-up in Pakistan hits roadblock after payments slashed, Reuters, https://www.reuters.com/article/us-pakistan-solar-energy-idUSKCN11P1IE
[140] APP, September 15, 2016, Quaid-e-Azam Solar Park Bahawalpur: Facts and Figures, *Times of Islamabad*, accessed from https://timesofislamabad.com/15-Sep-2016/quaid-e-azam-solar-park-bahawalpur-facts-and-figures

The Quaid-e-Azam Solar Power Park is expected to help Pakistan reduce its carbon footprint by displacing 57,500 tonnes of coal and cutting emissions by 90,750 tonnes per year. Pakistan's total carbon emissions increased by 123 percentage in 2015. These emissions are projected to increase by about 300 percentage by 2030 with the energy and agriculture sectors accounting for about 90 percentage of total emissions.[141]

The most recently available public report on the solar park's environmental impact has showcased positive results.[142] The assessment found that the development of the project was completed in accordance with all 18 of Pakistan's environmental protection acts. These include protective obligation for wildlife, archaeological sites, and protection of labor and child rights as part of the construction process.[143] The assessment concluded that the proposed project may have had a short-term impact on the environment during the construction phase while longer term impacts may be observed during the operation stage. Spatially the impacts were assessed over the 5 km radius of the project site.[144]

The assessment also requested the developers to select patches of land that were at least 500m away from any farm or populated settlement.[145]This would mitigate the hazards of water shortage and loss of vegetation in the area. Remarkably, the closest house was actually 5 km away from the site. Developers were also requested to discharge impurity laden wastewater into deep pits, rather than in the central sewage pipe.[146]

At the time of plant decommissioning, the developers and the government are required to safely segregate the solar panels into reusable, recyclable and non-recyclable waste. Further, a reputable third party waste handling team is required to be hired to dispose of the waste. The third party team would be approved by the environmental protection agency at the end of the park's plant life.[147]

The project also created many job opportunities across the region. With an operational capacity of 400 MW, it provides jobs to more than 2,000 Pakistani workers. Prior to the development of

[141] Zofeen T. Ebrahim, May 16, 2021, Is Pakistan preparing for a decarbonised world? *Dawn*, accessed from https://www.dawn.com/news/1623845
[142] Renewable Resources (Private) Limited, Initial Environmental Examination of Zorlu Solar Power Project (Pakistan), see https://www.adb.org/sites/default/files/project-documents/50174/50174-001-iee-en.pdf.
[143] Ibid., p. 43.
[144] Ibid., p. 78.
[145] Ibid., p.106.
[146] Ibid., p 111.
[147] Ibid., p.108.

the solar park, the site was largely remote and did not harbor any economic activity. Now a mini-city has emerged in the middle of the desert, with over 2,000 workers accompanied by heavy machinery, power transmission lines, blocks of buildings, water pipes and pylons. Today, the solar park aims to generate 15,000 to 33,000 jobs for locals and attract investment to the region.

However, the park's colossal size does have negative impacts on the environment. It is estimated that increasing human activity has disturbed the arid region's rich biodiversity and wildlife, such as the Indian gazelle, caracal cat and houbara bustard. Increased use of water to clean over 400,000 panels has led to additional resource overuse in a nation that is currently undergoing a water crisis. Opposing government officials also continue to criticize the unit costs of the solar park and blame seeping federal corruption to dent the solar potential of the nation.[148]

5. THE WAY FORWARD FOR GREENING THE BRI

Progress is being made on "greening" the BRI. Even before the formal launch of BRI, the primary focus of efforts to "green" Chinese overseas finance was on reducing and eliminating financial support for new coal plants given the significant impact of coal expansion on the global climate. That first stage is now ending. In September 2021 President Xi Jinping announced a stop to financing coal abroad. While the details of this announcement were not immediately clear (for example, it was not specified whether it would apply to just state banks or also commercial ones), subsequent developments have further affirmed the end of coal finance generally. In October 2021, Senior Vice Premier Han Zheng, who oversees the BRI portfolio, made a speech at the BRI Energy Ministers meeting that emphasized China's role in supporting clean energy. Later in the month, the G20 in Rome further pledged to cooperate on clean energy to "enable those countries that commit to phasing out investment in new unabated coal power" to do so.[149] Then at COP26 in Glasgow a surprise joint declaration from the United States and China stated the two countries, "Recall their respective commitments regarding elimination of support for unabated international

[148] Nudrrat Khawaja, December 6, 2015, Why is the govt privatising the Quaid-e-Azam Solar Park? *Dawn*, https://www.dawn.com/news/1224548; Farrukh Saleem, December 31, 2017, Opinion Capital suggestion, *The News*, https://www.thenews.com.pk/print/262624-capital-suggestion

[149] G20, 2021. "G20 Rome Leaders' Declaration." G20, Rome, October 2021.
See https://www.consilium.europa.eu/media/52732/final-final-g20-rome-declaration.pdf

thermal coal power",[150] and the final text from the UN conference committed all countries to "Accelerating efforts towards the phase-down of unabated coal power".[151] Finally, new coal phaseout announcements (some conditional on receiving international support) were made by Vietnam, Indonesia, South Korea, Egypt, Spain, Nepal, Singapore, Chile, Ukraine, and others.

But with the first priority of greening BRI—stopping new coal capacity—achieved, new, harder policy challenges arise. How will existing coal capacity be phased down and then out? When will new investments in oil and gas facilities stop? How can renewables be accelerated to compensate for the transition away from fossil fuels? How will EU and US-led infrastructure programs interact with the BRI? These questions will likely dominate the next phase of "greening" the BRI. Below we outline these emerging challenges and posit policy implications from our findings.

5.1 How to Phase Down/Out Existing Coal?

While stopping new coal plants is critical for achieving global climate goals, it is equally important to accelerate the retirement of the existing coal fleet. Promisingly, in many parts of the world the lifetime cost of installing new clean energy is now cheaper than running existing thermal power facilities, as the latter involve ongoing fuel costs that the former, once built, do not incur. However, even when the economics align, many countries face rising energy demand, limited energy access, and various political and regulatory barriers to a rapid clean energy expansion.

On top of this, achieving a just transition for workers and communities dependent on existing coal plants, mines, and other carbon-intensive services is required to make a coal phaseout/down politically acceptable in many countries. Workers and communities will require new skills and opportunities in a greener economy. Some interesting financial models are now emerging to address this challenge. For example, at COP26 South Africa announced an $8 billion partnership with several Western countries to phase out coal from its state-owned power monopoly.

How might BRI address this new challenge? New investments in alternative industries (e.g. RE plants) will be needed as part of transition plans. But government's seeking to phase down/out

[150] US-China, 2021. "US-China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s." Glasgow, UK, 10 November 2021. See https://www.state.gov/u-s-china-joint-glasgow-declaration-on-enhancing-climate-action-in-the-2020s/

[151] UNFCCC, 2021. "Glasgow Climate Pact," UNFCCC Doc 1/CP.26. November 14, 2021. See https://unfccc.int/sites/default/files/resource/cop26_auv_2f_cover_decision.pdf

fossil fuels will also need to develop the capacity to reskill workers and develop financing plans to wind down distressed fossil fuel assets, many of which may land in public accounts. Advance bonuses for early retirement, retirement portfolios (where institutions purchase coal assets in order to retire), or securitization will likely be needed (Bazilian et al. 2021). To date, however, "soft" investments in human capital or transition finance have not featured in BRI projects. Chinese firms have often preferred to bring in their own workers as opposed to investing in local labor. Moreover, it may also be politically difficult for China to invest in other countries' just transition when its domestic transition needs are so great. But governments looking to transition will likely have reason to seek Chinese support for these kinds of policies. Can BRI evolve to become a source of transition finance?

Our findings suggest such a move would involve considerable challenges. First, to the extent that Chinese firms and financers own or operate existing coal plants in BRI countries, they may be amongst the interest groups that oppose faster phase down/out of coal, as this may decrease the value of their assets. Second, to the extent BRI arrangements between China and the host country are more institutionalized, coal-invested Chinese interest groups could potentially exert considerable political leverage against rapid phasedown/out by raising the issue to the diplomatic level. Under these conditions, institutionalization may work against "greening" the BRI instead of for it. Rather than counting on China, other countries and financial institutions should claim a leadership role in transition finance. Finally, and more hopefully, to the extent China is interested in securing a country's favor for strategic reasons (e.g. Pakistan), it may be willing to accept the higher cost of supporting transition policies.

5.2 Stopping New Investments in Oil and Gas?

While coal is the largest source of global emissions, achieving global climate goals will also require dramatic reductions in the use of other fossil fuels, principally oil and gas. However, the political economy of these fuels is significantly different than that of coal both in China and in recipient countries.

While China produces coal domestically and has seen its large coal reserves as a key element of energy security, it has relatively few domestic sources of oil and gas. Indeed, securing access to oil and gas has been a major driver of Chinese foreign policy to Russia, Central Asia, and the Gulf, and a core motivation for many of the strategic projects within the BRI. Where building coal plants abroad was of economic value to large Chinese firms, it had little inherent national interest per

se. In contrast, upstream oil and gas exploration and extraction is a core Chinese foreign policy priority. Energy security is key to China's global energy ambitions, thus China will continue to depend on oil and gas imports for the foreseeable future. This suggests we are unlikely to see a shift away from BRI support for such activities in the near term. Given this reality, issue linkage and institutionalization are likely to offer little value toward greening the BRI in this dimension.

At the same time, we can expect domestic interest groups to be just as, if not more committed to oil and gas. Because these commodities can be a valuable source of exports and hard currency, they often lead to highly imbalanced political economies in which economic and political elites depend on the rents from ongoing exploitation. Under these conditions, we would expect significant opposition to removing BRI support for upstream oil and gas projects. Countries that depend on oil and gas imports may be more open to exploring demand-reduction measures, such as electric vehicles or mass transit.

5.3 How to Accelerate Renewables?

With many countries announcing plans to halt new coal plants and phase out existing ones, the demand for renewable energy in BRI countries has grown rapidly. China has also signaled a strong interest in supporting clean energy deployment in developing countries as evidenced by Senior Vice Premier Han Zheng's October 2021 speech drawing on China's world-leading RE industries and substantial domestic experience in RE rollout. However, as discussed above, RE presents basic economic and market challenges for Chinese firms compared to coal. In most markets, profits for RE development are lower, in part because of the smaller scale of RE projects. Policy barriers in many recipient countries further dampen the incentives for deploying RE, such as power pricing systems that favor incumbents. Therefore, though both China and recipient countries seem eager to expand RE, doing so quickly runs into practical implementation challenges.

In this context, our findings suggest that issue linkage and institutionalization can continue to play a valuable role. To the extent China prioritizes a country strategically, and that country's leadership seeks additional support for RE projects, we can expect Chinese firms and financiers to have additional incentives to deploy them. Moreover, institutionalized relationships can help to overcome some of the uncertainties associated with RE markets and perhaps create a forum to address the policy barriers RE faces. Institutionalization and issue linkage can accelerate the

maturing of RE markets in BRI countries, creating commercial opportunities for Chinese developers in the medium term.

5.4 How will BRI Interact with New US and EU Infrastructure Initiatives?

In 2021 both the United States and the European Union have announced plans to expand infrastructure finance in the developing world, including with a focus on green projects. Both the US program, Build Back Better World, and the EU effort, Global Gateway, have been emphasized in the June 2021 G7 communiqué, and are widely understood to be Western-led programs to compete with BRI.

While few details about these programs are yet developed, our findings suggest how they might affect RE deployment in BRI countries. As we have seen in Pakistan, when recipient countries prioritize RE, strategic interests from China (or other countries) can lead to greater willingness of firms to invest in RE, even if doing so carries some cost. We could therefore envision scenarios in which geopolitical contestation between rival donors could create further incentives for cheap provision of RE to recipient countries. Where there is local demand for RE, we might therefore expect rival infrastructure programs to generate positive outcomes for both recipient countries and the climate. However, we may not expect such dynamics in contexts where recipient countries instead seek fossil fuel infrastructure. In those cases, we might expect Chinese lenders and firms to offer more support than the new Western-led programs (presuming they do not also support fossil fuel finance).

Another possibility is that we see a division of labor between Chinese and Western programs in financing the transition, with Western governments investing more in “soft” skills and transition finance, and BRI instead focusing on building up new “hard” infrastructure. Such division of labor will require some level of coordination and could be compromised if geopolitical tensions continue to grow.

Finally, going beyond the findings of our report, it is also possible to envision scenarios in which Chinese and Western infrastructure programs actively compete to play a role in developing countries’ clean energy transitions with negative externalities for recipient governments. For example, if donor countries impose conditionalities on who may use clean energy IP then recipient countries would be locked into their own value chains. This lock-in outcome could impede the clean energy transition in the long run, as recipient countries would not be able to take advantage of supplier competition to minimize the cost of clean technology.

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APPENDICES

Appendix A

List of Cited Interview Subjects

Indonesia

1. Officer of Asian Development Bank, 12/22/2020
2. Journalist with extensive knowledge of Indonesia's clean energy development, 12/24/2020
3. Chinese NGO manager, 12/25/2020
4. Manager of an Indonesian company that provides consultancy for Chinese electricity investors, 12/27/2020
5. Indonesian researcher, 04/07/2021
6. European researcher with expertise on China's electricity investment in Indonesia, 04/12/2021
7. International NGO manager, 04/21/2021
8. Japanese researcher with expertise on Chinese and Japanese investments in Indonesia's power sector, 04/15/2021

Pakistan

1. NEPRA director in Pakistan, 09/27/2020
2. Pakistan's PPIB official, 10/02/2020
3. AEDB official in Pakistan, 10/09/2020
4. Chinese Academy of Social Sciences researcher, 12/21/2020
5. Chinese expatriate official journalist in Pakistan, 12/25/2020
6. Chinese environmental NGO manager, 12/28/2020
7. Pakistan environmental NGO manager, 04/16/2021
8. Chinese expatriate manager who worked for a major Chinese electricity project in Pakistan, 04/16/2021

Appendix B

Chinese Investments in Indonesia's Power Sector

1. Major data sources:
    - Primary information on Indonesian coal power plants was largely originated from Global Energy Monitor's Global Coal Plant Tracker and its other Indonesia-related dataset. Primary information on Indonesia hydropower plants was first collected from various sources including International Rivers database, Japan International Cooperation Agency, World Bank Indonesia Small Hydro GIS Database, and reports from PT. Wasa Mitra and PT PJB.
    - Information on projects' status, participators, scales, and other aspects was collected and crosschecked with CSIS's Reconnecting Asia data map, Chinese/Indonesian/English media articles and press releases from relevant companies. All hyperlinks are included in the database.
    - Projects involving the Indonesian State Electricity Company (PT PLN) are crossed with *Keputusan Menteri ESDM No. 2780 K/21/MEM/2008 Tentang Pengesahan Rencana Usaha Penyediaan Tenaga Listrik PT PLN Tahun 2009 s.d 2018* *(Ministry of Energy's Decree Concerning the Ratification of PT PLN's Electricity Supply Business Plan for 2009-2018)* and PT PLN's yearly *Rencana Usaha Penyediaan Tenaga Listrik* *(Electricity Supply Business Plan)*.
    - Information on projects with financial support from the Chinese policy banks are crosschecked with Boston University's China Overseas Development Finance database and AidData's Global Chinese Official Finance database.

2. Specific information on data:
    - Data collection and crosschecking were carried out during March 1st-November 30th 2020. All the coal projects under construction or operation status during this period are included. This database was also trying to include all coal and hydro power projects that were announced but halted or cancelled since 2000.

- A project's status as operating, constructing, or cancelled is identified based on checking of companies' websites, media coverage, and even sources including social media. Link are all included in the database.
- A typical coal power plant or hydropower plant would have multiple stages of planning, and different power generation units can have distinguishing investor relations or status. Therefore, information of power plants was recorded at unit level.
- Classification and definition on code items of the database can be found in the coding book.

Appendix C

Chinese Investments in Pakistan's Power Sector

1. Major data sources:
    - Primary information on Pakistan's power plants, especially from CPEC were largely captured from two sources: Pakistan government's official website of CPEC (energy) projects, Global Energy Monitor, and Boston University's China's Global Power Database from year 2000 onwards.
    - Primary information on Pakistan hydropower plants was collected from various sources including Water & Power Development Authority (WAPDA) , and hydropower.org.
    - Information on projects' status, participators, scales, and other aspects was collected and crosschecked with CSIS's Reconnecting Asia data map, Global Energy Monitor, Pakistani/English media articles and English press releases from relevant Chinese companies. Specific source links are included in the database.
    - As per the Special Assistant to the Prime Minister on Energy, Nadeem Babar, Projects involving the energy projects size, time, location and technology were checked from the Private Power and Infrastructure Board website, the regulator NEPRA's website, National Transmission and Dispatch Company and Central Power Purchasing Agency website.
    - Information on projects with financial support from the Chinese policy banks are crosschecked with Boston University's China's Global Energy Finance Database and Global Energy Monitor, and Pakistan's official CPEC projects website.
    - Pollution control information for Coal power plants was collected from Global Energy Monitor, Pakistan CPEC energy projects website and some from The National Electric Power Regulatory Authority (NEPRA) website/ reports.

3. Specific information on data:
    - Data collection and crosschecking was donet during September 1st-December 15th 2020. All the coal projects under construction or operation status during this period are included. This database also includes all coal and hydro power projects that were announced but halted or cancelled since 2000, but they are labelled as such.

- A project's status as operating, constructing, or cancelled is identified based on checking the companies' websites, BRI media coverage, and news stories my major local publications like Tribune, the News, Dawn etc. All links are included in the database.
- Information on pollution control for coal projects is sent separate separately, will be added as an additional sheet on the database.
- Some power plant has multiple stages of planning, and operation and, if distinguished, they are mentioned in the database according to their status.
- Classification and definition of code items of the database can be found in the coding book

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