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Banking on coal? Drivers of demand for Chinese overseas investments in coal in Bangladesh, India, Indonesia and Vietnam

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ABSTRACT

This paper investigates why new coal-fired power plants are being financed and built in South and Southeast Asia given that new coal plants without carbon capture and storage are incompatible with a 1.5 °C temperature goal. The paper particularly focuses on developing countries where these coal-fired power plants are being built that are recipients of Chinese government-backed finance. The central research question of this paper is: Which factors drive the demand for financing for coal-fired power plants from China's policy banks? Field research was conducted in four recipient countries: India, Indonesia, Vietnam, and Bangladesh. We find that the demand for Chinese-backed coal plants in the four recipient countries is mainly driven by domestic policy that embraces a growth of coal-fired power in their economies. Recipient country demand is well matched by China's willingness to finance and export equipment and services to build new coal-fired power plants overseas. In every case, there are explicit, preferential domestic policies for coal, and in at least one case renewables are disallowed by regulation from competing with coal on a level-playing field. None have environmental policies that would require cleaner or more efficient plants to be constructed and operated. The main policy implication of the findings is that it is crucial for recipient countries to put in place the enabling policy conditions for an energy transition to a low-carbon future.

1. Introduction

This paper investigates why new coal-fired power plants are being financed and built in South and Southeast Asia, given that new coal plants without carbon capture and storage are incompatible with a 1.5 °C temperature goal. The paper particularly focuses on developing countries where these coal-fired power plants are being built that are recipients of Chinese government-backed finance. The central research question of this paper is: Which factors drive the demand for financing for coal-fired power plants from China's policy banks?

The top ten recipients of Chinese investments in coal-fired power plants are listed in Table 1, and most are in Eurasia, with South Africa being the only outlier. All of these recipients except India are members of China's Belt and Road Initiative (BRI). We conducted field research in a subset of these countries – India, Indonesia, Vietnam, and Bangladesh – and present new empirical evidence that there exists substantial demand for coal-related Chinese finance and technology in the recipient countries for a variety of reasons. The Chinese government, its policy banks, and related firms have actively served this global demand for reasons elucidated in the discussion section.

A fundamental dilemma of the 21st century is how to reconcile the rising demand for energy in rapidly-industrializing countries, particularly in South Asia and Africa, with the need to reduce greenhouse gas emissions in the context of global climate change. Demand for energy arises from the economic development process, which historically has involved energy-intensive industrialization, provision of access to electricity to impoverished communities, and growth in demand for energy services by an emerging middle class that seeks increased mobility, refrigeration, information and communications services, heating, cooling, and cooking.

To deliver new energy supplies, substantial investments in energy-related infrastructure are required. China has emerged as the second largest foreign direct investor (all sectors) in the world after Japan, investing USD $130 billion in other countries in 2018. Although most of China's investments are gathered under the Belt and Road Initiative umbrella, it also makes large investments in non-BRI countries including India. From 2000 to 2019, China's policy banks invested US$235.6 billion in energy projects globally, and of that total, coal investments

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Table 1
Top ten recipients of coal-fired power finance from China (2000–2019), US dollars.

Indonesia	$9.3B
India	$7.7B
Vietnam	$7.0B
Pakistan	$5.6B
S. Africa	$4.5B
Ukraine	$3.5B
Bangladesh	$2.1B
Russia	$2.0B
Kazakhstan	$1.7B
Turkey	$1.4B

Source: [1].

accounted for 22% (US$51.8 billion). Vietnam received US$7 billion in coal finance from China between 2000 and 2019, Indonesia received US $9.3 billion, India US$7.7 billion, and Bangladesh US$2.1 billion [1].

Most multilateral development banks have restricted investments into coal-fired power due to concerns about their environmental impacts. The World Bank announced in 2010 that it would cease investments into coal except in rare circumstances "when there are no feasible alternatives to meet basic human needs" [2], and it has not invested in any coal-fired power plants since then (it further restricted investments in upstream oil and gas in 2017). The Asian Development Bank has not funded any coal-fired power plants since 2013 and will only support coal-fired power plants "on a very selective basis with stringent environmental, social, and clean technology standards" [3]. ADB's last financing of a major power plant was for the Jamshoro Power Generation Plant, a 600 MW supercritical coal plant in Pakistan [4]. The China-led Asian Infrastructure Investment Bank (AIIB) approved a new energy sector strategy in 2017 that contains a principle of reducing the carbon intensity of energy supply and "supporting and accelerating … transitions toward a low-carbon energy mix, including lower carbon emissions from fossil fuels." The strategy also states that "carbon efficient oil- and coal-fired power plants would be considered if they replace existing less efficient capacity or are essential to the reliability and integrity of the system, or if no viable or affordable alternative exists in specific cases" [5].

On a bilateral basis, several countries have supported coal-fired power plants overseas including Japan, Korea, France, China, and Germany. Japan and Korea, however, announced their intention not to finance any new overseas coal plants in July 2020 [6,7]. According to the non-profit Global Energy Monitor, China is the largest financier of coal by far with 26 GW in current financing overseas. Japan comes in second with 19.5 GW, and South Korea third with 4.8 GW.

China has many vehicles for financing coal-fired power plants, including, but not limited to, the China Development Bank (CDB), China Ex-Im Bank (Chex-im), China Export-Import Credit Insurance Association (Sinosure), and the Silk Road Fund, all of whom can be categorized as policy banks (also called development banks). None of China's policy banks currently have policies restricting investments into coal-fired power, nor does China have any policies governing overseas investments by commercial banks that restrict high-carbon investments [8].

China has emerged as an attractive lender for recipient countries due to its hands-off approach to development assistance. Since 1954, China has adhered to its "Five Principles of Peaceful Coexistence," initially articulated by Premier Zhou Enlai during a meeting with Indian counterparts. These five principles include: mutual respect for each other's sovereignty and territorial integrity, mutual non-aggression, non-interference in each other's internal affairs, equality and mutual benefit, and peaceful co-existence [9]. The principle of non-interference in internal affairs has two implications for the BRI. On the one hand, it starkly contrasts with the prescription-heavy Washington Consensus approach. It reflects a spirit of 'south-south' solidarity that is sensitive to sovereignty concerns. The non-interference posture is also politically expedient for China [10]. Not only does non-interference allow recipient countries to be masters of their own destiny, but it also aligns with China's interests in reducing its surplus domestic manufacturing capacity without having to take responsibility for the social or environmental impacts of its investments.

Yet, regarding climate change, the practice of non-interference may, in fact, constitute facilitation of non-compliance with, at minimum, the spirit of international treaties given the globally-agreed goal to limit warming under the Paris Agreement to 2 °C, and ideally 1.5 °C. China's approach of non-interference may also be useful to political leaders in recipient states. A recent study suggests that Chinese aid may be more vulnerable to political capture than World Bank aid [11]. In addition, Liu found gaps between the environment and social protection frameworks between Chinese financial institutions and multilateral financial institutions [12].

There is growing scholarship on the environmental and social impacts of overseas Chinese financing [13,14]. More specifically, there is an emerging scholarship on the impact of coal-fired power plants. This line of work examines the implications of the continued buildout of coal-fired power plants for tackling climate change [15]. Others have examined the motivations, goals, and strategies of Chinese actors in overseas investments related to energy [16–18]. This paper complements the existing scholarship by explicitly focusing on host country demand drivers of Chinese investments. Understanding the continued investment in coal-fired power plants requires an exploration of how domestic policies in recipient countries continue to incentivize coal use. By providing an empirical account of the drivers of demand for Chinese finance, this paper extends the scholarship towards a better understanding of both demand and supply of coal-power financing.

Vietnam, Indonesia, India, and Bangladesh exhibit considerable variation in their socio-economic and environmental characteristics as can be seen in Table 2. All these recipient countries have low per-capita income ($1,849 on average), although Indonesia's is roughly double that of Bangladesh. Bangladesh has the smallest percentage of the population with access to electricity (76%), compared with 100% in Vietnam. India and Bangladesh suffer more from conventional air

Table 2
Comparison of Case Study Country Characteristics.

	Indonesia	India	Vietnam	Bangladesh
Finance received from Chinese financial institutions (US$ billions)	9.3	7.7	7	2.1
Number of projects	21	6	12	2
Member of Belt and Road Initiative	yes	no	yes	yes
GDP per capita, PPP (current international US$) (2019)	12,302	7,034	8,374	4,951
Percentage of population with access to electricity, 2016	98	85	100	80
Fossil fuel CO_2 emissions (Mt) (not including land use change)	488	2,371	218	82
PM 2.5 air pollution exposure (micrograms per cubic meter), 2016	17	90	30	57
Growth rate in per capita electricity consumption (2014)	5%	5%	12%	6%
Economic growth rate (2018)	5%	7%	7%	8%
Manufacturing, value added (% of GDP) (2019)	20%	14%	17%	19%
Population in urban areas of more than 1 million (% of total population)	14%	16%	17%	16%

Data sources: For finance and number of projects [1]; For income, access to electricity, and PM 2.5 emissions [20]; For fossil CO_2 emissions, [21]. For adjusted net income per capita, note that this term is defined as income minus consumption of fixed capital and natural resource depletion and it is not adjusted for purchasing power parity. For per capita growth rate in electricity consumption and economic growth rate, [22].

pollution than do Vietnam and Indonesia, with the PM 2.5 concentrations in India being five times higher than in Indonesia. India's fossil-fuel CO_2 emissions are highest (in part due to its large population), and Indonesia's are four-times higher than listed in Table 2 if emissions from land-use change are included, making Indonesia's overall emissions rival those of India. Bangladesh's CO_2 emissions are negligible, but Vietnam's are on the rise. Vietnam, Indonesia, and Bangladesh are active members of the BRI, but India has refused to endorse it even as it has accepted large volumes of development finance [19].

Table 3 provides the latest conventional emissions standards for the four countries as of 2020. None of the recipient countries has explicit policies for GHG control in its power sector. We have included figures from the environment, health and safety guidelines of the International Finance Corporation (2017 version) to enable a comparison of these countries' standards against international best practices, but an even starker comparison is with China's own 2014 domestic standards for new coal-fired power plants which are identical to India's 2017 standards. India has the most strict pollution-control standards for power plants among the four countries, but the standards in Indonesia and Vietnam are relatively weak (with Bangladesh falling in between). Although India has received $7.7 billion from China for coal-fired power plants, it built six ultra mega projects with supercritical technology. In contrast, Indonesia had three times as many plants with mostly sub-critical technology and considerably more overall financing, more than US$9 billion (see Table 2).

2. Methods

This paper investigates which factors drive the demand for financing for coal-fired power plants from China's policy banks. We explore this question through field research in four developing countries in South and Southeast Asia: Bangladesh, India, Indonesia, and Vietnam. We conducted dozens of in-person interviews in four countries during 2018 to develop a comparable set of case studies of Chinese overseas investments in coal-fired power plants (see Appendix B). These countries were selected because they were among the largest recipients of Chinese policy bank investments in coal-fired power plants between 2000 and 2017 globally. India was the second-largest recipient of Chinese coal finance and was intentionally selected as an outlier because it is not formally a BRI country. We restricted our geographic focus to South and Southeast Asia for regional consistency and to make the field research feasible.

Table 3
Conventional Pollution Emissions Standards in Recipient Countries.

	SO_2, mg/m^3	NO_x, mg/m^3	PM, mg/m^3
Indonesia 2015	750	750	100
(for plants operating before 1 Dec. 2008)		(850)	(150)
Vietnam (QCVN 22:2009)*	500	650**	200
2005-current (for plants built before Oct. 2005)	1,500	1,000	400
Bangladesh	275 m (SS)	600	100
India (for units > 500 MW)			
2017-current	100	100	30
For plants built between 2004–2016	200	300	50
For plants built before 2003	200	600	100
China (2014 standards for new plants)	100	100	30
International Finance Corporation (IFC) 2017	200–600	500	40

* These are base limits (C) for coal burning, the maximum limits are calculated by Cmax = C * Kp * Kv, where Kp and Kv are capacity and regional factors.
** NOx value is 650 for volatile matters (Vk) of higher than 10%, and 1000 if Vk is ≤ 10%.
Data sources: Bangladesh: [23]; Indonesia: [24]; Vietnam: [25]; India: [26], China: [27].
Note: The table includes IFC 2017 standards as a benchmark.

The level of analysis for the country studies is at the national sectoral level. The country's policies, institutions, energy resources and endowments, environmental conditions, energy economic conditions, available technologies, stakeholders, and politics were examined as they relate to the power sector in each country. We did not conduct comparative plant-level analysis due to data restrictions and the political sensitivities of individual plants. We did visit some plants and/or interview firms in all four countries, however. We were especially focused on how policy variables, at the national level, impacted outcomes in each country's power sector [28].

Our primary research method was in-person interviews using a snowball sampling technique. The same set of interview questions was used for all interviews in a semi-structured format (see Appendix A). We sought interviewees who, in their official capacity, were involved in the development, financing, and construction of new coal-fired power plants in these countries, including all types of stakeholders (e.g. NGOs, banks, government officials, local officials, power companies).

We interviewed a total of 56 people in the four countries with at least 10 interviews per country (see Appendix B for summary tables with lists of interviewees). The interviews sought to understand how and why new coal plants were constructed, whether alternative types of power plants were considered, to what extent the domestic policy context mattered, and the extent of consensus around decision-making for the sector.

This study underwent human subjects review by a university Institutional Review Board. We obtained consent from interviewees and informed them that their responses would be recorded anonymously but that they would be referred to in any publications by the type of position they hold, e.g., local power plant official, local community member, financier (see Appendix B). If the interviewee requested complete anonymity (i.e.. not even to be identified by type), we granted it to them and refer to them in this paper in the format: (Interview "Country" "Number (s)", Year). Interviewees participated purely on a voluntary basis and were also told that they did not have to answer any questions or discuss any topics about which they were not comfortable. In numerous cases, interviewees in all four countries requested anonymity.

A literature review was completed for each country before the field research commenced. After field research was complete, each researcher wrote an informal country report, which was then presented at a workshop in October 2018. Each researcher co-wrote a case study with the lead author (see supplemental material). Comparative analysis of the country studies was conducted by the co-authors after the workshop and again after field research was complete.

3. Theory

Much of the existing literature on the BRI has sought to understand China's strategic, development and commercial interests related to its overseas investment (e.g. [16,29,17]). Some analysts have asserted that Chinese banks and firms actively promoted coal-fired power plant equipment and finance abroad because of China's surplus manufacturing capacity domestically [30].

We recognized, however, that recipient countries must shape and modulate Chinese engagement and our paper makes its main contribution here. Through in-depth field research, it is possible to clarify how developing countries exercise their own agency to meet their needs. In doing so, this country-specific approach to understanding the strategies of developing countries is resonant with the view that "it is thus neither possible nor wise to homogenize or reify this agency outside of particular contexts" [31]. Further, in exploring the agency of recipient countries, this paper contributes to the debate about the nature of Chinese interactions with other developing countries. Is the Chinese role geopolitical in nature (e.g. [29]), extractive and colonial (e.g. [32]), one of mutual benefit (e.g. [33,34]), or a mixture of both (e.g. [35])?

We also add knowledge about China's role as a source of overseas development investment and technology in a new geography and in a relatively new sector where it is challenging norms established by

western-backed development banks. Most of the current scholarship has been on Africa and Latin America (e.g. [33,36]). We extend the extant sectoral focus from agriculture and mining into energy. As a sector, energy is important not only because of the scale of investments taking place, as discussed above, and their role in supporting economic development but also because this is an area where there is a clear policy divergence between China and the major development finance institutions in terms of coal-fired power plant financing. In the context of agriculture, China is viewed as a source of technological know-how in addition to the provision of financial resources. With most OECD banking institutions restricting their investments into coal, China has created a niche as an attractive lender for developing countries that seek to add new coal-fired power capacity. With its willingness to continue to finance coal-fired power plants, China is exerting a competitive pressure in the system that is arguably delaying a convergence around stringent environmental standards in development assistance [37].

This paper contributes to our understanding of Chinese state capitalism. Scholars have sought to ascertain the relative roles of Chinese state interests versus market interests. Kong and Gallagher [38] argue that Chinese overseas energy development finance is an effort on the part of CDB and the China Ex-Im Bank to boost domestic demand, support national champions by exporting excess capacity, and decarbonize the Chinese economy. Kong examines the role played by policy banks such as the CDB and Chex-im and argues that the Chinese Communist Party's goals shape the strategies developed by the policy banks [17]. Our research empirically analyzes how Chinese state interests and market interests interact.

Finally, local contexts significantly shape and alter how Chinese influence plays out in a given country. There is a growing realization that the lack of homogeneity in Chinese interactions with developing countries is driven in part by the diversity of actors engaged in China's going global program [39]. For example, Haglund describes the "political embeddedness" of Chinese firms in local regulatory and political contexts [40]. Furthermore, policymakers in these local contexts are boundedly rational [41], with incomplete information about alternatives. We contend that investment decisions regarding coal-fired power plants need to be viewed in the context of decisionmaking that departs from textbook-style optimization approaches. Policymakers may not conduct methodical searches for least cost options. Rather, they may stop the search process when "good enough" options become available [42]. "Good enough" options in these cases happen to be Chinese-financed, mostly subcritical, coal-fired power plants.

4. Results

Results discussed in this section are based on empirical findings from the four countries studied, and the individual country studies are provided in the supplemental material [online link to be added].

The overwhelming evidence is that recipient countries have strongly demanded financing and technology from China for coal-fired power plants in South and Southeast Asia. In every case, there are explicit, *preferential* domestic policies for coal in the recipient countries, and in at least one case, renewables are disallowed by regulation from competing with coal on a level-playing field (see Table 4).

All four countries have energy sector plans that provide for the expansion of coal-fired power in the future (see Table 4). India's National Electricity Policy and the Ultra Mega Power Project (UMPP) program, both introduced in 2005, led to a giant expansion of coal-fired power in the decade that followed. Coal capacity grew from 62 GW in 2002 to 192 GW in 2017 (see Fig. 2 of supplemental material), and another 50 GW of net pre-approved capacity is expected to come online by 2022. The National Electricity Plan (NEP) of 2018, however, states that no new coal capacity will be added until 2027 as electricity market demand, stricter pollution standards, and policy shifts towards renewables have made coal uneconomical in some regions of India. Coal is currently the dominant source of electricity in India, accounting for 75.6% of electricity generation for consumer utilities at the end of the financial year 2017–18 [43]. In Vietnam, the National Power Development Plan 7 (NPDP7) forecasts coal to be the main source of baseload power as well as the largest source of new installed capacity at 42.6%, or about 55 GW by 2030 (see Table 3 of supplemental material). In Indonesia, the national energy plan, Rencana Usaha Penyediaan Tenaga Listrik (RUPTL), is adjusted every year and consistently allocates new capacity additions to coal rather than renewables. In its energy planning, the government estimates that 70.4 GW of new power capacity is needed and that coal-fired power will account for 64% of it by 2024 [44]. In Bangladesh, the 2016 Power System Master Plan sets a target of 50% of power to be supplied by coal by 2030.

Environmental policy governing the power sector is relatively weak in three of the four countries. All four countries have conventional pollution emissions standards for power plants (see Table 3), but only India's are as stringent as China's own 2014 standards. Indonesia's coal plants are subject to the weakest standards, although Vietnam's standards for coal plants built prior to 2005 are even weaker. None of the countries have performance standards or other policies targeted at reducing emissions of greenhouse gases from power plants (see Table 4). Enforcement of the policies that do exist is inconsistent and depends on local monitoring capacity and the strength of political will in the central government. In some cases, civil society groups are highly skeptical that pollution control and environmental impact assessment policies will be enforced. Because China's own policies governing overseas investment are that Chinese firms must comply with host-country regulations, there is no incentive for Chinese firms or banks to go beyond compliance with local policy. The prevailing approach for both recipient country and Chinese firms is to build plants that are "good enough" for the present time that will meet the relatively weak local standards.

Politically, there is moderate civil society pressure to limit coal. In Bangladesh, strong opposition to the siting of one Chinese-financed coal-fired power plant in the village of Banshkali led to protests that resulted in four citizens being killed, but did not halt the construction of the plant. In Vietnam, at least three local municipal governments have successfully resisted the siting of coal plants that the central government wanted to place in their cities. In India, civil society opposition is mainly centered around coal mines, not coal-fired power plants, but discontent with the urban air pollution is growing. And, in Indonesia, there has been opposition from some civil society groups, some of which have filed lawsuits against new coal mines and coal construction [45].

Technological cost is perceived to be a barrier to cleaner alternatives in all four recipient countries, although views are evolving in India. Interviewees cited much higher costs for renewables as compared with coal in Bangladesh and Vietnam (see Table 5). In India, the government recently recognized that renewables have become cost competitive in some regions, and that some new coal-fired power plants are uncompetitive and now stranded assets. Indonesia mandates that renewables are more expensive through policy. Even more efficient coal-fired power plant technology, supercritical coal,[1] has struggled to compete. In three of the four countries, the majority of plants built to date are sub-critical plants (see Table 5), although more recent plants in Vietnam and India are supercritical.

Chinese policy banks supply finance for coal plant construction, but neither the Chinese banks nor the Chinese equipment supplier firms appear to be overtly pushing coal equipment or finance on the recipient countries. As one government official interviewed in Indonesia commented, "If we ask for coal, they [China] will sell us coal. If we ask for solar, they will sell us solar" (Interview ID 6, 2018). Still, the Chinese are

[1] Super and ultra-super-critical power plants need a lower amount of coal to generate the same amount of energy compared to subcritical coal-fired power plants. Super-critical plants are able to achieve a higher level of efficiency because their boilers operate at a higher temperature and pressure than subcritical ones.

Table 4
Policy and Political Factors.

	Explicit preferential policies for coal?	Energy sector plans that support coal expansion?	Greenhouse gas policies for power sector?	Policies that explicitly penalize Renewable energy?	Policies that encourage renewable energy?	Enforcement of conventional pollution standards and EIAs?	Civil society resistance to coal?
India	Yes, National Electricity Policy; 2005 Ultra Mega Power Project (UMPP) program	Yes, 2005 National Electricity Policy	Perform, Achieve, and Trade (PAT) scheme implemented (cap and trade for energy efficiency)	No, although anti-dumping duties on imported solar panels and modules have hindered deployment	Yes, 2006 National Tariff Policy; 2008 National Action Plan on Climate Change & The National Solar Mission for solar PV; For wind, capital subsidy regime (until 2015); Generation-based incentive (2009–2015); Competitive auctions (from 2016)	Yes; enforcement of new stricter pollution standards delayed due to the current economic distress of coal plants	Mixed. Most resistance is opposition to coal *mines*, not power plants
Vietnam	Yes, est. in NPDP7; coal to account for 43% of power by 2030	Yes, NPDP7 sets expansion target for coal power	No	No. Limited transmission network fails to accommodate RE. Solar's high tariff makes it unfavorable to EVN	Yes, Decision 2068/2015 on promoting RE, Decision 11/2017 on Solar FiT	Mixed, depending on local monitoring capacity	Yes, some local government resistance to siting of coal plants in their jurisdictions; also from an active local NGO, namely GreenID
Indonesia	Yes, RUPTL sets goal of 64% power from coal by 2024	Yes, RUPTL plan sets expansion target for coal	No power sector specific target but economy-wide target exists	RE purchase price fixed at 85% of ave. gen cost	Target of 23% of total primary energy supply by 2025 but supporting policies are missing	Unlikely	Yes
Bangladesh	Yes, Quick Enhancement of Electricity and Energy Supply Act of 2010 streamlined approvals for coal	Yes, 2016 Power System Master Plan sets target for 50% of power to be supplied by coal by 2030	No	Implicitly; emphasis on oil fired rentals shifts focus away from renewables	Renewable Energy Policy of Bangladesh 2008, target of 10% of power demand by 2020; Implementation lagging, currently at 1.5%	No	Yes

Table 5
Technological cost factors.

	Super or sub-critical?	Are costs a barrier for renewables deployment?
India	2002-on 70% sub-critical; 2012–2017, 42% supercritical	Yes, until 2017. In 2017, RE capacity addition exceed coal addition (15GW vs. 7.7GW); RE auction prices in Rajasthan at 3 US cents per kWh, which is 20 to 30% cheaper than coal power cost.
Vietnam	Before 2016, all 21 plants sub-critical. 4 plants built after 2016 supercritical	Mixed. 2018–19 RE FIT = 8–9.5c/kWh and coal is 7–7.3c/kWh; 2020 RE FiT = 7.09–8,38c/kWh. Limited transmission capacity and grid connection are also barriers.
Indonesia	Sub-critical (100–150 MW size plants prevail)	Yes, purchase price for renewables-generated power is 85% of average generation cost (a basket that consists mostly of oil and coal)
Bangladesh	Super-critical (>600 MW)	Yes, solar is 12c/kWh and coal is 6–8c/kWh

Table 6
Financing factors.

	China largest provider of FDI in energy?	China largest provider of FDI in general?	Chinese finance perceived as concessional?	Evidence that recipient country sought coal finance from China?
India	No	No, China is not in the top 10 foreign investors	Yes	Yes
Vietnam	No	No, China is third largest investor as of 2019.	Yes, Chinese interest rate is only 2.4–2.6% (against commercial sources 3.9% − 6.18%) on top of LIBOR @ 2.33%	Yes
Indonesia	No	No, China is third largest investor as of 2017	Yes	Yes – "If we ask for coal, they will sell us coal"
Bangladesh	Yes	Yes	Yes	Yes

competitive and willing suppliers of both finance and coal-fired power equipment. They strive to offer competitive financing rates that are perceived as concessional rates in every country studied (see Table 6). In all four countries, the evidence is clear that the recipient countries directly sought coal finance from China.

Notwithstanding the growing perception in the West that China is the largest provider of FDI in Asia, China was only the third largest investor in Indonesia as of 2017. It was also not among the top five largest investors in Vietnam, although foreign direct investment from China and Hong Kong (reported separately) increased by 18.5% and 12.7% in 2019 [46]. China is not in the list of top ten foreign investors in India. For energy specifically, China is not the largest investor in energy in Vietnam, as it lags both Korea and Japan. China is also not one of the largest investors in India's energy sector. China is, however, a major source of FDI for both Bangladesh and Indonesia, especially in their energy sectors.

All four countries sought Chinese investment and equipment for the construction of coal-fired power plants regardless of whether or not they were members of the BRI. There is no major difference in outcomes between the BRI (Indonesia, Vietnam, and Bangladesh) and non-BRI recipient countries (India), and this finding undermines the geopolitical hypothesis for why the BRI exists at all. China appears to have been

equally willing to finance and provide equipment to all four countries.

The strongest driver of recipient country demand for Chinese-based coal plants is their own domestic policy. In every case, recipient country domestic energy plans and policies explicitly call for new coal construction. In interviews with local government officials in the four countries, coal was perceived to be the best source of large baseload power for a rapidly emerging economy [Interview IN 11 & 12, 2018; Interview ID 8 & 15], and the lowest-cost power option [Interview IN 8 & 11, 2018; Interview VN 2, 3, 4, 5 & 7, 2018]. The Vietnam National Assembly voted against the use of nuclear power, so the use of nuclear technology for electricity generation is not an option in Vietnam. In what may be unique to Bangladesh worldwide, its national energy plan is a gas-to-coal strategy (i.e., not a coal-to-gas strategy), which will significantly increase greenhouse gas emissions in this highly climate-vulnerable country. For many government officials in these developing countries, coal-fired power is the electricity supply option that they know best [Interview VN 1, 2 & 3, 2018], and their unfamiliarity with renewables or other alternative sources of supply makes them skeptical of their potential. Some government officials and experts did not believe their grid was capable of absorbing intermittent renewable energy at scale [Interview VN 1 & 2, 2018; ID 8 & 15]. Finally, none of the governments are prioritizing climate change policy because they are more focused on other priorities, most notably improving energy access and ensuring adequate supply of electricity for a rapidly-growing economy [Interview IN 1 & 10, 2018].

Interviews also revealed that recipient countries preferred Chinese financing and technology over others because Chinese coal technology was thought to be cheaper [Interview IN 2,6 & 14, 2018; VN 2, 3, 5 & 7; BD 1 & 2], product offerings in terms of capacity and efficiency were larger [Interview IN 3,6,13 & 14, 2018; ID 8 & 11], supplying, servicing, and replacement of parts were quicker [Interview IN 7 &14, 2018], financing was concessional and less conditional [Interview IN 7, 2018; VN 2, 3, 4 & 6; BD 2], and disbursement of funds was quick. Chinese firms also have an advantage in being the only ones that still produce small unit sizes (smaller than 200 MW) for coal plants (Interview ID 10 & 11).

5. Discussion

We find that the demand for Chinese-backed coal plants in the four recipient countries is mainly driven by domestic policy that embraces a growth of coal-fired power in their economies. Together, these four countries alone plan to add approximately 160 GW of new coal-fired power plants between 2019 and 2030, according to their respective energy plans.

Recipient country energy strategies, plans, and policies strongly shape the nature of the incoming finance from China and other sources. While this study does not compare the nature of incoming finance and technology from China with others such as Japan or South Korea, it shows that the Chinese catered to the recipient's needs by offering cheaper and more flexible technology options, quick after-sales service, and easy upfront financing for the project. For example, when countries have sought more advanced coal-fired power plants, such as supercritical or ultra-supercritical plants, Chinese companies have made those options available. To date, the recipient countries have actively sought Chinese financing because it generally was the cheapest option available, especially at a pre-tender stage, due to a combination of technology and financing costs. Recipient countries have generally been happy to take Chinese technology along with the finance even when it is not explicitly tied because technology and service providers are quick and responsive, and Chinese product costs are highly competitive, especially when export financing from the China Ex-Im Bank is available.

The environmental consequences of new coal-fired power plants are not a significant concern of national governments in the recipient countries, but some local governments are attentive to environmental impacts. Local air pollution, effects on water, agriculture, aquaculture, and overall quality of life were concerns raised by local governments or NGOs. Climate change concerns were not raised by stakeholders in any of the four countries.

A lack of policies requiring the use of cleaner technologies in the recipient countries resulted in a lack of incentives to finance and transfer low-carbon and low-conventional pollution technologies. Where such policies did exist, they have not been well enforced to date and so have not been taking seriously from the actors involved. Strictly from a local conventional pollution-control perspective, domestic standards affect the level of pollution more than the nature of technology (sub-critical or supercritical) [47] but from a climate change perspective, significant emission reductions can be achieved with ultra-supercritical technologies compared with subcritical coal technologies due to the efficiency gains. None of the recipient countries have CO_2 performance standards or CO_2 pricing for power plants so no clear policy incentive exists for domestic firms or Chinese financiers to shift to a non-coal option. Therefore, new domestic environmental policies are of paramount importance to create incentives for the transfer and use of both conventional and GHG control technologies in power plants. This finding is consistent with prior literature about the importance of the enabling environment to stimulate the deployment of cleaner energy technologies [48].

Under conditions of robust and rising demand for energy, which is typical when countries begin to take off economically, the default decision in each of these four countries has been to use coal for baseload power. Perhaps coincidentally, the CDB addressed China's own electricity shortages through coal-fired power plant construction during the 1990s and early 2000s. In China's case, however, economic growth and electricity demand were ultimately decoupled through strong and effective efficiency policies [49,50], and China subsequently implemented a non-fossil target for power supply. In China's 13th five year plan, coal consumption caps were introduced for the first time to constrain new growth in coal production.

Preferential government treatment for coal production and consumption existed in all recipient countries during the period studied, although India is now beginning to remove some of these protections given that coal is not the cheapest source of power in parts of the country. Price controls, tariff setting, protections of jobs, preferential taxation, centralized control of the grid, and monopolistic utility structures were the mechanisms used by these countries to protect coal production and use. Crony capitalism leads to a "lock-in" effect for coal. The existing owners of coal mines and power companies in recipient countries are powerful and have come under recent scrutiny, especially in Indonesia.

The main policy implication of the findings above is that recipient countries would need to put in place the enabling policy conditions to achieve an energy transition to a low-carbon future. Each new coal-fired power plant is likely to last 35–50 years, and pre-mature retirement of these plants is unlikely given their upfront capital costs. While it is likely that renewable energy technology costs will continue to fall and become cost-competitive against coal, our findings underscore the manner in which existing policies entrench incumbent technologies and prevent the penetration of newer ones despite displaying cost advantages.

The empirical evidence presented in this paper reinforces three extant theoretical concepts discussed above in the theory section: recipient country agency, norm contestation, and bounded rationality/the 'good enough' phenomenon.

Recipient countries exhibit strong demand for Chinese-financed coal-fired power. In many instances, the lack of transparency in the contract awards and procurement has led critics to raise concerns (Interview BD 7 & ID 7). Our field research uncovered no evidence that Chinese actors (government or firms) pressure the recipient countries to accept less-efficient subcritical coal technology. The Chinese government tacitly permits overseas financing of coal plants of all types as a matter of policy [8], however, and Chinese policy banks have evidently provided finance upon demand.

We find there to be a mutually beneficial relationship whereby Chinese financiers and equipment providers are well matched with energy ministries and power companies demanding Chinese money, equipment, and services. Broader developmental benefit for recipient countries is accrued through improved energy access, faster electrification in recipient countries, and the availability of electricity supply to industries. Yet, due to the lack of effective pollution control policies, all of these coal plants are also jeopardizing human health, causing localized ecological damage from air and water pollution, and contributing to global climate change, which will even affect Chinese citizens in the longer run. In addition, recent scholarship has not found evidence to support the assertation that installing coal-fired power plants leads to improvements in energy access [51].

As this study did not make assumptions about the nature of Chinese state capitalism, and whether politics or market concerns drive its operation, our field research was able to empirically confirm the interplay between the strong internal pull factors in recipient states and the ready availability of Chinese finance.

Bretton Woods institutions such as the World Bank and limited-membership forums such as the OECD have put in place rules limiting international public finance to build new coal-fired power plants. China has not openly contested these norms, and in some cases it has partially embraced them (e.g., the financing guidelines of the China-backed Asian Infrastructure Development Bank). The emerging norm of limiting financing for coal, however, runs up against the principle of sovereignty in states who choose to pursue their respective energy trajectories even when they are inconsistent with the spirit of and the long-term goals of the 2015 Paris Agreement on Climate Change.

Indeed, globally, if all the coal-fired power plants that are currently planned are in fact built, the carbon budget achieving 2°C would be used up by the new coal plants alone [52]. Even if the increases in coal-fired power are technically consistent with their nationally-determined contributions (NDCs) (as they are, for example, in Vietnam and Indonesia), they reveal low ambition. On the financier side, China's financing of these projects is inconsistent with Article 2 (1)c of the Paris Agreement on greening financing flows.

Consistent with bounded rationality theory whereby decisionmakers choose "decision outcomes that are good enough to suit decision makers' purposes, but that are not necessarily optimal outcomes," [53], we find that policymakers make decisions under constraints that result in choices supportive of coal-fired power plants. For example, it is evident through our Bangladesh case study that officials have operated under information constraints about the availability of renewable energy resources, leading to policymakers accepting coal-fired power plants as "good enough" choices (the Bangladeshi power development plan was produced with the technical assistance of Japan, which may not have been entirely neutral in its interests). With the discovery of substantially greater wind resources, at higher turbine heights, if and how policymakers update their prior assumptions about the availability of these resources will be an area worthy of investigation.

Furthermore, there is also evidence of a "stop rule" that suggests that policymakers stop their search process once a minimally-acceptable option emerges [53]. When the readily available concessional Chinese finance is combined with cheap coal-fired power plant technology, the combination is highly attractive to governments who need a quick fix to a present challenge, such as rapidly rising electricity demand in Vietnam. This finding is also consistent with earlier scholarship that found Chinese automotive firms and the Chinese government itself also employed a 'good enough' principle by failing to demand cleaner and energy-efficient technologies (such as catalytic converters or electronic fuel-injection technology) from foreign technology providers during the development of the Chinese auto industry. Chinese actors did not bargain hard for a cleaner or more efficient technology in their negotiations with foreign joint venture partners after China's reform began in the 1980s because they were primarily focused on developing an auto industry, and the foreign firms did not offer cleaner alternatives [42].

6. Conclusion

Unmet energy needs in developing countries are immense. How these countries provide plentiful supplies of energy to their citizens and growing industrial sectors will strongly affect local environmental and health conditions and have a major bearing on collective global prospects of achieving the goals of the Paris Agreement. This paper finds that developing countries have sought Chinese overseas investment in coal-fired power for a variety of reasons and that their demands are well matched by China's continued willingness to finance and export equipment and services to build new coal-fired power plants overseas.

The article identifies the main drivers of demand for financing for coal-fired power plants from China's development banks in South and Southeast Asia. Recipient countries seek financing and technology for coal-fired power plants because of strong and seemingly relentless demand for electricity as their economies grow rapidly, comfort and familiarity with coal technology, energy security concerns that make coal seem attractive, a lack of explicitly supportive policies for renewable energy, perceived or actual lack of land and resource availability for renewable technologies, inadequate grid infrastructure, perceptions of higher costs for cleaner alternative options, highly protective federal/central government policies for coal, and the prevalence of financially distressed state-owned electricity monopolies. Countering these drivers for coal are local government or civil society demands for cleaner alternatives, the cost of wind and solar technologies being cheaper than coal in some contexts already, and new policies in support of renewables, particularly solar PV, in India.

Challenging the prevailing notions of cost-minimizing recipient states or policymakers minimizing carbon impacts, we find evidence of boundedly-rational policymakers making decisions based on a 'good enough' rationale for the present moment. Given the pressing imperative to meet energy needs at least cost, the easy supply of Chinese finance and coal-fired power equipment and services provide an adequate basis for recipient country governments to rationalize their support for coal-fired power plants through the BRI. Under Chinese law, Chinese enterprises and investors are required only to adhere to the environmental policies of the host country governments and do not appear to face consequences even if they fail to do so. India imported mostly sub-critical power equipment from China until the national government implemented a supercritical coal mandate with stricter emission norms. Vietnam and Indonesia continue to provide favorable conditions for importing sub-critical coal power plant equipment. In Bangladesh, pressure from civil society and concerns about energy security have helped to nudge the government towards supercritical power plants, but capacity challenges limit the government's ability to monitor and enforce environmental regulations.

This paper adds to the literature on China's growing role as a financier of development projects around the world by clarifying how policies and contextual considerations in recipient states shape the nature of Chinese engagement. While the findings underline the importance of the agency of recipient states in how they shape their energy-environment-development pathways, the paper also identifies the importance of domestic capacity to formulate and enforce environmental, health, and social protection standards and safeguards to be a significant limiting factor. In other words, the exercise of agency may be limited by capacity constraints.

China's Belt and Road Initiative has the potential to become the largest means for the diffusion of cleaner energy technologies throughout the developing world. The BRI could not only help unlock markets for clean energy technologies for China but also meet the pressing energy needs of developing countries in a manner that is consistent with the overarching goals of the Paris Agreement on Climate Change. It will only do so if recipient countries exercise more agency and/or if Chinese overseas investment policies change.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Interview questions

Motivations

1. Who are the key actors involved in this project?
2. Why was this project pursued? What need does this fill?
3. What was the decision-making process to set up this plant? What was the nature of Chinese engagement? Other actors'?
4. What incentives does this project provide to the host country? To the Chinese side/investors?

Technology choice

1. What is the fuel source for this power plant (coal, natural gas, oil, biomass, co-firing?)
2. What is the specific combustion technology (sub-critical, supercritical, IGCC, NGCC)?
3. How did you pick this specific fuel source and power-plant technology for the project?
4. What criteria did you use to evaluate among options? (Follow up may be necessary on: local fuel availability, relative costs, relevant government policies incentivizing certain types of fuels or technologies, access to technology suppliers, who they are selling power to, licensing arrangements).
5. Of all of these factors listed in the above question, which were most important (rough ranking)?

Environmental aspects

1. What are the conventional emissions from this plant (ideally what are the specific emission factors for SO_2, PM, NOx, CO, Hg)?
2. Are there any emission controls on the plant (e.g. de-sulfurization equipment)?
3. What is the efficiency of the plant?
4. What are the CO_2 emissions of the plant?
5. Does the plant use any CO_2 capture and storage technology?

Access to finance

1. What are the terms of the investment? How is Chinese investment different from other options?
2. What are local financing options? How is the Chinese investment different?
3. [If not already answered above] How would the availability of concessional finance change your decision above?
4. Were institutions that could provide concessional finance (such as the World Bank, Global Environment Facility, Asian Development Bank, or Green Climate Fund approached? How did that play out? Or, why were they not approached?

Policy support and policy barriers

1. Identify key policies that support this investment
2. In what other ways has the government facilitated the execution of the project? What about other actors?
3. What are the policy barriers that this plant faces?
4. Are there policy barriers to the use of other types of energy technologies?

Stakeholder participation

1. Please describe the stakeholder engagement process. (Was the process used for this plant any different from conventional utility projects?)
2. How was stakeholder input used?
3. How did stakeholder input alter decision-making, if at all? At what levels?
4. What has the reaction been since this planted was signed? How do stakeholders feel?
5. What is your perception of how local communities find this plant? How about international NGOs? [If there have been protests, follow up on how that has been handled, why there have been protests, etc.]
6. What is your own personal opinion about this project (to clarify potential bias)?

For stakeholders

1. Did you participate in any kind of stakeholder engagement process? If so, what was your experience like?
2. Do you support the construction of this plant? Why or why not?

3. What is your perception of how local communities find this plant? How about international NGOs? [If there have been protests, follow up on how that has been handled, why there have been protests, etc.]

Policy context

1. How does this choice fit within the broader energy/climate/economic landscape?
2. What are larger trends in the country that affect decisions such as the one to develop this power plant?
3. Anything else regarding the policy context and local, contextual factors?

Appendix B. List of cited interviewees

Bangladesh (Fieldwork: September 2018)

Interview BD 1	Regional power producer
Interview BD 2	Energy expert, think tank
Interview BD 3	Official, Sustainable and Renewable Energy Development Authority
Interview BD 4	Official, Ministry of Environment and Forests
Interview BD 5	Official, Ministry of Environment and Forests
Interview BD 6	Official, Department of Environment
Interview BD 7	Civil society activist
Interview BD 8	Official, Embassy of China
Interview BD 9	Energy expert, academia
Interview BD 10	Civil society official

Indonesia (Fieldwork: July – August 2018)

Interview ID 1	Coal expert, NGO
Interview ID 2	International organization official
Interview ID 3	Investor association official
Interview ID 4	Infrastructure bank official
Interview ID 5	Infrastructure bank official
Interview ID 6	Energy expert, think tank
Interview ID 7	Multilateral development bank official
Interview ID 8	Energy expert, think tank
Interview ID 9	Energy expert, academia
Interview ID 10	Official, Ministry of Planning (BAPPENAS)
Interview ID 11	Former official, PLN
Interview ID 12	Multilateral development bank official
Interview ID 13	Legal expert, NGO
Interview ID 14	Coal business association official
Interview ID 15	Government official, Ministry of Energy and Mineral Resources (MEMR)
Interview ID 16	Former government official and a climate change expert

India (Fieldwork: August – September 2018)

Interview IN 1	Coal expert, think tank
Interview IN 2	Energy expert, international think tank
Interview IN 3	Journalist
Interview IN 4	Energy expert, think tank
Interview IN 5	Official, Central Electricity Regulatory Commission (CERC)
Interview IN 6	Chief executive officer of a company with its own captive power plant
Interview IN 7	China and East Asia expert, academia
Interview IN 8	Energy finance expert, multinational power development company
Interview IN 9	Coal expert, international think tank
Interview IN 10	Coal expert, NGO
Interview IN 11	Former official, Ministry of Power (MOP)
Interview IN 12	Senior management, multinational turbine and boiler manufacturer
Interview IN 13	Plant operations head, captive coal-fired power plant
Interview IN 14	Plant maintenance expert, multinational plant operations consulting firm
Interview IN 15	Coal expert, NGO
Interview IN 16	Former Joint Secretary, Ministry of New and Renewable Energy (MNRE)
Interview IN 17	Head, solar PV industry association

Vietnam (Fieldwork: June 2018)

Interview VN 1	Specialist, Ministry
Interview VN 2	Project manager, power engineering consultancy
Interview VN 3	Energy consultant, power engineering consultancy
Interview VN 4	Plant Director, BOT coal-fired power plant
Interview VN 5	Director, power engineering consultancy
Interview VN 6	Legal expert, state-owned power company
Interview VN 7	Project manager, Alstom
Interview VN 8	Vice Director, Provincial Investment Department
Interview VN 9	Environmental scientist, university
Interview VN 10	Green enery expert, NGO
Interview VN 11	Energy finance expert
Interview VN 12	Director, Provincial Investment Department
Interview VN 13	Expert, local NGO

Appendix C. Supplementary data

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