NAVIGATING RISK IN Brazil's ENERGY SECTOR: THE CHINESE APPROACH

INTER-AMERICAN DIALOGUE

EDITED BY MARGARET MYERS AND LISA VISCIDI

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FOREWORD

I am pleased to present "Navigating Risk in Brazil's Energy Sector: The Chinese Approach," a new report edited by Margaret Myers, director of the China and Latin America Program, and Lisa Viscidi, director of the Energy, Climate Change and Extractive Industries Program, at the Inter-American Dialogue. The report analyzes critical challenges to investing in Brazil's oil and gas, electricity generation and transmission sectors from the perspective of Chinese companies and identifies opportunities for cooperation and policy improvement.

This Dialogue report was made possible through the generous support of the Alcoa Foundation. It highlights findings from a public meeting on Chinese investment in Brazil's energy sector, organized in collaboration with the China-Brazil Business Council (CBBC) and the Industrial Federation of the State of Sao Paulo (FIESP) during FIESP's 2014 Infrastructure Week conference in Sao Paulo.

Our report features the work of three distinguished analysts of Latin America's energy sector. Naki Mendoza, a reporter at Energy Intelligence Group, analyzes Chinese investment in Brazil's oil and gas sector. Ilan Cuperstein, the Federal University of Rio de Janeiro representative to the China Brazil Center for Climate Change and Energy Technology Innovation, outlines China's role in renewable energy generation in Brazil. And Chris Cote, MPP candidate at the Harvard Kennedy School of Government and former research associate at BrazilWorks, examines investment by China's State Grid Corporation in Brazil's transmission sector.

The Dialogue's China and Latin America program engages and informs academics, policy-makers and private sector leaders in China, Latin America and the United States on evolving themes in China-Latin America relations. The Energy, Climate Change and Extractive Industries program informs and shapes policies that promote investment while encouraging economically, socially and environmentally responsible development of natural resources.

The Inter-American Dialogue is the leading US center for policy analysis, exchange and communication on issues in Western Hemisphere affairs. The views expressed in this report are those of the authors, and do not necessarily reflect the perspectives of the Inter-American Dialogue, the China-Brazil Business Council (CBBC) or its sponsors.

Michael Shifter
President

INTRODUCTION

Margaret Myers and Lisa Viscidi

Chinese investment in Brazil has expanded over the past decade, albeit more slowly than bilateral trade, and the oil and gas and electricity sectors are an important destination for Chinese direct investment. But despite demonstrated interest on the part of China's government and firms in Brazil's energy sector, Chinese investors have been slow to engage in many cases. The authors of this report indicate several barriers to investment that have obstructed Chinese involvement in recent years—the same barriers facing other international investors in Brazil. They range from price controls and stringent local content stipulations to a lack of familiarity with local market dynamics. Chinese firms are also increasingly weighing the costs and risks of investing in Brazil with investment options elsewhere in the world.

As elsewhere in Latin America, Chinese investment is driven by a complex mix of government planning and profit-based motivations. While occasionally supporting China's energy security objectives, Chinese national oil companies (NOCs) are known to operate according to profit-based incentives in Brazil, and to readily exchange their abundant capital for opportunities to enhance competitiveness in emerging service sectors. Through mergers and acquisitions, NOCs are gradually expanding their portfolios to include upstream oil and gas holdings. Chinese firms of all sorts are also bidding across value chains, including in infrastructure, services, and equipment exports. Chinese electricity giant State Grid, for example, expects large returns from its electricity infrastructure projects in Brazil and is now interested in expanding into Brazil's generation and distribution markets.

The Chinese and Brazilian governments still have a hand in large-scale deals, however, especially with respect to energy projects. As indicated in the first section of this report, Presidents Dilma Rousseff and Xi Jinping are thought to have arranged China National Petroleum Corporation (CNPC) and China National Offshore Oil Corporation (CNOOC) participation in the exploitation of Brazil's Libra oil fields. Bilateral cooperation in renewables is also largely government-driven. As noted in the second section,

China's private sector deals in Brazil's renewables are fairly insignificant, although there is potential for growth given increasing power demand and the capabilities of Chinese suppliers.

The following suggestions for Brazilian policymakers and Chinese firms—based on analysis from the authors of this report—could reduce perceived risk and provide additional opportunity for growth-promoting investment in Brazil's energy sector.

1) Revise local content supply regulations

Easing of local content restrictions would benefit Chinese oil firms looking to expand their involvement in Brazilian exploration and production. It would afford them opportunities to procure a familiar base of suppliers and top notch equipment from abroad, lessen their dependence on domestic human resources, and reduce the time required to understand local market compliance regulations.

Local content regulations also pose challenges for Brazilian firms. In Brazil's oil industry, the percentage of products and supplies used in upstream projects that must be manufactured in Brazil has historically ranged from 37–65 percent, depending on the project's phase of development. But given the enormity of the resource base and the recent expansion of domestic upstream projects, Brazil's industrial shipyards have become increasingly overstretched. As the dominant operator in the country, Petrobras is struggling with infrastructure bottlenecks, domestic service sector capacity constraints and inadequate human resources, which have led to project delays and cost over-runs.

Local content regulations set by the Brazilian Development Bank (BNDES) have also limited Chinese participation in Brazil's growing wind market. Efforts to revise wind industry local content regulation have been blocked by Brazil's steel industry, however.

2) Liberalize prices for transportation fuels and electricity tariffs

Government-imposed price caps on transportation fuels and electricity tariffs deter investment from Chinese companies and inhibit private sector investment in refining and electricity generation more broadly.

A government policy capping the retail price of diesel and gasoline below international prices led Petrobras to incur downstream losses of more than $40 billion since 2011, forcing it to take on more debt in order to deliver on the cash-generating upstream projects that it operates on behalf of partner companies. Fuel price caps have also dissuaded Chinese companies from investing in Brazil's refining sector. A government policy to align fuel prices and alleviate Petrobras' financial pressures would aid in removing risk and uncertainty among potential consortium partners and could encourage companies from China and elsewhere to invest in Brazil's downstream sector.

Likewise, in the power sector, price controls have deterred investment from Chinese firms in renewable energy generation, particularly wind and solar, where production costs are higher than traditional hydropower projects. Liberalizing electricity tariffs would help attract investment in power generation from renewable energy sources as well as natural gas.

3) Improve community engagement

Chinese firm State Grid has implemented a highly successful approach to community engagement and public relations over the past few years, which could be easily replicated by Chinese firms that are struggling to build a positive image in the region.

In order to cultivate a positive image in Brazil, State Grid hires local managers, invests in local communities, and sponsors local cultural events. The president of State Grid, Cai Hongxian, also participated in several interviews with Brazilian business magazines, noting the importance of his Brazilian managers and the fact that many of his Chinese employees have learned Portuguese. Cai attributes much of his company's success in Brazil to its approach to community and public relations.

After a period of aggressive expansion throughout Latin America—owing in particular to the global financial crisis—Chinese oil firms are looking to develop existing projects and partnerships rather than forging new ones. To do so, Chinese firms need to bring in more than capital—they need more capable personnel who can operate projects. That means gaining familiarity with local market dynamics, legislative frameworks, and labor and indigenous movements. With this in mind, the region might expect additional government, public and community relations activity from Chinese firms in the coming years. State Grid's example is a favorable one and could be especially successful if it promotes technology transfer when installing state of the art transmission lines throughout Brazil.

4) Promote dialogue among the private and public sectors and with non-governmental organizations

As several Chinese scholars and energy industry experts have indicated, China's NOCs should engage with a broad range of stakeholders, including civil society, unions, and political parties not in power, in order to avoid political contingencies and build deeper ties with Brazilian society.

Chinese firms would also benefit from more cross-firm communication and information exchange. Dialogue and cooperation between Chinese and Brazilian firms is currently driven mainly by government-established forums. For example, bilateral cooperation on renewable technology development is mostly evident within the China Brazil Center for Climate Change and Energy Technology Innovation (CBC), which was established by both governments in 2010. Expanding on the successes of existing private sector-focused organizations, such as the China-Brazil Business Council, the two countries should establish more spaces for exchange between Chinese and Brazilian businesses at varying levels of firms, including CEOs, managers and technicians.

POLITICAL RISK AND RESOURCE NATIONALISM:
WHY THE CHINESE ARE MOVING CAUTIOUSLY INTO BRAZIL'S OIL SECTOR

Naki Mendoza*

Viewed as the new darling of the oil industry just a few short years ago thanks to the discovery of massive offshore pre-salt reserves, Brazil has lately struggled to attract investment from international oil companies as a result of heavy interventionist policies, a growing role for its overburdened state-controlled oil company Petroleo Brasileiro (Petrobras), and a general sense of higher political risk. These factors not only affect the international oil majors but have also complicated China's efforts to invest more actively in Brazil's upstream, likely influencing its NOCs to take a measured approach to large-scale resource acquisitions there, especially given the wealth of upstream opportunities elsewhere.

China is also shifting its own priorities for foreign-resource investments and its NOCs are pursuing a conscious strategy to gradually build their experience and know-how in new markets. The result is what appears to be a slower approach by China in Brazil compared to its large participation in oil and gas projects elsewhere in South America. Nevertheless, China still views Brazil as a strategic long-term investment. Its pattern of steadily growing its portfolio of assets suggests a strong interest in the South American country and foreshadows a greater presence there as Chinese companies become more adept at operating in the Brazilian market.

Libra: A New Beginning

China's NOCs made headlines in Brazil in 2013 as members of the consortium that won the rights to develop the giant pre-salt Libra field—Brazil's largest ever oil field discovery. The auction marked the first foray into Brazil for global industry giants China National Petroleum Company (CNPC) and China National Offshore Oil Corporation (CNOOC). But the tender also turned heads for what many considered to be unexpectedly moderate participation by the two NOCs, both of which limited their stakes in the project to 10 percent.

The Libra auction was a watershed moment for Brazil that opened a new chapter in the country's history as an oil producer. The field's estimated 8–12

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billion barrels of recoverable reserves makes it one of the largest oilfield discoveries in the world so far this century. With it come expectations that Libra's expected peak production of around 1.4 million barrels per day—nearly 75 percent of Brazil's total current volumes—will turn Brazil into a world-leading oil producer and generate transformational wealth from roughly US$400 billion in taxes and royalties over the 35-year life of the field.[1] The sheer size of Libra means that it may be one of the most expensive oil field projects ever undertaken. Initial development costs are estimated at around 400 billion reais (US$175 billion).[2]

The capital costs and scale of the resource suggested that the auction was tailor-made for large participation by cash-flush, resource-seeking oil companies. As a global offshore expert, Petrobras already possesses considerable technological know-how. The company is one of the world's largest oil producers from ultra-deep waters, including in the deep waters of the US section of the Gulf of Mexico. Petrobras operates more than 90 percent of Brazil's oil production, 92 percent of which comes from offshore fields.[3] Its US$221 billion five-year investment plan is one of the largest corporate capital expenditure programs in the world, which also makes it the world's most heavily indebted oil company and in need of additional financing from partner companies. The relatively limited investment by comparatively cash-flush CNPC and CNOOC in the Libra consortium therefore baffled observers. Their 10 percent stakes contrast with the 20 percent interests taken by each of the fellow consortium companies Royal Dutch Shell and France's Total. Petrobras holds the remaining 40 percent stake in the Libra project.

China's seemingly passive approach towards Libra can be understood, however, in the context of Brazil's reforms to its upstream oil sector. The changes first proposed in 2007 and signed into law in 2010 rewrote the rules of investment in Brazil's pre-salt resources. New laws limited foreign participation in pre-salt projects in favor of a larger government stake vis-à-vis Petrobras. In turn, the privileges that the reforms bestowed on Petrobras have burdened the company with exorbitant development costs and overstretched its project management capabilities. Other market-restrictive policies enforced by the government, such as stringent local content requirements for service contracts and subsidized domestic fuel prices, have placed additional project-execution and financial pressures on Brazil's national oil company. The heavily regulated environment has led to a string of operational inefficiencies, production delays, and enormous downstream losses for Petrobras that have created a specter of uncertainty among foreign oil companies—CNPC and CNOOC included—about their future investment in Brazil.

Changing the Rules of the Game

Foreign companies have been allowed to participate in oil exploration and production in Brazil since 1999, when the National Petroleum Agency (ANP) started to host annual public auctions for upstream concessions, which included blocks with pre-salt hydrocarbon potential. But a string of discoveries of giant pre-salt fields starting in 2007, among them Libra, changed the paradigm in Brazil. Conservative estimates place Brazil's recoverable pre-salt resources at no less than 50 billion barrels.[4] That is more than four times the country's total proven reserves when Libra was discovered.[5]

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[1] Reuters, 'Brazil Gears Up for Big Oil Auction Amid Heavy Security', October 21, 2013, http://www.reuters.com/article/2013/10/21/us-brazil-oil-auction-idUSBRE99K0G920131021.

[2] *The Economist*: 'Cheap at the Price', October 24, 2013, http://www.economist.com/news/americas/21588392-single-bid-vast-field-shows-weakness-brazils-state-led-approach-developing-its.

[3] Agência Nacional do Petróleo, Gás Natural e Biocombustíveis (ANP), June 2014, production bulletin.

[4] US Energy Information Agency, http://www.eia.gov/countries/analysisbriefs/brazil/brazil.pdf.

[5] *Valor Economico*, http://www.valor.com.br/sites/default/files/images/libra_grande_site_2.jpg.

Blessed with its newfound endowment, the government suspended public auctions in 2008 to devise new laws that increased its control of the country's pre-salt resources. The legislation established a new production-sharing model for all future pre-salt acreage and made Petrobras the mandatory operator of all future pre-salt projects, holding a minimum equity stake of 30 percent. Other laws created a wholly owned state entity to manage the development of pre-salt projects, granted Petrobras exclusive rights to develop up to 5 billion barrels from previously unassigned pre-salt acreage in exchange for a larger government stake in the company, and established a social fund to use government revenues from pre-salt developments to finance specific government programs. President Luiz Inacio Lula da Silva signed the bills into law in 2010.

Brazil ended a five-year hiatus from competitive bid rounds in 2013, holding three auctions for new oil acreage after the reforms were approved. A May 2013 auction for non-pre-salt acreage generated widespread interest. Of the 289 blocks offered, 142 drew winning bids, attracting 2.8 billion reais in signing bonuses from the 30 companies that participated.[6] None of the acreage offered was deemed pre-salt, so the new laws did not affect any of the contracts for the assigned concessions. CNOOC and the China Petroleum and Chemical Corporation (Sinopec) both registered to bid, the latter as part of its joint venture with Spanish oil major Repsol. But CNOOC withdrew its name shortly before the auction and Sinopec did not submit any high offers, presumably under the assumption that both companies were holding out for the larger pre-salt bid round later in the year. A November 2013 bid round focused on shale gas exploration blocks proved less successful because just 72 of the 240 blocks offered were awarded, mainly due to the remote location of the basins.

Undoubtedly the centerpiece of Brazil's 2013 bid rounds was the Libra auction. As the first auction to apply the new pre-salt laws, the tender was considered a referendum on the attractiveness of Brazil's new framework. Ultimately, only one consortium presented a bid, needing to pledge just the minimum 41.65 percent profit oil and the 15 billion reais signing bonus to win the development rights. The five-company consortium reflected the contemporary balance of power in the oil and gas industry, mixing the technical and project-execution capabilities of Western oil majors with the financial clout and market access of Chinese oil companies. China's low profile was nonetheless puzzling to industry experts.

China's Gradual Approach

Despite their minimal participation, CNOOC and CNPC's investment in Libra represents a significant new phase of Chinese NOC investment in Brazilian oil and gas. Before Libra, China's upstream strategy in Brazil had been to acquire non-operator minority stakes in producing assets, in partnership with experienced international operators. The strategy allowed Chinese companies to leverage a base of production while they studied the local business conditions and reached a better understanding of Brazil's regulatory environment before making any large-scale majority acquisitions. Part of that logic is rooted in the negative experience of previous foreign-resource acquisitions gone awry. Among them is the Sino Iron project being developed by Citic Pacific Mining (CPM) of China in Western Australia. The project has run US$6 billion over budget and is four years behind schedule. Part of the problem, industry experts say, stems from CPM's insufficient due diligence of local market regulations, including immigration and labor codes that caused various project delays.[7]

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[6] ANP '11ª Rodada tem arrecadação recorde', May 14, 2013, http://anp.gov.br/?pg=65961&m=&t1=&t2=&t3=&t4=&ar=&ps=&cachebust=1409075871583.

[7] Downs, Erica 'Whatever Became of China, Inc?' June 24, 2014, Brookings Institution.

In a separate case, CNOOC's 2012 takeover of Canadian independent oil producer Nexen was also closely scrutinized by Canada's regulators. The deal was ultimately approved but not without pushback from the Canadian government. "When we say that Canada is open for business, we do not mean that Canada is for sale to foreign governments," Prime Minister Stephen Harper told a news conference at the time of the deal.[8]

Libra is significant inasmuch as this is the first time that Chinese NOCs have invested in a pure exploratory play in Brazil, which commits them to participate more fully in the complete lifecycle of an upstream project in the country. China's investment in Libra was the culmination of a series of strategic acquisitions in Brazil shortly after the country's giant pre-salt plays were being discovered. Before that, Brazil's upstream was of only marginal interest to China given Petrobras's de facto monopoly and the lack of substantial resources worthy of large-scale investments. The pre-salt discoveries starting in 2006 changed that equation.

Keen on eventually investing in the prolific resources being unearthed, China's NOCs began to build their presence in Brazil and gradually to develop their expertise in the local market. The trajectory began in 2010 when Sinopec formed an alliance with Repsol to purchase a 40 percent stake in its assets in Brazil for US$7.1 billion, providing Sinopec a foothold in some of the world's largest pre-salt plays. Among its projects is a stake in the giant pre-salt Sapinhoa field—one of Brazil's largest—and operating interest in the deepwater pre-salt BMC-C-33 block.[9] One year later, Sinopec added a stake in Portugal-based Galp Energia's Brazilian assets for US$5.2 billion, which gave it a stake in the giant pre-salt Lula field, the first huge pre-salt field discovered in 2006, through Galp's interest.

Libra is the first time that Chinese NOCs have invested in a pure exploratory play in Brazil.

The Repsol and Galp acquisitions were the first instances in which Sinopec directly participated in upstream projects in Brazil. Its initial entry in the country was in 2004 through a contract with Petrobras to construct a natural gas pipeline linking the country's northeast and southeast gas transportation networks. Sinopec's internationalization trajectory is a rather recent development; it has announced the bulk of its foreign acquisitions since 2010.[10] Its trajectory in Brazil therefore appears to reflect an ongoing strategy of integrating the know-how from experienced partners to develop its own operator capacities.

State-owned Sinochem Corporation has followed similar market logic in Brazil. The government conglomerate is primarily involved in the production and trading of chemicals and fertilizers, but has gradually expanded its portfolio to include upstream oil and gas holdings. In 2010 the company purchased a 40 percent stake in the Campos Basin deepwater Peregrino field from Norway's Statoil for US$3 billion. In Statoil, Sinochem has partnered with a proven global deepwater expert that has identified Brazil as one of its key international growth markets.

Sinochem tried to further increase its holdings in Brazil in August 2013 by attempting to purchase Petrobras's 35 percent stake in the Shell-operated Parque das Conchas deepwater project. But the deal was eventually upended by the project's current

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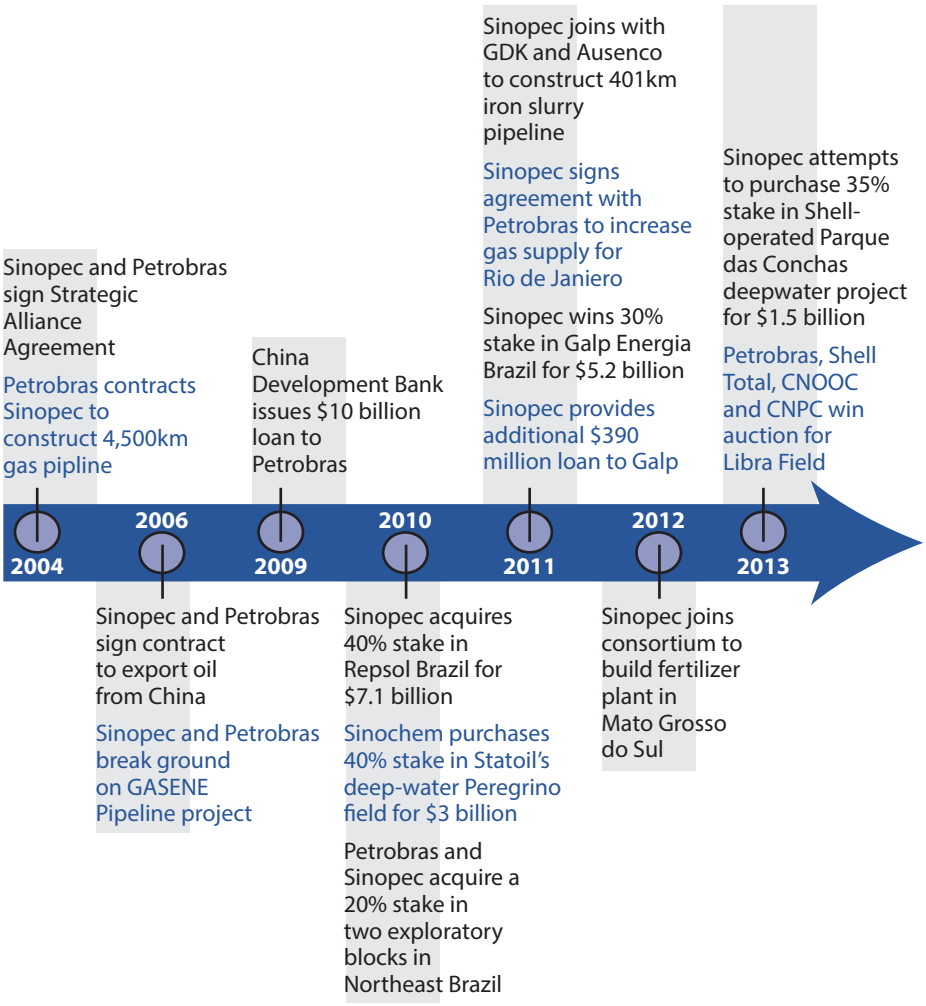
[8] *New York Times*, 'Canada Clears $15 Billion Chinese Takeover of an Energy Company', December 7, 2012, http://dealbook.nytimes.com/2012/12/07/canada-clears-15-billion-chinese-takeover-of-an-energy-company/.

[9] Repsol press release, 'Repsol Confirms the Significant Potential of Brazil's BM-C-33 Pre-salt Block', May 12, 2012.

[10] China-Brazil Business Council, 'Chinese Investments in Brazil from 2007–2012: A Review of Recent Trends', June 2013.

Figure 1. Chinese Engagement in Brazil's Oil & Gas Sector, 2004–2013



partners, which exercised preemptive rights to increase their respective stakes.[11]

Asset sales by Repsol, Galp and Statoil were part of their corporate strategies to optimize upstream portfolios in the aftermath of the global financial crisis. They provided fitting opportunities for Chinese NOCs to expand in Brazil just as their interests in the country's deepwater and pre-salt resources were growing. Although Sinochem's bid was unsuccessful, it again held firm to the behavior of China's NOCs in Brazil: an attempt to partner with experienced operators through a minority stake in producing assets.

[11] 'Shell Approves New Development Phase for Brazil Offshore Field', *Oil Daily*, Energy Intelligence Group, July 22, 2013.

Elsewhere in Latin America

China's minority presence in Brazil's oil industry contrasts with its activities elsewhere in South America, where it has taken a more significant equity and operator role and moves in faster. In Ecuador, Andes Petroleum—a consortium comprising CNPC and Sinopec—has been operating upstream concessions since 2006 in the mature Oriente Basin, while in Venezuela Sinopec and CNPC are significant partners in developing large-scale strategic projects in the country's vast Orinoco heavy oil belt. Recently announced deals by state-owned Petróleos de Venezuela (PDVSA) include a US$14 billion project with Sinopec to develop the Junin-1 block in the central Orinoco Belt and a US$14 billion project with CNPC to develop the nearby Junin-10 block.[12]

China's NOCs procured their assets in those countries through a hybrid approach of public bidding and direct state-to-state deals, negotiated at the highest levels of government, and often considered China's preferred way of acquiring national resource interests. China established a foothold in Venezuela's Orinoco belt through direct government negotiations, first in 2010 when PDVSA and CNPC struck a US$16.3 billion deal to jointly develop the Junin-4 heavy oil block, followed by the Junin-1 and Junin-10 deals announced in 2013. In Ecuador, Chinese state-owned companies have participated in competitive public tenders, including the most recent eleventh bid round in December 2013. But the bid process in Ecuador is widely viewed as less transparent than other public tenders in Latin America.

China's general preference for direct state-to-state deals is another factor that makes its participation in the Libra auction particularly significant. Although Chinese and Brazilian officials met in Beijing to preagree on China's role in the Libra Round, by participating in a competitive and open public bidding process Chinese NOCs have gradually evolved towards a more market-based approach in the way they procure upstream assets abroad.

A Controversial Process

The Libra auction itself was nonetheless criticized as a flawed process fraught with risks, and as a structure that prevented oil companies—including Chinese NOCs—from fully pursuing their commercial objectives. The actual 41.65 percent minimum profit oil requirement was low compared to the 60–75 percent rates previously mulled by ANP. But when the signing bonus, royalties, taxes and mandatory social contributions are taken into account, the government take from Libra will be well over 80 percent. The record US$6.9 billion signing bonus—more than five times the total amount collected from the May 2013 bid round—was meant to draw only the industry's biggest names. Yet the absence of some of the largest international oil companies such as Chevron, Exxon Mobil, BP and BG revealed an aversion to the terms. The unresolved status of Pre-Sal Petroleo until just weeks before the auction also concerned potential bidders and was believed to have influenced how much profit oil bidders were willing to pledge.

Although the rules of the auction were fully transparent, experts say it created a structure that compromised the true competitiveness of the auction. Because Petrobras was required by law to operate the project, it was possible for oil companies to form a consortium around the remaining 70 percent without directly consulting Petrobras, knowing that the Brazilian major would participate regardless of its stake. But pursuing that course and committing Petrobras to an unknown financial sum would risk angering the operator company. Potential bidders, therefore, were believed to have sought approval from Petrobras to participate in its proposed consortium even if it meant limiting their true commercial objectives.

[12] 'Venezuela Unveils Heavy Oil Deals With Chinese Firms', *Oil Daily*, Energy Intelligence Group, September 19, 2013.

Libra's size and its significance as the first tender under the new production sharing terms also turned the bid process into a political objective for the government. Brazilian oil industry experts agree that the government took an active role in soliciting participation from IOCs and NOCs in order to pursue its political objectives. Those objectives, they say, were to form a consortium that included experienced Western oil majors but which limited the participation of China's state-owned companies to a minority role. Such a consortium would enable Brasilia to dismiss any criticism that Libra's terms were so draconian as to attract only resource-seeking national oil companies. Indeed, the government achieved its goal, praising the outcome of the Libra auction and citing the mosaic of oil companies that participated in the winning bid. Skeptics point out, however, that only one consortium presented an offer for the minimum requirements. The lone bid was the product of perceived risks among international oil companies and a government-level decision to assemble a consortium comprised of companies diversified across capital structure and operator experience.

A New Global Energy Landscape

The Libra auction took place at a time when China's NOCs were finding themselves stretched thin overseas. After a period in the last decade when Chinese companies were stuck bidding on relatively low-quality, high-risk projects, prompting Sinopec Chairman Fu Chengyu to lament in 2004 (he was then CEO of CNOOC) that "the good projects are already taken," China suddenly became awash with attractive upstream opportunities around the world.[13]

In 2013, before the Libra auction, CNPC paid more than US$5 billion for US independent ConocoPhillips's 8 percent stake in the giant Kashagan oil field development in Kazakhstan. That same year CNPC spent US$2.6 billion to acquire Petrobras's 100 percent interest in two upstream blocks in Peru. Those deals come on top of the billions of dollars that China has invested in North American shale projects since the US unconventional revolution took off in earnest around 2008, roughly around the time that Brazil was discovering and appraising its massive pre-salt fields. The US shale revolution has transformed the global energy landscape, offering a new destination for upstream capital on fairly attractive terms. China has taken particular note of this development. Since 2010, China's NOCs spent in excess of US$10 billion to acquire upstream assets in the United States, most of which have been geared towards unconventional projects.[14] With a major reform opening the energy sector to foreign oil companies, Mexico also presents an interesting new opportunity for Chinese NOCs. Brazil, therefore, has become just one of many destinations where China's NOCs could choose to invest. Flush with acquisitions, CNPC chairman Zhou Jiping declared to an investor conference in Hong Kong in early 2014 that his company was "applying the brakes" on international resource acquisitions.[15]

China's state-owned resource companies will also likely be more closely scrutinized before receiving financing for overseas acquisitions. The call in last November's Third Plenum decision for state-owned enterprises to increase the value of state assets, raise production efficiency, and compete on an equal footing means that government and policy bank support for resource investments abroad will probably be more conditional than at any time in the past. Chinese companies are more likely to receive approval and funding

[13] Downs, Erica 'Whatever Became of China, Inc?' June 24, 2014, Brookings Institution.

[14] Downs, Erica 'Implications of the US Shale Energy Revolution for China', November 8, 2013, Brookings Institution.

[15] 'China freia aquisições em recursos naturais', *Valor Online*, March 31, 2014, http://isebvmf.com.br/index.php?r=noticias/view&id=281132.

for their acquisitions if they have a proven track record and experience dealing with producing assets overseas.[16]

Chinese lenders and firms are right to proceed with some caution in Brazil. Petrobras now finds itself heavily indebted and over-burdened by the legacy of its monopoly-era assets and the future pre-salt commitments that the 2010 reforms assigned it. Because of natural declines at its mature fields and start-up delays to greenfield projects, Petrobras has failed to grow its oil production for the past three years. It has set an ambitious target to more than double its current output and reach 4.2 million b/d by 2020. The company has committed itself to a massive five-year investment plan, with more than one third of spending earmarked for the development of pre-salt fields.[17] The investment plan is premised on the company's maintaining an investment grade credit rating to manage the borrowing costs of its US$109 billion of net debt, and on Petrobras's internal forecasts that it will not generate positive cash flow until 2016. Following downgrades last year, ratings agencies have a negative outlook on Petrobras, and warn that growing debt levels leave little room for operational error. Moody's, for example, says any possible ratings upgrade will be contingent on the delivery of pledged increases in production.[18]

Petrobras also has a track record of poor project management, project delays, and cost overruns, which foreign oil companies must carefully consider when deciding whether to partner with the Brazilian major. The company is rolling out a wave of 23 new offshore production facilities by 2018 to meet its 2020 output target. Many have been hit by setbacks. Of the nine production systems Petrobras planned to bring on stream last year simply to maintain stable volumes, just four were launched.

China has suddenly become awash with attractive upstream opportunities around the world.

The delays have frustrated IOCs currently investing in Petrobras-operated projects. Chevron saw its overall production dip by 2.2 percent last year and pinned some of the blame on the delay in the start-up of the Papa Terra heavy oil field, in which it holds a 37.5 percent stake. The United Kingdom's BG also hopes to be producing 500,000 boe/d in Brazil by 2020, but remains very dependent on Petrobras's timely delivery of 12 new floating production vessels by 2018. Oil companies looking to develop non-pre-salt plays independent of Petrobras must still contend with stringent local content requirements that have left Brazil's 10 shipyards overstretched, leading to various logistical bottlenecks and inflated project costs.

Looking ahead

Given its current state, Petrobras's required operator role in future pre-salt fields creates an increasingly unworkable burden for the company. Analysts say that a tacit recognition is emerging among industry officials that the company lacks the financial and operational capacity to continue shouldering the load. Allowing IOCs to have a larger stake in future pre-salt production seems a likely priority for the winner of October's presidential election in Brazil. Reducing Petrobras's upstream burden is seen as a relatively straightforward way to ease the financial pressures facing the company compared to the other options. In contrast,

[16] Downs, Erica 'Whatever Became of China, Inc?' June 24, 2014, Brookings Institution.

[17] Petrobras 2014–2018 Business Plan.

[18] Moody's Investor Service, 'Moody's assigns Baa1 rating to Petrobras' USD 8.5 billion in global notes', March 11, 2014.

scrapping domestic fuel subsidies that have cost the company billions in downstream losses risks stoking inflation and angering consumers, while easing local content requirements would present legal challenges for current service contracts.

No date has been set for the next pre-salt auction, but according to officials from Brazil's Energy Ministry, Petrobras's excessive commitments likely mean that the next pre-salt bid round will auction off a much smaller asset than Libra. Petrobras will likely have to downsize its current assets, which could open up attractive acquisition opportunities that fit China's model of growth in Brazil's upstream.

Conclusion

While China's participation in Brazil's largest-ever oil auction was somewhat underwhelming, its strategy in the country indicates that its NOCs are on a steady course to grow their presence in Brazil's upstream. Their pattern has been characterized by a gradual buildup of assets, which has given them time to better understand the regulations and complexities of new markets. The massive pre-salt plays discovered by Brazil in the last decade are on the scale of resources in which Chinese NOCs typically invest in abroad, and Chinese firms are likely to gradually ramp up investment in Brazil's oil sector in the coming years.

China's presence in Brazil, however, should also be viewed as just one option among many other exciting large-scale resource opportunities that have opened up around the world within the past decade. The risks facing foreign companies in Brazil are significant. As China proposes more control over its state-owned enterprises, its oil firms must carefully weigh the viability of project success in Brazil against other opportunities.

WEIGHING LOCAL RISKS AND OPPORTUNITIES:
SINO-BRAZILIAN COOPERATION IN RENEWABLE ENERGY

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In contrast to China's clear strategic interest in Brazil's oil and gas sector, Chinese investment in renewable energy has been modest. And despite expressed interest from both governments in clean energy cooperation, Chinese firms are still carefully weighing the benefits and risks of investment in Brazilian renewables.

As large, developing nations with relatively high carbon dioxide emissions, China and Brazil stand to benefit from enhanced cooperation in this sector. The two countries maintain coordinated positions in the United Nations Framework Convention on Climate Change Conference of Parties, and established the China-Brazil Center for Climate Change and Energy Technology Innovation in 2010 to lead bilateral research initiatives in bioenergy, solar energy, and urban sustainability.[19]

Yet Chinese firms—like their multinational counterparts—have been discouraged by Brazil's notoriously challenging investment environment in power generation and other industries.[20] While Chinese manufacturers are encouraged to "go out," government support beyond assisting registration of Chinese firms abroad and navigating local requirements appears limited. As a result, Chinese firm-level engagement in Brazil's renewable energy sector is restricted to relatively small-scale investments. The only sizable investments have been in hydroelectricity, mainly in transmission rather than distribution, led by state-owned enterprises already based in Brazil, such as State Grid.

Navigating a Challenging Business Environment

As in other industries, including oil and gas and power transmission, companies investing in renewable energy generation in Brazil face price controls, regulatory uncertainty, and strict local content rules. In 2012, for example, Brazilian President Dilma Rousseff announced a measure mandating a lowering of energy tariffs for expiring concessions that were on the verge of renewal. In addition, the high cost

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[19] Held, David, Charles Roger and Eva-Maria Nag, *Climate Governance in the Developing World.* Cambridge, Polity Press, 2013.

[20] *Boletim de Investimentos Chineses no Brasil 2012-2013,* Centro Empresarial Brasil China (CEBC). Rio de Janeiro, 2013.

of services and rigid labor laws are often cited as general bottlenecks to investment.[21] In the case of wind energy, BNDES' local content requirements to access preferential lines of credit, as well as the low price imposed by the government, have kept Chinese companies away from the Brazilian market. Solar energy, on the other hand, does not yet have a market in Brazil, despite the huge potential for electricity produced by photovoltaic (PV) panels across most of the national territory. A lack of comprehensive national policies to strengthen the market through demand-creation and different forms of subsidies or built-in tariffs are also major obstacles.

Brazil's renewable energy policy is patchy. Hydroelectricity and, more recently, wind energy are already included in government power auctions held each year by the National Electricity Agency (ANEEL), and enjoy specific credit programs through BNDES. But other sources such as solar and biomass are still in need of more comprehensive policies and basic government incentives, which are expected to be provided soon. Brazil's main energy supply, hydroelectricity, faces growing resistance against new, large-scale dam projects from environmental and social groups. This creates more pressure to encourage other renewable sources, especially wind, solar, and biomass.

The Brazilian government estimates an increase in energy demand from 118 gigawatts (GW) in 2015 to 154 GW in 2020, and says that renewable sources should play a predominant role in this increase in supply.[22] Thus, new and more aggressive policies are expected in the next few years to expand renewable energy markets. If Chinese companies use this time to adapt and learn about local legislation, political structure, and market operation, they should be very well positioned to take a leading role in this expansion.

In an effort to mitigate risk, Chinese firms have generally opted to work in consortia with Brazilian companies, mainly state-owned firms such as Eletrobras and its subsidiaries. Large hydropower projects have attracted these Chinese companies, which can offer state-of-the-art technology for low prices to their Brazilian partners, making them viable and successful.

The examples below of Chinese investment in wind, solar, and nuclear energy demonstrate the many challenges to and opportunities associated with investing in renewables in Brazil.

Wind Energy

The Brazilian wind energy industry is among the fastest growing in the world. In January 2014, Brazil installed 2.2GW of wind energy capacity—an increase of 50 percent compared to 2012. By the end of 2022 more than 17,000 megawatts (MW) of wind power will be installed, an increase of 85 percent annually over a decade, according to the government's Ten Year Plan. Capacity is dispersed among 90 wind farms located mostly on the northeastern and southern shorelines.[23] European firms dominate Brazil's wind energy industry. German Enercon's Brazilian subsidiary Wobben maintains over 1GW of installed capacity, followed by Danish Vestas, with over 900MW of installed and pending capacity. Seimens has installed an additional 210MW of wind energy generation capacity.[24]

China's presence in Brazil's wind industry, however, is virtually non-existent, with the exception of a 30MW installation by

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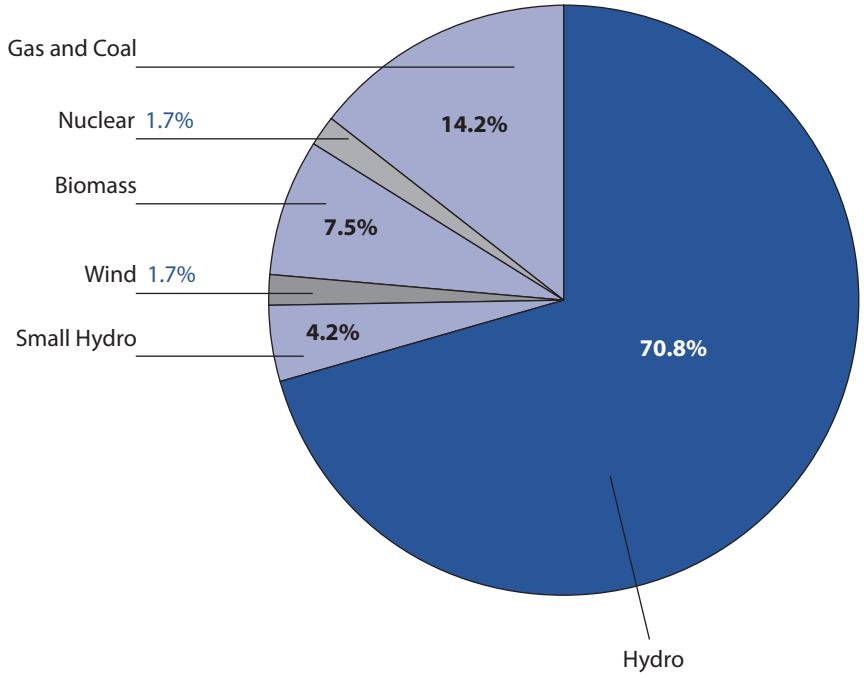
[21] *Boletim de Investimentos Chineses no Brasil 2012–2013*. Centro Empresarial Brasil China (CEBC). Rio de Janeiro, 2013.

[22] *Projeção de Demanda de Energia Elétrica para os próximos 10 anos (2011–2020)*. Empresa de Pesquisa Energética (EPE), http://www.epe.gov.br/mercado/Documents/S%C3%A9rie%20Estudos%20de%20Energia/20110222_1.pdf (accessed August 18, 2014).

[23] 'Capacidade de geração de energia eólica cresce 18% no Brasil em 2013.' G1, http://g1.globo.com/economia/noticia/2014/02/capacidade-de-geracao-de-energia-eolica-cresce-18-no-brasil-em-2013.html (accessed May 13, 2014).

[24] Shelton-Zumpano, Petras. *Chinese and Indian Wind Power Investments in Brazil: Opportunities and Risks*. Mimeographed document, 2012.

Figure 2. Brazil's Installed Electricity Capacity by Source, 2012



Source: Plano Decenal de Energia 2022, EPE.

Sinovel in a Desenvix-run wind farm in Sergipe. From 2011 to 2012, three of the largest Chinese wind energy companies, Sinovel, Goldwind, and Guodian United Power, announced intentions to establish offices and factories in Brazil. These plans, however, have yet to materialize—probably because of Brazil's strict local content standards. Having only recently begun their internationalization processes, Chinese wind firms still prefer wholesale exports of manufactured equipment and are reluctant to establish the required manufacturing operations in Brazil without guaranteed demand.

Solar Energy

The only sizable investment by a Chinese company in solar energy in Brazil has been the announcement by AstroEnergy of a US$350 million solar energy generation project in the state of Ceará, in the northeastern region. The company will use two parks for the production of energy and will bring 46,000 solar panels for the first park, which is expected to generate 300 jobs.[25] Another visible project has been the supply and installation of 5,000 PV panels by Yingli Solar, the first solar energy firm to become a sponsor of a World Cup, on the roof of Maracanã Stadium in Rio de Janeiro.

The modest level of Chinese investment in solar energy stems mainly from the lack of a comprehensive national policy

[25] *Boletim de Investimentos Chineses no Brasil 2012–2013*. Centro Empresarial Brasil China (CEBC). Rio de Janeiro, 2013.

Chinese firm-level engagement in Brazil's renewable energy sector is restricted to relatively small-scale investments.

for photovoltaic energy generation and grid integration. Brazil does allow distributed generation, whereby individual users can produce solar energy and sell it back to the national grid. However, although the government has signaled its intention to hold a solar energy auction similar to its successful wind auctions, the relatively high price of solar energy per kilowatt hour (kw/h) has kept those plans on hold. Experts and companies have criticized this reluctance to launch a national policy to create a steadier demand for solar energy, arguing that creating demand through auctions would lead to larger-scale production and thus a lowering of prices.[26] In 2014, regulating agencies hinted they may make local content requirements for solar energy more flexible in order to expand the market faster. The initial proposals released by Eletrobras, however, rely heavily on solar plants, which can be three times more expensive than distributed generation. These questions are expected to be resolved by the new government after the elections in October 2014.

Brazil has used thermo-solar equipment for water heating for decades, but Chinese companies have not entered this market yet because of the highly competitive and well established market in Brazil, which considerably increases the entry costs for Chinese suppliers. In 2012, during the United Nations Conference on Sustainable Development (Rio+20), Himin, one of the largest thermo-solar companies in China, announced a partnership with the Brazilian company Nadezhda to set up a joint venture as part of the internationalization of the brand.[27] The joint venture, however, had not come to fruition as of June 2014.

Nuclear Energy

China's state-owned State Nuclear Power Technology Corporation (SNPTC) established an office in Rio de Janeiro in 2013 to seek cooperation projects in the field of nuclear technology with Brazilian partners. SNPTC decided to invest in Brazil following the government plan, issued in 2010, to build eight new nuclear plants. This plan was put on hold after the accident in Fukushima, Japan, in 2011, but experts expect it to be revisited and adapted in the next decade because of the increase in national energy demand. By June 2014, the only contracts that SNPTC had signed in Brazil were with SGB for the supply of non-nuclear materials.

Brazil is developing its third nuclear power plant, Angra-3, in cooperation with Germany through Siemens; this is expected to start operating in 2018. SNPTC hopes to be a viable alternative partner for future projects in Brazil and has set a strategy to start cooperation with Eletronuclear—the Brazilian subsidiary of Eletrobras responsible for nuclear energy—and Indústrias Nucleares do Brasil (INB), which is responsible for the production of nuclear material for the two existing plants in the country. The idea is to start with small projects and guarantee the firm's placement as an alternative for future large projects.

Nuclear energy has particular national security, environmental and human safety, and political considerations that make it a more complex issue to approach. Nonetheless, the Brazilian government has stated its interest in expanding generation

[26] Azevedo, Tasso. 'Brasil segue investindo de forma lenta em energia solar.' *Akatu Temas,* http://www.akatu.org.br/Temas/Energia/Posts/Brasil-segue-investindo-de-forma-lenta-na-energia-solar (accessed June 3, 2014).

[27] Fernandes, Ana. 'Fabricante chinesa de aquecedor solar quer abrir 5 mil lojas no Brasil.' *Valor Econômico.* http://www.valor.com.br/empresas/2720424/fabricante-chinesa-de-aquecedor-solar-quer-abrir-5-mil-lojas-no-brasil (accessed June 15, 2014).

of nuclear energy in Brazil, albeit at a slow pace, which may represent a potentially successful area for cooperation between China and Brazil.

Conclusion

Although Chinese investment in Brazil's renewable energy industry is currently small, there is potential for growth. Brazilian policymakers recognize the need for comprehensive policies to incentivize renewable energy sources, which will inevitably be supplied by foreign companies as Brazilian firms lack the necessary technology to scale up. As new and large hydroelectric projects encounter growing resistance and higher political costs, Brasilia will have to find alternative solutions for increasing energy demand while keeping its matrix as clean as possible.

At the same time, amid declining demand in Europe and the United States for Chinese wind generators and solar panels following the global financial crisis, Brazil may become a priority market in which both sides have much to gain from further cooperation. The most important variables to be observed in the medium term are the efficiency and scope of Brazilian renewable energy policies and Chinese companies' willingness to establish production lines in Brazil, which would enable them to gain access to more favorable credit terms from Brazilian funding agencies.

As the first wave of massive investments by Chinese companies in Brazil gives way to a second, more prudent and mature wave, Chinese companies should take advantage and continue to improve their understanding of specific Brazilian market structures and cultural and political conditions to be better positioned to compete in this new market that will expand dramatically in the next five to ten years.

STATE GRID'S BOLD LEAP:
CHINESE INVESTMENT IN BRAZIL'S TRANSMISSION SECTOR

Chris Cote*

Unlike Chinese firms' slow crawl into Brazilian renewable power generation, State Grid Brazil Holding, the subsidiary of Chinese transmission giant State Grid Corporation China, has made quick inroads into the country's transmission market since its founding in 2009. Rising electricity demand and inadequate infrastructure have created attractive investment opportunities for China's state firm. Equipped with unique, ultra-high voltage transmission technology, State Grid is in the process of establishing itself as a first-rate player in Brazil's transmission sector, which is in constant need of upgrade and expansion.

State Grid appears to be in Brazil to stay. The company plans to use its deep pockets to invest in various facets of Brazil's electricity industry, taking advantage of returns on investment while opening new markets for its technology. State Grid Brazil announced in 2013 its intentions to double investment to US$10 billion through 2015 and has indicated it will move into the generation and distribution markets in the next five years, led primarily by profit-based incentives.[28]

Brazil's Booming Power Demand

In 2001, a widespread blackout exposed major vulnerabilities in Brazil's electricity system, prompting the government to push forward reforms that would expand power generation and transmission, and create investment opportunities for foreign firms. The loss of power—leading into an election year, no less—underlined the vulnerability of Brazil's hydropower-dependent system and the overall inadequacy of the country's generation and transmission systems, including poor interconnectedness between the regional power grids.[29]

In response to supply challenges, President Lula, shortly after being elected in 2003, overhauled the national electricity system. He promised to guarantee supply, strengthen the interconnectivity and reach

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[28] Interview with Cai Hongxian, State Grid Brazil Holding S.A., Energy Board Room, September 17, 2013, http://www.energyboardroom.com/interviews/interview-with-cai-hongxian-state-grid-brazil-holding-s-a.

[29] See Chris Cote and Mark Langevin, 'Brazil Electricity 101', *BrazilWorks,* December 2013, http://brazil-works.com/wp-content/uploads/2013/12/Brazilian-Electricity-101-Final-Draft.pdf.

of the grid, and lower electricity prices for consumers. New laws and regulations came into effect and infrastructure was expanded to meet growing demand. As a result, over the past decade, generation capacity grew by 44 percent to 119,535 megawatts (MW) and transmission lines expanded by 25 percent to 100,000 kilometers (km) in 2014.[30,31]

Looking ahead, Brazil will have to further expand both its generation and transmission sectors to keep up with demand.[32] Installed generation capacity in Brazil needs to increase by more than 50 percent in 10 years to 183,053 MW in 2022, requiring thousands of kilometers of new transmission lines. Most of this proposed new generation will feed Brazil's southeast and center-west regions, which together consume almost four times the electricity of the south, the next largest region. But demand in the underserved and sparsely populated north is also growing at breakneck pace.[33,34]

Brazil's electricity grid will need to grow by 2.5 percent annually over the next five years, requiring government commitment and considerable investment. The most recent Transmission Expansion Plan, a study led by the Energy Research Company (EPE)—the research arm of the Ministry of Mines and Energy—projects that companies will invest 9.7 billion reais between 2013 and 2018 to extend the current power grid by 13,259 km.[35] Brazil must also address high technical loss rates of 17.3 percent, and tighten the connection between regional grids.[36] Loosening those bottlenecks through the strategic construction of additional lines and substations will help avoid blackouts in the future. Thirty-nine new substations are scheduled to be installed by 2018 to address this issue.[37]

State Grid's Foray into Brazil

Brazil's growing electricity needs present major investment opportunities for China's State Grid, now the seventh largest corporation in the world, as it seeks to grow its footprint overseas.[38]

State Grid has dramatically expanded its stake in electricity transmission in Brazil through a combination of new acquisitions and contracts. After buying the transmission assets of two Spanish holding companies and winning construction rights in three auctions, it controls the rights to more than 10,000 kilometers of transmission lines in the country.[39,40] In 2010, it bought out Plena Transmissora, a Spanish consortium of seven transmission companies which together controlled 17 power lines extending 3,243 km throughout Mato Grosso, Goiás, Minas Gerais, and Distrito Federal.[41] State Grid acquired five more transmission companies held by

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30 *Annual Energy Review 2004*, U.S. Energy Information Agency, 331, http://www.eia.gov/totalenergy/data/annual/archive/038404.pdf.

31 Salarini, Leandro, 'A Expansão das Linhas de Transmissão no Brasil', Instituto Federal do Espiritu Santo.

32 'Resenha Mensal: EPE revisa projeção de consumo de energia elétrica en 2014,' Empresa de Pesquisa Energética, May 29, 2014, http://www.epe.gov.br/mercado/Paginas/ResenhaMensalConsumodeenergiael%C3%A9tricacresce2,1emabril.aspx.

33 'Plano Decenal de Expansão de Energia 2022,' 43.

34 *Ibid,* 81.

35 'Programa de Expansão da Transmissão (PET) 2013–2018', Empresa de Pesquisa Energética, November 26, 2013, 2: http://www.epe.gov.br/imprensa/PressReleases/20131126_1.pdf.

36 PDE 2022. 44.

37 *Ibid.*

38 'Global 500, 2013', *Fortune,* 2014, http://fortune.com/global500/state-grid-corporation-of-china-7.

39 State Grid Brazil Holding is a subsidiary of State Grid Corporation of China and State Grid International Distribution Ltd. Nevertheless, to avoid filling this paper with acronyms, 'State Grid' will refer to State Grid Brazil Holding; its parent company will be referred to by its full name or SGCC.

40 Salarini, Leandro, 'A Expansão das Linhas de Transmissão no Brasil', Instituto Federal do Espiritu Santo, August 23, 2013, http://prezi.com/msejl_csarlp/a-expansao-das-linhas-de-transmissao-no-brasil.

41 Data compiled from financial reports available on the State Grid Brazil Holding website, http://www.stategridbr.com/balances.html.

Spanish firm Actividades de Construcción e Servicios (ACS) in 2012, gaining 14 lines extending just over 2,000 km.[42]

State Grid has further grown its assets in Brazil through competitive bids for large-scale contracts. In February 2014, State Grid, together with Brazilian state corporation Eletronorte, won rights to build transmission lines that will run more than 2,000 km from the Belo Monte hydroelectric dam in the Amazonian north to the populous southeast. A group led by State Grid also successfully bid for the right to build transmission lines to connect the hydroelectric plants on the Teles Pires River to the national grid, in partnership with Copel, the energy company of the state of Pará.[43]

Despite its proclaimed requirement for high returns on investment abroad, State Grid has bid below the government-set ceiling in auctions for large transmission contracts. The company bid 38 percent below the ceiling for the Belo Monte transmission contract[44] and 40 percent below in the Teles Pires River auction.[45] These moves could signal a willingness to sacrifice high returns in order to grow State Grid's share in a major foreign market. Relatively low offers could also indicate State Grid's lack of familiarity with Brazilian bidding processes.

Like other Chinese firms operating overseas, State Grid has sought partnerships with Brazilian firms on large-scale transmission projects, which it likely views as an opportunity to learn and adapt to business practices in the country. Working alongside companies such as Copel and Eletrobras also signals to others in Brazil—including regulators, licensors, and other businesses—that State Grid is a trustworthy and credible organization.

The company would indeed appear concerned about its reputation in Brazil. In an effort to counter widespread negative perceptions of Chinese firms in Brazil, the president of State Grid, Cai Hongxian, has participated in several interviews with Brazilian business magazines and noted the importance of his Brazilian managers, the Chinese employees who have learned

State Grid Transmission Lines in Brazil

Year	Name	Partners	Length (km)	Lines	Type
Dec. 2010	Plena Transmissora	None	3,243	17	Acquisition
Mar. 2012	Consórcio Sino-Copeliano/ Consórcio Guaraciaba	Copel	1,605	5	Auction
Dec. 2012	ACS	None	2,049	14	Acquisition
Dec. 2012	Consórcio Paranaíba	Copel/Furnas	967	3	Auction
Feb. 2014	IE Belo Monte	Eletronorte/ Furnas	2,200	1	Auction
TOTAL			**10,064**	**40**	

SOURCE: ANEEL and State Grid.

[42] *Ibid.*

[43] Rochas, Ana Flavia, 'State Grid e Copel vencem leilão de Teles Pires', *EXAME* via Reuters, March 9, 2012, http://exame.abril.com.br/mundo/noticias/state-grid-e-copel-vencem-leilao-de-transmissao-de-teles-pires.

[44] 'Leilão da transmissão de Belo Monte alcança 38% de deságio', ANEEL, February 2014, http://www.aneel.gov.br/aplicacoes/noticias/Output_Noticias.cfm?Identidade=7741&id_area=90.

[45] 'Consórcio Sino-Copeliano vence Lote A do Leilão de Transmissão nº 02/2012', ANEEL, March 9, 2012, http://www.aneel.gov.br/aplicacoes/noticias/Output_Noticias.cfm?Identidade=5294&id_area=90; 'Consórcio Guaraciaba arremata Lote B', ANEEL, March 9, 2012, http://www.aneel.gov.br/aplicacoes/noticias/Output_Noticias.cfm?Identidade=5295&id_area=90.

Portuguese, and the social investments that State Grid is making in local communities.

The Benefits of Technology Transfer

So far, both Brazil and China have approached cooperation on electricity development in Brazil with rose-tinted glasses. The advantages from the Brazilian perspective are clear: China brings technology, deep pockets, and a long-term commitment to steady development. The transfer of Chinese technology to Brazil is an important aspect of State Grid's strategy and the state firm has pursued projects wherein its technological expertise provides it with a competitive edge over local firms. The installation of Ultra High Voltage (UHV) transmission lines, smart grid, and smart metering systems could measurably improve Brazil's transmission sector.

The two enormous projects at Teles Pires and Belo Monte, more than 4,000 km in total, are the perfect showcase for UHV transmission lines, a technology that China has taken a lead in developing DC transmission lines of 800 kV allow large loads to be transferred across long distances, and at the same time significantly reduce loss rates during transmission. As of 2012 Brazil did not have 800 kV lines, but the Ten Year Energy Expansion Plan envisages that they will make up more than 7,000 km of Brazil's grid by 2022. The Belo Monte lines will be the first 800 kV lines in the country.

Beyond 800 kV lines, 1100 kV DC lines are under research by State Grid's operations in China.[46] Chinese firms' use of smart-metering could also revolutionize the transmission sector. Brazil already uses technologies to automate the transmission of electricity through substations, but China's well-funded research and development teams may offer improvements.[47]

Joint research centers established between the two countries could provide an additional opportunity for technology development. The Nanjing Automation Research Institute (NARI), a subsidiary of State Grid Corporation of China, is an industrial automation research firm that is working to improve upon current technologies in this area. The company is opening a manufacturing facility in São Paulo.[48] State Grid has also partnered with the Electric Power Research Center (CEPEL), Eletrobras's research arm and the Operator of the National Electricity System (ONS), and EPE to work on high-voltage transmission technology and smart-metering systems.[49]

Skeptics question how far this technology sharing will go. But State Grid appears ready to share the bounty of its R&D programs, from DC UHV lines to smart grid. As one company presentation at the 2014 Africa Smart Grid Forum claims: "State Grid Corporation of China is ready to share experiences with international peers and jointly promote research and development of smart grid to ensure safe, efficient, clean and sustainable energy supply." [50]

Looking Ahead

State Grid Chairman, Cai Hongxian, has indicated that his company will expand operations beyond transmission in the coming years, saying in an interview recently that "it is only a matter of time" before the company expands beyond transmission lines to operate in every sector of Brazil's electricity market.[51] State Grid indeed appears to be eyeing several

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[46] Liu, *Electric Power and Energy in China,* 161.

[47] NARI Technology. http://www.naritech.cn/en/html/pro90.shtm.

[48] Interview with Cai Hongxian, Energy Board Room.

[49] Interview with Cai Hongxian, Energy Board Room.

[50] 'Developments, Prospects, Opportunities, and Challenges of Smart Grid in China', State Grid Corporation China, May 15, 2014: 34, http://www.africasmartgridforum2014.org/en/expert/presentationliminaire/chen-yueming-developments-challenges-opportunites-and-prospects-en.pdf .

[51] Interview with Cai Hongxian, Energy Board Room.

hydroelectric generation projects in Brazil, which it will likely approach through acquisitions and auctions. The company has also indicated interest in buying out Camargo Corrêa's share of CPFL, a São Paulo-based energy group whose share prices recently tumbled.[52]

The chairman of State Grid of Brazil foresees a future for his company transmitting electricity within cities. Cai has noted that although State Grid will avoid Eletrobras' sale of its distribution assets, he does plan for his company to be involved in intra-city distribution within five years.[53] Power distribution involves running more generators to push more electricity into the grid at peak usage times and technologies to sense, control and ultimately automate that process. Even if the company shies away from the cultural, legal and regulatory labyrinth of power distribution for the time being, other subsidiaries may play a role. Xuji Group, the largest smart-metering manufacturer and a subsidiary of State Grid Corporation of China, uses State Grid's Rio de Janeiro office and staff as a local liaison to Brazilian markets.[54]

Other Chinese companies, including China Three Gorges Corporation (CTGC), are also engaging in electricity sector investment. CTGC owns just over a fifth of Energias de Portugal (EDP), which controls 1,798 MW of hydroelectricity in Brazil.[55] In February 2014, through its subsidiary CWE Investment Corporation, CTGC purchased half of EDP's stake in the 700 MW hydro plant São Manoel.[56] The plant will be built on the Teles Pires River, a tributary of the Amazon.

Expectations of large profits are a big reason State Grid is in Brazil: one employee reported to a newspaper that the company will not invest abroad without profit margins two to three times higher than what a similar project would net at home.[57] After three years, State Grid decided to expand investment in Brazil's electricity sector. In October 2013, Cai Hongxian, president of State Grid Brazil Holding, announced the company would invest $10 billion, up from $5 billion, in Brazil through 2015.[58]

Conclusion

Despite the advantages of Brazil-China cooperation in energy transmission, both countries have good reason to temper overall expectations. Many aspects of Brazil's electricity policies remain inefficient and may discourage investment. The Instituto Acende, a Brazilian electricity think tank, identifies three broad challenges for the country's electricity sector: inadequate supply, high and inefficient taxes, and waning investor confidence due to tepid reports on Brazil's macroeconomic trajectory from the major ratings agencies.[59] And China, a country facing its own electricity sector challenges, has promised revolutionary results from smart grid technology that has been used on only a limited number of projects at home. While the partnership does look promising, much remains to be seen over the next several years.

[52] Bronzatto, Thiago, 'State Grid esta de olho no CPFL', *EXAME,* May 8, 2014, http://exame.abril.com.br/blogs/primeiro-lugar/2014/05/08/state-grid-esta-de-olho-na-cpfl/.

[53] Interview with Cai Hongxian, Energy Board Room.

[54] *Ibid.*

[55] 'Brazil Operations', EDP, http://www.edp.pt/en/aedp/unidadesdenegocio/energiasdobrasil/Pages/Producao.aspx

[56] 'EDP Energias do Brasil vende 33.3% São Manoel para China Three Gorges', *Jornal da Energia,* February 10, 2014, http://jornaldaenergia.com.br/ler_noticia.php?id_noticia=16076&id_secao=17

[57] Liu, *Electric Power and Energy in China,* 161.

[58] Wellington, Bahnemann, 'State Grid planeja investir US$10 bi no Brasil', *Agencia Estado* via *Valor Econômico,* October 26, 2013, http://economia.estadao.com.br/noticias/geral,state-grid-planeja-investir-us-10-bi-no-brasil,168537e

[59] 'Aprimoramentos para o SetorElétricoo: Propostas aos Candidatos (mandato 2015 - 2018)', Instituto Acende 13, January 2014, http://www.acendebrasil.com.br/media/estudos/2014_WhitePaperAcendeBrasil_13_Propostas_aos_Candidatos_Rev1.pdf.

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