WORKING PAPER SERIES

16/022

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September 12, 2016
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ABSTRACT

As Chinese firms ramp up participation in Latin American electricity infrastructure projects, this brief study reviews the strengths and possible shortcomings of Chinese electricity firms. Large state-controlled generation, grid and nuclear firms have made big contributions to the recent transformation of China’s power sector, which has delivered huge expansion, technological upgrading, increased reliability, universal service and many other benefits. Excess capacity throughout China’s electricity supply chain arising from an unexpected demand slowdown provides a powerful incentive to pursue international marketing opportunities. Beijing’s “go outward” campaign assures financial and policy backing for overseas investment initiatives. Potential difficulties include Chinese firms’ lack of experience with the regulatory complexity and public controversy that often surrounds Latin American infrastructure projects as well as the tendency of Chinese equipment makers to deliver products that incorporate what Chinese specialists describe as “small defects.”

JEL Categories: F23, F61, L24, L94

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Chinese participation in electricity-related infrastructure projects has already begun in Latin America. State Grid Corporation, the world’s largest utility company, has acquired substantial power transmission assets in Brazil. Sinohydro, the world’s leading builder of dams, is active in Ecuador and Venezuela. Argentina has agreed to the extensive involvement of China National Nuclear Corporation in the construction of two nuclear power plants, one based on Canadian technology and the second on the Chinese-developed Hualong One design.

This brief essay reviews China’s potential as a partner in the development of electricity-related infrastructure, focusing on non-nuclear technologies. We consider three issues: China’s achievements in building its own electricity industry; potential advantages of Chinese partnership in developing Latin America’s electricity infrastructure; and possible difficulties associated Chinese participation in offshore infrastructure projects.

China’s Electricity Industry

Electricity provides one of many success stories associated with China’s recent growth spurt. China entered the post-World War II era with low levels of power production, fragmentary electrification of its vast land mass, and limited command over modern technologies associated with the generation, transmission, delivery and management of electric power systems. All this has changed. China is now the world’s largest producer of both electricity and equipment for the manufacture and distribution of electric power. Chinese firms operate at or near the global technology frontiers in many segments of the electricity supply chain. China’s power system now provides electricity to China’s entire population and across its vast landscape.

Growth. Following substantial expansion during the planned economy era (1949-late 1970s), China’s electricity production began to accelerate during the 1980s, as the power sector struggled to keep pace with demand growth resulting from an economy-wide speedup following the onset of economic

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reforms. Power shortages were common. As new capacity began to reduce excess demand, growing management expertise enabled a shift from unexpected service interruptions to planned outages. The initial decade of the current century brought a general balance between demand and supply, although episodes of regional and seasonal shortage persist in both urban and rural areas.

This supply surge pushed China past the United States as the world’s largest producer and consumer of electricity. In 1990, China’s power use was only 22 percent of the comparable U.S. figure; in 2015, China’s power consumption exceeded the U.S. total by more than 40 percent.

Organization. China’s electricity sector is dominated by giant state-controlled firms. Five corporate groups generate nearly half of China’s electricity. The power produced by each of these groups rivals Brazil’s total production, which in 2015 amounted to 586 TWh, or 10.3 percent of China’s 2015 total of 5,682 TWh. Two immense grid companies, State Grid and Southern Grid, distribute over 90 percent of China’s electricity. Each of these firms ranks among Fortune listing of the top 500 global firms, as do several Chinese construction enterprises.

Scale. Rapid growth has coincided with ramping up of the average size of Chinese electricity facilities. Between 2000 and 2013, the number of generating stations with capacity of 600 MW and up rose from 20 to 529, and their share in overall capacity jumped from 5.6 to 41 percent. The length and voltage of power transmission lines have also grown substantially.

Technical parameters. Standard parameters such as power consumption within generation facilities, transmission losses and unit consumption of coal in thermal generation facilities (the dominant technology in China’s power sector) resemble comparable figures in advanced market economies. Following major improvements in reliability, Chinese respondents report fewer outages, and quicker response to requests for new connections than informants in Brazil, India or the Russian Federation. Firms in Brazil, India and Russia are more than ten times as likely to identify electricity as a “major constraint” than are Chinese enterprises (World Bank 2016).

Access. Electrification of isolated communities in western China occurred during 2015, completing China’s effort to extend power service to its entire land mass and populace.

Technological advance. Technical advance is much in evidence. New coal-fired generation plants employ ultra-supercritical combustion systems. State Grid is extending the boundaries of ultra-high voltage long-distance power transmission and working to install a variety of advanced “smart grid” technologies.

Environment. China has encountered serious problems of air quality, due in part to extensive use of coal, which powers about two-thirds of electricity production. Vigorous efforts are now underway to limit negative spillovers from power generation. These include implementation of clean coal technology, large-scale expansion of wind, nuclear and solar power generation, subsidies to promote retrofitting of improved combustion chambers and installation of scrubbers to limit emissions from thermal facilities, and penalty pricing to discourage further expansion of energy-intensive industries.

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3 During the 1990s, the Beijing headquarters of the Chinese Academy of Social Sciences, a sponsor of this conference routinely experienced tingdian [power stoppage] every Friday.
Globalization. In recent years, China’s electricity sector has emerged as a growing force in global markets for electrical equipment, project management and the construction and operation of generation facilities and electrical grids. What are the implications for Latin America?

China’s Advantages as a Partner in Latin American Electricity Development

Chinese firms have a number of characteristics that qualify them as attractive potential partners for Latin American electricity development.

Growing capabilities and experience. Following several decades of (partly self-imposed) economic isolation, China has moved rapidly to seize opportunities available through participation in global markets for commodities, information, technology and capital. The electricity sector has reaped substantial benefits, as Chinese officials have adroitly employed access to the world’s largest market for electricity-related goods and services as a form of currency with which to obtain technology transfers through licensing and joint ventures.

Access to advanced technology, combined with rapid increase of operating experience, vast expansion of scientific and engineering education and strong official support for industrial research and development has multiplied Chinese capabilities relevant to the construction, operation, maintenance and upgrading of electric power facilities.

China’s emergence as the world’s largest electricity market spurred the gradual development of a domestic supply chain that by now extends to virtually all electricity-related products and services. Leading Chinese firms have harnessed a combination of internal R&D, participation in officially-sponsored research consortia, offshore investments and acquisition of overseas companies to propel their advance toward global technical frontiers.

Chinese firms display particular strength in the construction and equipping of hydro-electric and coal-fired thermal generating plants as well as the construction, operation and management of large-scale power grids. State Grid, Sinohydro, the five big power generation groups, and some of the construction firms and machinery manufacturers, for example equipment specialist Shanghai Electric, have accumulated substantial overseas investment, marketing and project management experience.

Rapid expansion of wind and solar installations have made China a global leader in the construction of renewable energy facilities.

China’s nuclear companies have accumulated considerable experience in the construction and operation of nuclear facilities, most built around French, U.S. or Russian reactor design. Key components of new nuclear plants are increasingly sourced from domestic equipment suppliers. Demonstration plants incorporating domestic reactor design are now under construction.
Strong official support. China’s “Going Out” (zouchuqu) policy of encouraging domestic firms, particularly large, state-controlled enterprises, to invest overseas in order to bolster their own competitiveness and to support the nation’s foreign policy goals, dates from the late 1990s. China’s 2001 entry into the World Trade Organization, official policies that contribute to growing financial strength of leading state-sector firms, implementation of President Xi Jinping’s signature “One Belt One Road” initiative to encourage Chinese infrastructure projects beyond the nation’s borders, and Beijing’s initiative in establishing the Asia Infrastructure Investment Bank, all signal powerful support for offshore infrastructure investments at the highest levels of government.

Large and growing excess capacity in electricity and related sectors. An unexpected slowdown in the growth of domestic demand for electricity sent annual growth plunging from double digits throughout most of 2000-2011 to near zero in 2014/15, with industry sources projecting continued slow growth. As a result, not just China’s power plants, but the entire supply chain – design agencies, equipment and component manufacturers, construction firms, materials vendors - long oriented toward rapid expansion, now must struggle to cope with this sudden reversal of fortune.

To illustrate: an executive of Shanghai Electric, a leading supplier of power plant equipment, commented in 2014 that demand for thermal power plant equipment had dropped by 50 percent during the previous five years, and, with government officials blacklisting coal, could see a similar decline during the following five years (Mu and Shu 2014).

The unanticipated falloff in demand has caught many firms, including the five big power generating groups, with heavy debt burdens. Plant closures, layoffs and bankruptcies, already visible in the coal sector, could spread to across China’s electricity supply chain. These circumstances motivate Chinese firms to pursue overseas investments as a means of increasing the demand for a broad array of electricity-related products and services.

The result: a confluence of political and economic imperatives that pushes leading firms in a broad array of electricity-related businesses toward aggressive pursuit of overseas business opportunities with strong expectations of energetic official support. The beneficial consequences of this government-business partnership are readily visible in the willingness of Chinese financial institutions to provide ample credit at attractive rates to support the involvement of Chinese firms in offshore infrastructure projects.

Potential difficulties with Chinese infrastructure partners

Chinese participation in international infrastructure projects raises questions in two areas, which we summarize under the headings of “hardware” and “software.”
Hardware. Quality of equipment is the central issue, and Chinese experts provide key information. Thus SHEN Liechu, a machinery industry veteran and former Vice-Minister of Machine-building reports that a common refrain among both domestic and overseas clients is that Chinese equipment is “usable, but not too reliable.” The reason: “small problems continue” (HU Qing 2016). The Panama Canal provides a Latin American example: an article reporting difficulties with Spanish-made tugboats noted that “canal workers... also experienced problems with ... Chinese boats with inferior clutches.” Difficulties continued even after “the canal authority replaced the clutches for close to $10 million” (Bogdanich et al 2016).

We attribute the prevalence of quality problems to two underlying circumstances. Chinese manufacturers have a tendency to assign higher priority to production volume and cost management than to product quality. This behavior is rooted in market structure: buyers often insist on low prices, knowing that quality may suffer. Some observers trace neglect of quality to the socialist plan system that prevailed during the People’s Republic’s early decades and only gradually gave way to market-based demand formation under the reform policies introduced from the late 1970s (Brandt et al 2008). Together with frequent periods of excess demand, strong pressure by both domestic and overseas buyers to reduce costs has encouraged manufacturers to persist in the planned-economy practice of shipping goods with minor defects.

Official insistence on import replacement is another source of quality problems. Import replacement is a major objective of Chinese industrial/technology policy. Latin American observers, drawing on their own national/regional experience, will easily comprehend the mix of historical, ideological and economic factors driving China’s import substitution policies. They will also understand the risk that excessive pressure for “domestication” of sophisticated products and components can undermine the quality, reliability, longevity and safety of equipment and components. Again, we quote retired Deputy Minister SHEN: “In recent years, China has made great strides in self-reliance and domestication of high-end equipment. However feedback from users indicates that although there are no major issues, small problems persist” (HU Qing 2016).

As the Panama Canal example demonstrates, equipment defects can raise costs and undermine the reliability of electricity and other infrastructure projects.

Software. Although the reforms of the past several decades have moved China’s economy the path toward a market system, the electricity sector, dominated by a handful of state-controlled enterprises and surrounded by official price controls, is only now beginning to experience an operating environment in which market forces are the central determinant of results. Despite the growing overseas experience of Chinese infrastructure firms, these companies have limited expertise in dealing with the economic, social and political currents that surround the planning and implementation of infrastructure projects in circumstances that combine market
economies with the unpredictable cut and thrust of open debate and democratic politics. We can point to several areas in which difficulties might arise:

- Integrating local producers into supply chains for infrastructure projects – especially relevant in countries like Brazil and Mexico with substantial manufacturing capabilities.

- Responding to regulatory interventions by local, regional and national governments. China’s giant electricity firms have a history of ignoring official procedures, for example by developing and operating major projects without securing required permits (Cheng and Tsai 2009 list numerous instances).

- Managing local labor supply in environments where worker behavior may respond to independent trade union leaders, media opinion and/or appeals by government or opposition politicians.

- Dealing with popular environmental movements that may seek to mobilize public opinion, block efforts to assemble land or seek to modify, delay or cancel proposed infrastructure projects, possibly with the encouragement of opposition politicians or local and international NGOs.

CONCLUSION

Chinese participation in Latin American electricity represents a highly attractive prospect. With its wide array of capabilities, deep supply chain, impressive technical capacity, strong record of upgrading, and growing overseas experience, China’s electricity sector has much to offer. The confluence of Beijing’s policy initiatives with the financial and employment implications of massive excess capacity will whet the appetite of potential Chinese participants in Latin American electricity development. The same circumstances should create opportunities for Latin American electricity projects to secure attractive financial arrangements for accessing Chinese products and expertise. To ensure the success of cooperative arrangements, host governments and local businesses should emphasize quality assurance and ensure that Chinese participants understand the formal rules and informal norms underlying the behavior of local citizens and institutions.

REFERENCES


