

PPP INSIGHTS

AN EXPLANATORY NOTE ON ISSUES RELEVANT TO PUBLIC-PRIVATE PARTNERSHIPS

The Expansion of China's Generation Capacity

By Yijia Nan and Mark Moseley*

I. Introduction

Power is a crucial factor in economic growth and quality of life, but building an adequate level of generation capacity has proven difficult for many developing countries. A number of jurisdictions have suffered from years of energy supply shortages, and this inadequacy continues to hinder their development.

In the recent past, China's generation capacity grew at an extraordinary rate, and this has drawn worldwide attention. For example, in 2009, China increased its generation capacity by almost 90 GW—more than the entire current total generation capacity of the United Kingdom.

This note is intended to identify the key entities involved in the dramatic recent expansion of China's generation capacity, and the legal relationships between those entities, including the legislation and contractual agreements underpinning those legal relationships. The note starts with a brief description of the context in which this growth occurred, and closes with Section V, which comments on particular aspects of the Chinese experience (including the respective roles of the private and public sectors), and Section VI, which offers some 'lessons learned' from the development of China's power sector.

II. Background

A. UNPRECEDENTED GROWTH IN GENERATION CAPACITY AND OUTPUT

China's power generation capacity has soared in the last two decades, from 1989, when the total national installed capacity was 100 GW

(approximately the current capacity of Spain) to over 900 GW (almost the current total capacity of the European Union).

Much of this growth took place in the last ten years. From 2000 to 2009, China's installed capacity increased at an average annual growth rate of 11.84%, with the addition of 550 GW of new capacity. At the same time, total electricity output reached 36812 TWh by the end of 2009. The growth in output over the last twenty years is set out in Table 1.

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Table 1: National Total of Electricity Output

Year	1990	1995	2000	2005	2007	2009
Total output (TWh)	6212	10077	13556	25003	32816	36812

Source: China Statistical Yearbook 2009, Published by China Statistics Press

Table 2: Gross Domestic Product of China

Year	1978	1988	1998	2007	2008	2009
GDP (RMB ¥ billions)	365	1504	8440	25731	30067	33535

Source: China Statistical Yearbook 2009, Published by China Statistics Press

B. ELECTRICITY TRANSMISSION AND ACCESS

China is now operating the world's largest electricity transmission grid. By the end of 2009, China had a total of 399,400 km of high voltage transmission lines (220kV and above), with a total transforming capacity up to 1,762 GVA. The progress in rural electrification has been equally remarkable, with 99.85% of rural families now having access to electricity.

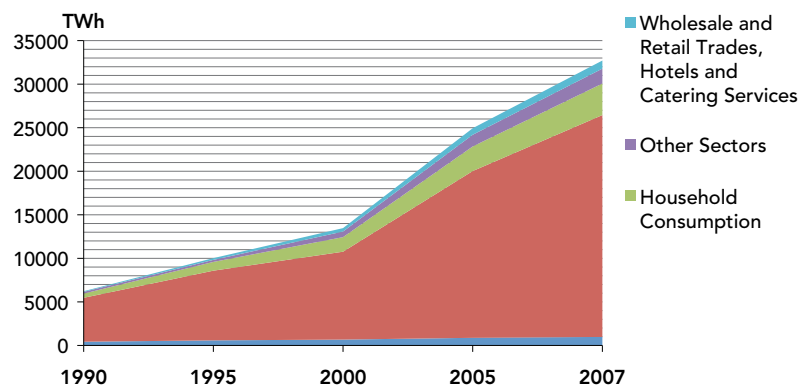
C. THE SURGING DEMAND IN ELECTRICITY

China's economy has maintained a remarkable growth rate over last three decades and also

showed a quick recovery from both the Asian financial crisis of 1998 and the global financial crisis of 2008. (Table 2)

This increase in economic output has spurred a corresponding increase in electricity consumption. In 2004–5, the industrial sectors, especially in the east coastal provinces, suffered from significant electricity shortages. Even with the major capacity additions since then, shortfalls continue to occur, particularly during the summer months. In short, the growth of capacity, extraordinary as it has been, is still struggling to meet the continuing surge of demand.

In 2009, the total consumption of electricity reached 36595 TWh, an increase of 6.44% compared to 2008. The bulk of the demand came from primary and secondary industries, as illustrated in Figure 1.

Figure 1: Electricity Consumption by Sector

Source: China Statistical Yearbook 2009, Published by China Statistics Press

III. Major Stakeholders in China's Power Industry

A. A BRIEF HISTORICAL REVIEW

The first Ministry of Electric Power Industry was created in 1955, which was entrusted with the dual responsibility of both the regulation and the production of electricity. As part of a program of general economic reform, the government proposed to separate the production function from the regulatory function. The activity of production was assigned to the State Power Corporation (SPC), founded in 1997 as a state-owned enterprise with an independent legal personality. However, besides operating large-scale power plants, the SPC still held some quasi-regulatory responsibilities, such as planning, construction, monitoring and management of the national power network; and operation, management and modulation of inter-regional power grids. In 2002, a further structural reform within the power industry was approved by the State Council, with a key strategy of separating power generation, transmission and distribution. Through the *Generation Assets Reorganization Scheme*, the assets and functions of the SPC were divided amongst two grid companies and five generation companies. At the same time, the regulatory sector of the Ministry of Electric Power was reassigned to several governmental units, including the NDRC (National Development and Reform

Commission) as planner and policy-maker; the SERC (State Electricity Regulatory Commission) as the main regulator; and the CEC (China Electricity Council) as a non-governmental association bridging the state-owned enterprises and governmental units.

The institutional reforms are illustrated in Figure 2.

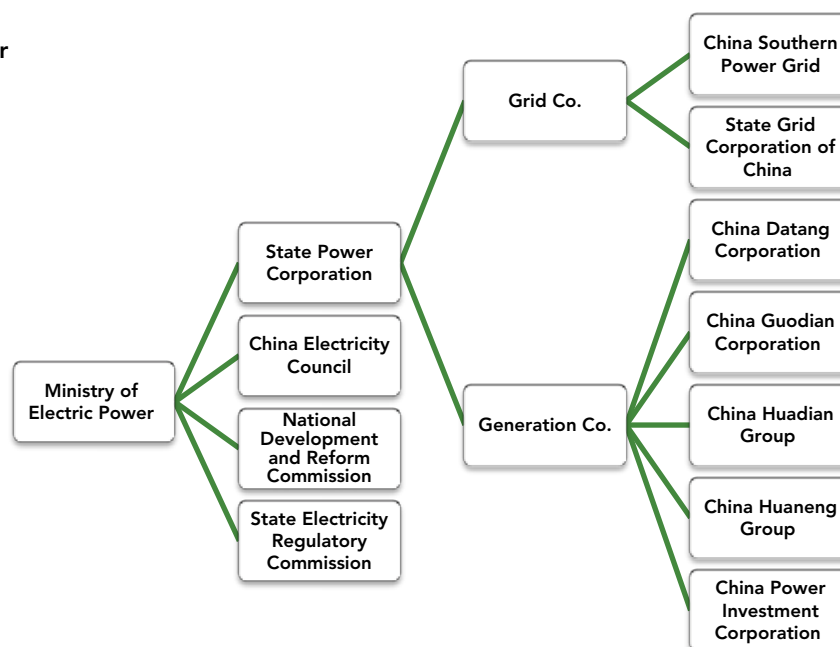
B. REGULATORY INSTITUTIONS

The main regulators of the power industry today can be divided into three tiers: the central level (including NDRC, SERC and other departments); the local level; and the industrial level.

Central Level

1. **NDRC**, a key organ of economic and social administration, responsible for :
 - i. Planning: formulating and implementing strategies and plans of national economic development, including annual plans, medium and long-term development plans; the layout of key construction projects and productivity; and structural and institutional reforms; and
 - ii. Key Project management: approving, authorizing, and inspecting key projects.

Figure 2: Structural Reform of the Power Sector



There is an Energy Bureau established within the NDRC, with a special focus on drawing up plans, policies and strategies for the energy sector.

2. **SERC**, which is empowered by the State Council, performs the principal administrative and regulatory functions in the power sector, including:
 - i. **Planning**: participating in the formulation of development plans for the power sector, including the development of electricity markets;
 - ii. **Market supervision**: ensuring orderly and fair competition in the market, and the regulation of transmission, distribution and non-competitive generation businesses;
 - iii. **Administration**: Development and enforcement of safety and technical standards; and the issuance and monitoring of business licenses; and
 - iv. **Tariff Regulation**: Proposing tariff adjustments to the government pricing authority (the Development and Reform Commission) on the basis of market conditions¹; and regulation of fees and charges for ancillary services.
3. **Other Relevant Government Departments**:
 - i. **The State-Owned Assets Supervision and Administration Commission (SASAC)**, a ministry-level body which handles the responsibilities of the state as an investor, including the supervision of state-owned enterprises (SOEs) and enhancement of the value of state-owned assets. The SASAC also has responsibility for appointing and removing the top executives of SOEs and for reforming and restructuring the SOEs.
 - ii. **The Ministry of Commerce (MOFCOM)**, which is responsible for domestic and foreign trade and international economic cooperation. One of its subsidiaries, the Foreign Investment Administration (FIA)

is responsible for regulating foreign

investment, including coordinating the approval and administration of projects involving foreign capital.

- iii. **The Ministry of Finance (MOF)**, which is responsible for formulating economic and public finance policies plus revenue and tax policies; the administration of public finance; and the management of the expenditures of the central government
- iv. **The Ministry of Environmental Protection (MEP)**, which is responsible for environmental policies; and the management of key environmental issues, such as emission reduction and pollution control.
- v. **The Ministry of Land Resources (MLR)**, which is responsible for the planning, administration, protection and utilization of natural resources, including land, mineral and marine resources; and for regulating the assignment, lease, evaluation, transfer and acquisition of government lands.
- vi. **The Ministry of Water Resources (MWR)**, which is responsible for water administration, including the formulation of development strategies and policies for the water sector; integrated water resources management; water resource protection; water conservation, flood control and drought relief; and for providing guidance on water infrastructure projects.

Local Governmental Entities

With regard to most new generation projects, the local government has a prominent role to play. Local governments are responsible for setting local taxes and tariffs; granting user rights to land and other fixed assets; granting access to water supply; local procurement issues, and environmental issues. In addition, local governments often initiate their own generation projects, sometimes though local state-owned enterprises and sometimes though local government authorities (such as a local water bureau). However, local governments must follow the regulations and guidance from the central government, especially when it comes to cross-provincial and strategic projects.

¹ In the power generation segment, the pricing authorities have basically adopted a cost plus tariff policy, which is based on the actual cost of production plus a fixed profit margin. Occasionally, however, generators can suffer from regulatory delays in adjusting tariffs to accommodate rising fuel costs.

Industry Association

The China Electricity Council (CEC) is a non-profit organization of all China's power enterprises and institutions, operating under the supervision of the SERC. CEC is responsible for developing the industry's self-regulation policies (to augment the regulation by the SERC) and for providing consulting service at the request of its members. The establishment in 1988 of CEC, which acts as a bridge between the government and the power enterprises, is regarded as being a significant step in restructuring the power industry, whereby governmental functions were separated from individual power companies, and a new structure was developed, featuring (i) macro control from the government; (ii) self operation by the enterprises; and (iii) self-regulation by the industry associations.

C. MAJOR POWER COMPANIES

After the reform of 2002, the former State Power Corporation was divided into multiple power generation companies and grid companies. There are currently five major companies in the generation sector, and two grid operators, all of which are state-owned enterprises under the direct administration of SASAC.

Power Generation Companies

- China Datang Corporation
- China Guodian Corporation
- China Huadian Group
- China Huaneng Group
- China Power Investment Corporation

Besides the above-noted five successors of the State Power Corporations, which controlled 42% of the national generation capacity (in 2007), there are numerous other smaller power generation companies active in the sector. They are either regional, such as Shenzhen Energy Corporation, Anhui Province Energy Group, or with specialties, such as China Guangdong Nuclear Power Group, and China Yangtze Power.

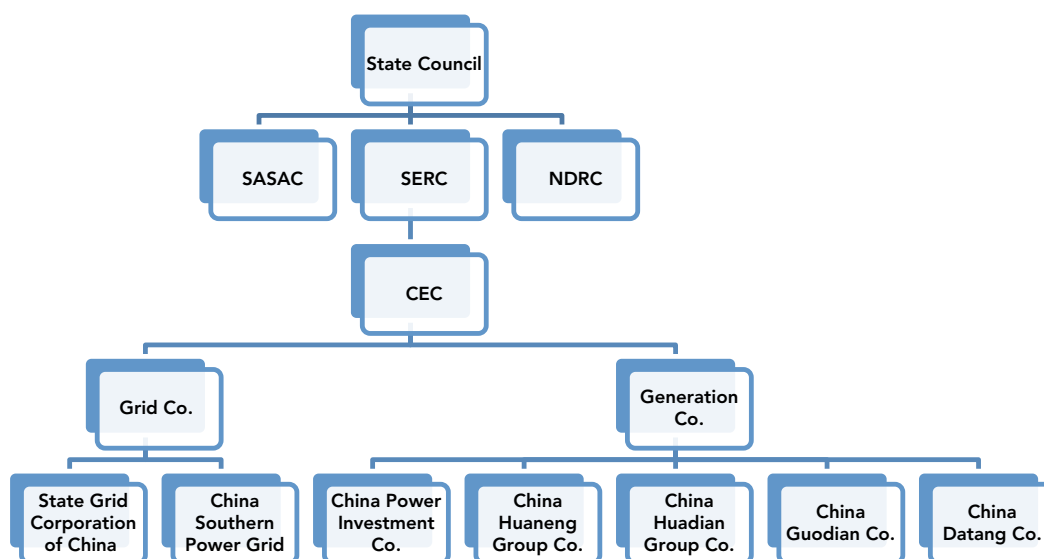
Grid Operation Companies

- China Southern Power Grid
- State Grid Corporation of China

D. RELATIONSHIPS

The interrelations of these major players of the power industry are illustrated in Figure 3, below.

Figure 3: Institutional Structure of the Power Sector



IV. Legal Framework of the Power Industry

Along with the boom in capacity, the legal framework of the power industry has also rapidly progressed. Today, the legal framework is a sophisticated system, with some distinctive hierarchies. There are national laws, ministerial regulations, guiding opinions, measures and procedures, local rules and regulations, self-regulation rules of the industry and internal governance rules for each of the state-owned power companies and grid companies. Interestingly, use is also made of the concept of ‘trial’ rules and procedures, whereby new concepts are introduced for stakeholder comment, before becoming fully effective.

The main laws and regulations in the power sector are listed below, including some of the proposed rules and procedures, but it should be noted that this list is subject to change due to ongoing reforms. These laws may be found at the PPP in Infrastructure Resource Center for Contracts Laws and Regulations (PPPIRC), www.worldbank.org/ppp, specifically at: <http://ppp.worldbank.org/public-private-partnership/china-energy-laws-and-regulations>.²

A. NATIONAL LAWS (APPROVED BY THE NATIONAL PEOPLE’S CONGRESS)

1. Laws on Electricity: [The Electric Power Law](#)
2. Laws on Energy Policy: [The Renewable Energy Law](#) and [The Energy Conservation Law](#)
3. Laws on Resource and the Environment: [The Water Law](#); [The Land Management Law](#); and [The Environmental Impact Assessment Law](#)
4. Laws on Markets: [Price Law](#); [The Public Bidding Law](#); and [The Government Procurement Law](#)
5. Other Relevant Laws: [The Industrial Safety Law](#)

² If you cannot reach the link directly, you may find these laws under “Legislation and Regulation”, “Energy” or by searching through the Library.

B. CENTRAL GOVERNMENTAL REGULATIONS

State Council Regulations

1. Regulations on Supply and Utilization of Electricity [电力供应与使用条例](#)
2. Regulations on Power Grid Dispatch Administration [电网调度管理条例](#)

Market Supervision Regulations

1. Measures of Power Markets Regulation (Trial) (SERC) [电力市场监管办法（试行）](#)
2. Basic Rules of Power Markets Operation (Trial) (SERC) [电力市场运营基本规则（试行）](#)
3. Guiding Opinion of the Construction of Regional Power Markets (SERC) [关于区域电力市场建设的指导意见](#)
4. [Tentative Measures of Pilot Projects on Direct Power Purchase from Generation Enterprise by Users \(SERC and NDRC\)](#)

With:

- i. [Model Contract of Direct Purchase of Electricity by Major Users \(Trial\)](#) 《大用户与发电企业直接交易购售电合同（示范文本）（试行）》
- ii. [Model Contract of Direct Purchase of Transmission and Distribution of Electricity by Major Users \(Trial\)](#) 《大用户与发电企业直接交易输配电服务合同（示范文本）（试行）》

Pricing Regulations

1. [Tentative Measures of Price Administration of Electricity Uploaded to Grids \(NDRC\)](#) [上网电价管理暂行办法](#)
2. [Tentative Measures of Price Administration of Transmission and Distribution of Electricity \(NDRC\)](#) [输配电价管理暂行办法](#)
3. [Tentative Measures of Price Administration of Electricity Sales \(NDRC\)](#) [销售电价管理暂行办法](#)
4. [Tentative Rules of Price Review of Inter-Regional Transmission of Electricity \(SERC\)](#) [跨区域输电价格审核暂行规定](#)

Grid Operation Regulations

1. [Grid Operational Rules \(Trial\) \(SERC\)](#) [电网运行规则（试行）](#)
2. [Tentative Rules of Inter-Regional and](#)

Inter-provincial Power Dispatch Optimization (SERC) 跨区跨省电力优化调度暂行规则

Regulations on State-Owned Enterprises

1. Tentative Measures of the Administration of Generation Right Trading (SERC) 发电权交易监管暂行办法
2. Measures of the Entry of Newly-installed Generation Set into Commercial Operation (Trial) (SERC) 新建发电机组进入商业运营管理办法（试行）
3. Implementation Measures for Disclosure of Information of Electricity-Supply Companies (Trial) (SERC) 供电企业信息公开实施办法（试行）

Other Administrative Regulations

1. Measures of Electricity Accountability Management (SERC) 电力可靠性监督管理办法
2. Measures of Electricity Demand-Side Management (SERC and NDRC) 电力需求侧管理办法
3. Measures of Standardization of Power Industry (Trail) (Energy Bureau, NDRC) 能源领域行业标准化管理办法(试行)
4. Measures of Environmental Protection in Power Industry (MEP) 电力工业环境保护管理办法
5. Land Quotas for Electricity Project Construction (Thermal Power Plant, Nuclear Power Plant, Substations, Converter Stations) (MLR and Ministry of Housing and Urban-Rural Development) 电力工程项目建设用地指标（火电厂、核电厂、变电站和换流站）

C. EXAMPLES OF LOCAL RULES

1. Tianjin Municipality: Rules of Electricity Supply and Utility 天津市供电用电条例
2. Hunan Province: Provisions on Electricity Development 湖南省电力建设若干规定

D. EXAMPLES OF SELF-REGULATION RULES OF THE CEC AND OF THE STATE-OWNED POWER COMPANIES AND GRID COMPANIES

1. Measures of Review of Industry Standard of Electricity Sector (CEC) 电力行业标准复审管理办法
2. Specification of Establishment of Industry Standard of Electricity Sector (CEC) 电力行业标准制定管理细则
3. Measures of Connection of New Power Plant to the Grid (Southern Grid Co.) 新建电厂并网管理办法

The national laws provide broad guidance and are procedurally more difficult to amend. Accordingly, it is the secondary regulations and rules that truly drive the reforms in the industry. The NDRC regulates pricing. The SERC focuses on administration and market regulations. The SASAC, in turn, supervises power corporations. Other specific regulations, such as environment issues and land use rights, are developed by the corresponding governmental bodies.

V. Some Comments On the Chinese Experience

A. THE ROLES OF PUBLIC AND PRIVATE ENTITIES IN CHINA'S POWER SECTOR

The 1980s and 1990s : Introduction of the Private Sector

In the late 1980s and early 1990s, China's power industry was struggling with a large nationwide demand and very limited domestic public funding for large infrastructure projects, at both a central and local level. The domestic capital market was undeveloped. Accordingly, a reform program was

initiated to promote private participation, especially from the foreign private sector, in infrastructure projects.

Under the reform program, a series of projects were executed in the form of Build-Operate-Transfer (BOT) power plants. One example of this type of plant is the 720 MW Laibin B Power Plant, in Guangxi Province, built by EDF Asia, pursuant to a concession agreement awarded in 1996 through a competitive bid process. By 1998, a total of 24 plants financed with foreign direct investment with a capacity of 4.9 GW were in

operation, and other similarly-financed plants with a combined capacity of 9GW were under construction.³ Although there had been some foreign capital in China's power sector prior to the reform program, it was mainly in the form of funds provided by international financial organizations such as the World Bank and Asian Development Bank, and only 3 plants had been built using foreign financing. However, following the instigation of the reform program, foreign direct investment in the sector successfully helped to fund an additional 21 major plants, involving a total of USD 8.5 billion between 1995 and 1998.⁴

As part of the reform program, significant changes were made to the pre-existing legal framework, particularly in regard to foreign direct investment. The State Planning Commission (now the NDRC) and the Ministry of Electric Power designed specific rules and model contracts to better facilitate such projects. Foreign-related projects were administrated separately by the Ministry of Foreign Trade and Economic Cooperation (MOFTEC), and enjoyed prescribed benefits in tariffs and other terms and conditions, as described in the government publications *Several Issues Concerning the Examination, Approval and Administration of Experimental Foreign-invested Concession Projects* (1996) and *Several Provisions on Foreign Investment in Power Projects* (1997). The milestone document of the reform was the *Opinions on Relevant Questions Concerning Intensifying the Reform of the Power Industry* issued in 1998, which proposed a significant structural modification of the sector, including the complete separation of production, distribution, sales and delivery functions and assets, and the eventual establishment of a competitive electricity market.

The New Millennium: A Change in the Market Dynamics

Beginning in the 2000s, major changes started to occur in China's power industry, which dramatically altered the balance between foreign investors and domestic private companies on the one hand, and state-owned enterprises and public authorities on the other.

By far the most significant change was the rapid increase in domestic liquidity and financing available to state-owned enterprises and public authorities for infrastructure projects. GDP growth was consistently high during the decade, and public revenues grew at an even faster rate. Because of the prosperity of the urban real estate market, local governments began to acquire very large treasuries through land-use-right auctions. In addition, a number of state-owned enterprises completed structural reforms and began to access international capital markets, benefiting from their status as listed companies on stock exchanges in Shanghai, Shenzhen, Hong Kong and New York. Even more significantly, the state-owned enterprises took advantage of the fact that they were easily able to obtain low-interest loans from well-financed state-owned commercial banks, based on corporate finance credit arrangements which were significantly less onerous than project financing arrangements.

In this climate, the competitive advantages of private companies, particularly foreign companies, diminished rapidly. In particular, there was no longer a need for direct foreign investment—indeed, by June 2010, China had become the holder of the world's largest foreign exchange reserves. As for domestic Chinese private companies, they found themselves unable to compete (particularly after the 2008 financial crisis) with the ability of the state-owned enterprises to access low-cost capital from the state-owned banks. Furthermore, during the 2000s, there was increasing domestic criticism of the privileges that had been granted to foreign companies. In response, these privileges were gradually eliminated, and the MOFTEC was abolished. Finally, there were also significant changes in terms of the skills available domestically. State-owned enterprises and public authorities were able to hire experienced Chinese power engineers and managers, and were also able to purchase sophisticated turbines and other equipment manufactured locally.

For all of these reasons, China's power generation sector has now become dominated by central and local state-owned enterprises and public authorities.

3 Blackman, A., Wu, X., 1999 Foreign Direct Investment in China's power sector: trends, benefits and barriers. *Energy Policy* 27, P695-711

4 China's Power Sector Reforms, Where to next? International Energy Agency, 2002. P37

B. THE ROLE OF CENTRAL AND LOCAL PLANNING

The periodic announcement by the central government of a Five-Year Plan is usually quite a significant event. Each such plan (officially known as The Five-Year Plan for National Economic and Social Development) is a macro-level guideline, “mainly aiming to arrange national key construction projects, manage the distribution of productive forces and individual sector’s contributions to the national economy, map the direction of future development, and set targets.”⁵ The targets are not always specific in nature, nor are they formally binding on local governments and state-owned enterprises. However, the common practice is that the targets will be exceeded; therefore, the targets are usually modestly set. When a certain industrial sector is listed as ‘encouraged’, preferential policies and measures and favorable taxes will follow, which will offer strong incentives to pursue activities within the designated sector.

The Energy Bureau of the NDRC prepares an initial draft of the passages in the Five-Year Plans relating to the power industry. Each such draft is then completed with the collaboration of experts and specialists from research institutions, from the CEC, and from the research units of the major power companies.

On this basis, central planning does not have a completely determinative role in regard to the growth of the power industry but, in the last five years, it has been quite a powerful tool to accelerate the development of power sector infrastructure, especially for renewable power projects.

Similarly, the provincial-level and city-level Development and Reform Commissions will formulate mid-term and long-term local plans, to develop local power sectors, based on local resources and local electricity demand.

C. ADMINISTRATIVE PROCEDURES FOR NEW GENERATION CAPACITY

As indicated above in Section III, a variety of entities can initiate a new generation project. These include the large state-owned power companies (such as the China Datang Corporation), plus local governments acting through local

state-owned enterprises or through local government authorities (such as a local water bureau). In each instance, a number of steps must be taken, as illustrated by the following list of the procedures to be followed for a small-scale hydro-power plant:

1. Registration of a project company.
2. Making of an application to the local water administration department for water resource development, supplemented by two reports: an assessment of integration into the overall development scheme of the river basin, and a flood risk assessment.

The required reports are produced by a local research institute, which is usually a member of the China Water Conservancy and Hydropower Investigation and Design Association.

It should be noted that the right to undertake water resource developments must, in some regions, be obtained through a public auction process.

3. After approval of the application, the project company submits to the local water administration department two other reports: a report on water resource utilization, and a report on water and soil conservation. These reports are also produced by the local research institute and evaluated by an expert committee at the local water administration department.
4. After the acceptance of these reports, further assessments include:
 - i. a proposal in respect of the project site selection, submitted to the water authority;
 - ii. an environmental impact assessment, also submitted to the water authority;
 - iii. a land use application, submitted to the land resource authority; and
 - iv. if woodlands are involved, approval must also be sought from the State Forestry Administration.
5. The project company then files a comprehensive feasibility study of the project, along with all the above-noted approvals, with the local Development and Reform Commission. The feasibility study is then evaluated by an expert committee and, after this evaluation has been done, if further modification is needed, it is again submitted for review and approval.

5 From www.china.org.cn.

6. All the design papers for the project must be submitted to the local water authority.
7. After completing the construction preparation phase (which includes procurement of the construction supervision company and the construction contractors, clearance of the site, and construction of temporary structures), the project company must submit an application to the water authority for authorization to begin the construction of the project.
8. During the construction phase, the relevant authorities will undertake inspections at key stages (such as the water impoundment stage and the start of generation stage) to ensure conformity with application documents and to ensure that appropriate environmental protection measures are in place.
9. Following construction, the relevant authorities will undertake a further round of inspections.
10. Finally, the project will be officially registered with the local water authority.

As indicated, the preceding list of procedures pertained to a small-scale hydropower project. Similar procedures will be followed for other types of generation facilities, with variations depending upon the nature and scale of the project. For example, a large hydropower project may involve provincial or even national water authorities, land authorities and Development and Perform Commissions. In the case of the massive Three Gorges Dam, the decision to start construction was voted upon by the National People's Congress.

D. FUTURE DEVELOPMENTS

Towards a Competitive Power Market

As noted above in Section V.A, the 1998 reform program contemplated the eventual creation of a competitive power market with multiple buyers and sellers. More recently, on November 30, 2010, the SERC published the draft *Basic Rules for Electric Power Trading*, on which it has invited comments. Under these draft rules, generators, transmission companies, electricity supply companies and authorized large industrial customers would be allowed to participate in electricity trading. Trading would take place either through

centralized competitive bidding using an energy trading platform, or through direct bilateral negotiations between buyers and sellers (the preferred method for trades involving more than a year's supply of electricity). The proposed market design would include provisions for cross-provincial trades.

However, notwithstanding these efforts to create a competitive power market, there are significant structural impediments to real competition. The five generation companies and two grid companies, which were created from the former State Power Corporation, form a close oligopoly and have a very significant presence in the market. In such an environment, the challenges faced by private sector generators are significant, and the prospects for a truly free market are unclear.

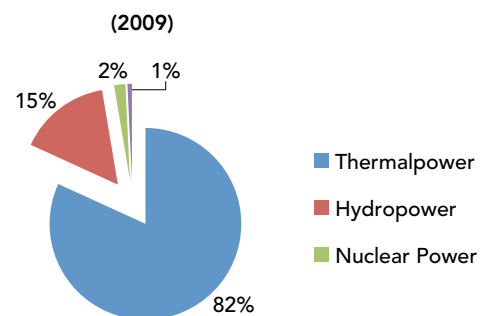
Going Green

Very significant efforts have recently been made in China to encourage the use of renewable resources in the power sector and a greater commitment to achieving energy efficiency. (For further information on renewable energy and clean technology, please visit: <http://ppp.worldbank.org/ppp/content/clean-technology-ppp>)

As can be seen from Figure 4, conventional thermal power is still the major source of electricity in China. Most of the small coal-fired power plants built in China the 1980s are very inefficient, and emit significant quantities of greenhouse gases and other pollutants. Since then, however, significantly greater efficiencies have been achieved at Chinese thermal plants, and a series of laws and regulations have promoted the use of other, renewable, sources of energy.

For example, at the national level, the National People's Congress passed, in 2005, the

Figure 4: Electricity Output by Source



Renewable Energy Law and, in 2009, the Circular Economy Promotion Law (the word “circular” in the title is essentially synonymous with ‘sustainable’). The NDRC has also promulgated measures such as *Relevant Provisions for the Administration of the Generation of Electricity Using Renewable Energy Resources* (可再生能源发电有关管理规定), and the *Trial Measures for Price Administration and Costs Sharing of Electricity Generated from Renewable Energy* (可再生能源发电价格和费用分摊管理试行办法). Local governments are following this direction too, as evidenced by the Shanghai Municipality’s *Several Provisions on Promoting the Development of the Alternative Energy Industry* (上海市关于促进上海新能源产业发展的若干规定). Power companies themselves have begun incorporating these guidelines in their internal procedures, as demonstrated, for example, by the China Guodian Corporation’s *Guidelines on Construction of Green Thermal Power Plants* (国电公司绿色火电厂建设指导意见).

In this new area, opportunities are open for both foreign and domestic companies. As stated in MOFCOM’s *Catalogue for the Guidance of Foreign Investment Industries* (Amended in 2007), foreign investment in the power industry is encouraged in respect of the:

- i. Construction and operation of electricity power through the ‘clean fuel’ processes of: integrated gasification combined circulation technology; circulating fluidized bed

technology; and pressurized fluidized bed technology.

- ii. Construction and operation of combined and heat power plants.
- iii. Construction and operation of hydropower plants.
- iv. Construction and operation of nuclear power plants (so long as the Chinese partner holds the majority of shares).
- v. Construction and operation of ‘new energy’ power plants (solar energy, wind energy, geothermal energy, tidal energy and biomass energy, etc.).

In contrast, the following activities are not open for foreign investment:

- i. Construction and management of conventional coal-fired power of condensing steam plants whose unit installed capacity is less than 300 MW within the small power grid in Xizang, Xinjiang and Hainan Provinces, and of coal-fired power plants with condensing-extraction steam facilities.
- ii. Construction and management of power networks.

Notwithstanding these opportunities for foreign investment in renewable technology, wind power in China is currently dominated by the large state-owned enterprises, while the solar sector is an area of intense competition between various domestic private companies.

VI. Lessons Learned from the Chinese Power Sector

In considering whether China’s success in creating new power generation capacity can be replicated in other developing countries, the following points should be noted.

A. THE LINKS BETWEEN ECONOMIC GROWTH AND POWER GENERATION

Many studies of developing countries have shown that the reliable and affordable supply of electricity is essential for economic growth. The experience of the recent past in China has also demonstrated that this relationship is a ‘two-way street’, in that China’s economic growth has, in

turn, helped to drive the extraordinary expansion of generation capacity in the country.

China’s consistently strong growth rates, trade surpluses and high commercial and household savings rates have given rise to a massive increase in domestic capital liquidity. This, in turn, has meant that investors in new power generation projects were easily able to access very substantial amounts of domestic financing, which greatly facilitated the construction of capital-intensive power plants. As discussed in Section V, this proved to be a critically important element in the success of the state-owned power companies, which could obtain such financing from the state-owned banks on very attractive terms.

Further, the explosive increase in China's manufacturing sector, plus the migration of the population to urban centers, has helped to create a massive increase in the demand for electricity, thereby making these new power plants commercially very attractive. This attractiveness was reinforced by a tariff policy which allowed for full cost recovery, including a prescribed profit margin.

Finally, the growth in China's industrial base has meant that investors in new power plants have been readily able to access, within China, both sophisticated technology and skilled workers and managers.

B. FOREIGN AND DOMESTIC FIRMS IN CHINA'S POWER INDUSTRY

As was also discussed in Section V, China initiated reforms during the 1990s which were designed to facilitate foreign participation in the power sector. This led to significant offshore investment in new generation capacity during the course of that decade. However, as noted above, by the following decade China had acquired both the technical skills and the capital necessary to develop the sector using domestic resources.

A somewhat similar pattern may now be unfolding in regard to the renewable subsector of the power industry. Initially, China welcomed foreign firms with advanced technology in wind, solar and other forms of renewable energy. Increasingly, however, Chinese firms are mastering these technologies and are beginning to dominate the market.

C. INSTITUTIONAL AND LEGAL CONSIDERATIONS

Although China's power sector may, at first glance, seem to be heavily influenced by central government control, the reality is that the central authorities basically provide general guidance, with numerous opportunities for a variety of pilot projects at the local level. This flexibility has allowed for significant experimentation with new financial and legal models, and was likely an important contributing factor to the remarkable success that China has had in creating new power generation capacity for all consumers in the country. ■

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