

Analysis of Applicable Liberalization Models in China's Electric Power Market¹

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1. Introduction

The development of China's power industry has been remarkable by any standard in comparison to the power sectors in many other developing countries. Since the issuance of the State Council's "Provisional Regulation on Encouraging Fund-Raising for Power Construction" in 1985, the power sector has successfully raised investment from both domestic and foreign sources. As a result, in less than two decades, the Chinese power industry has become the world's second largest installed capacity and generation power producer after the United States. The electricity consumption per capita in 2001 was four times higher than it was in 1980. Electricity supply has also been expended nationwide into rural areas. Furthermore, the Chinese electricity industry is undertaking its milestone project, as know as "West-to-East Power Transmission" during the "Tenth Five-year Plan" (2001-2005).

Notwithstanding these major achievements or great efforts, the Chinese power sector still suffers some major problems that result from its previous central planning policies, such as uneven electric power demands, high wire loss of electricity, highly vertical integration of power generation, transmission and distribution, fragmentation of power grid networks among provinces, unreasonable rates, and so on. Recognizing the need to respond to these challenges, the government has continually implemented far-reaching reforms in the electric power industry. Nowadays, competition in the power sector has become a key driver for future reforms to achieve economic and energy efficiencies that are not possible under current structural and institutional arrangements. The Chinese power sector is in essence entering the final stage of its shift to market principles.

Meanwhile, in promoting competition in China's electric power industry, there are vast international experiences from which to draw lessons, as well as numerous market designs and implementation strategies. These lessons, designs, and strategies need to be distilled into a comprehensive and consistent approach that is sensitive to the circumstances and reform objectives in China's power sector. Therefore, this paper aims to analyze the adopted liberalization models by the power sector and to point out the approaches need to be considered in some aspects which may applicable in those developed counties but may not as favorable as in China.

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2. Overview of Reforms in International Electric Power Industries

2.1 Reform in Developed Countries versus Developing Countries

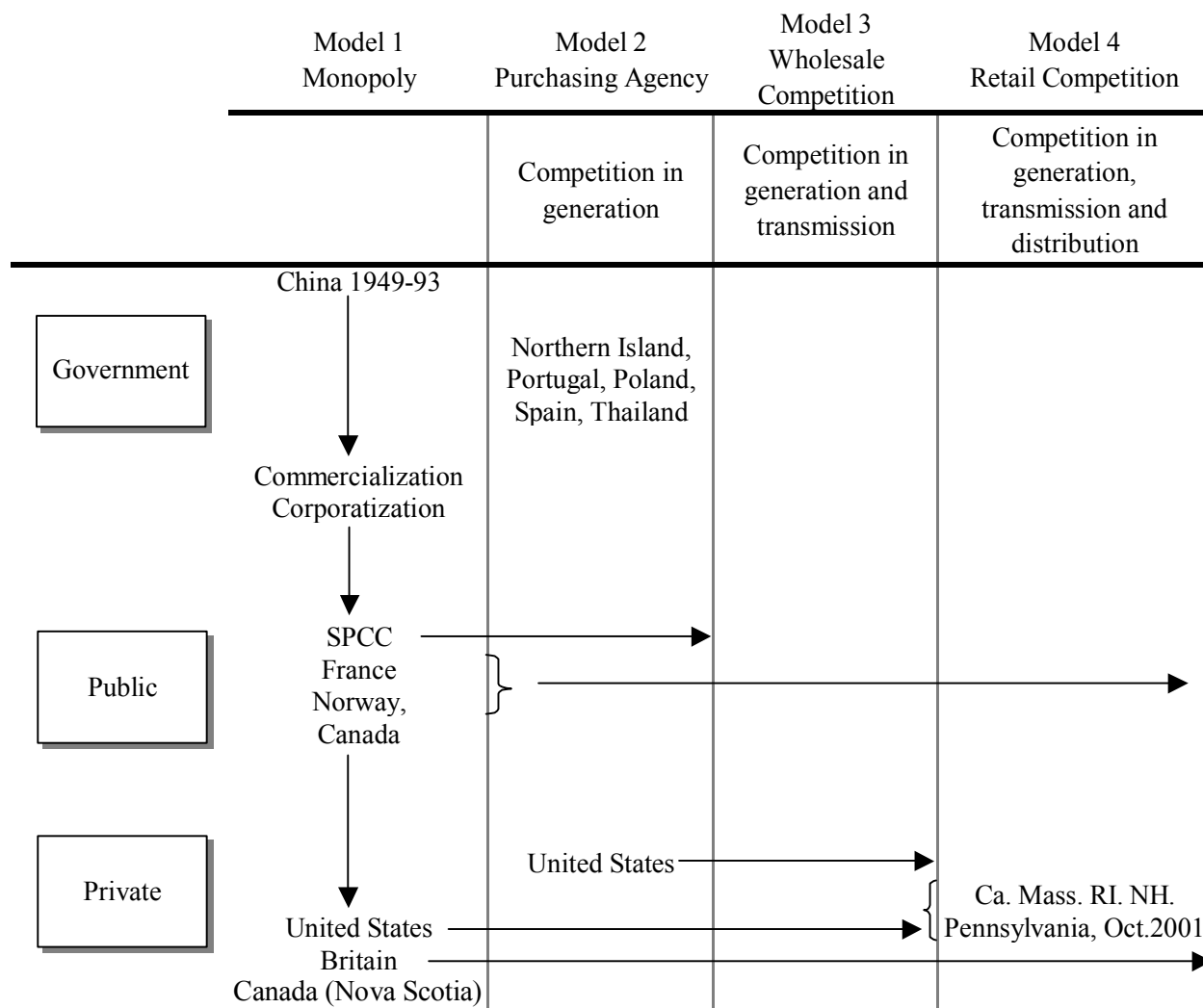
Countries began to act on reforms in the power industry started in the United States. In the 1970s, the United States allowed independent power producers to sell electricity to investor-owned utilities (IOUs). In doing so, the legislation introduced competition among power suppliers. This was the first step toward unbundling the vertically integrated power industry. In 1992, the Energy Policy Act enacted by Congress and Orders 888 and 889 of the Federal Energy Regulatory Commission (FERC) required utilities owning transmission lines to provide open access to all electricity generators. New firms flooded into the market and a new class of middlemen, known as power marketers and power brokers arose to sell electricity from generation to local distributors, leading to the emergence of wholesale electricity markets. Development in the United States has played an important role in the erosion of the power industry as a natural monopoly rationale, which was confirmed by more significant steps taken in the 1980s by some European countries. As of May 2000, independent power producers accounted for nearly 45 per cent of the total 866 electric power companies, who are eligible to sell their wholesale power. Although 17 states had enacted legislation in reforming their power sectors, 7 states have delayed their restructuring plans due to the impact of the California energy crisis, whereas California suspended its unbundling reform in September of 2002. There were still 26 states taking little or no action toward restructuring by February 2003¹.

In Britain, the Thatcher government announced plans to privatize the country's entire electricity industry in February 1988. Three years later, on April 1, 1990, the privatization process was completed with the exception of nuclear power. The Central Electricity Generating Board (CEGB) – the public-owned monopoly responsible for generation and transmission in England and Wales – was privatized into two generating companies: National Power and PowerGen. A transmission company, the National Grid Company (NGC) was created as an independent public corporation, wholly owned by regional distribution companies, playing a central role in the administration of the industry's power pool. Along the way, substantial elements of competition were introduced into both power generation, the wholesale and retail markets by implementing the New Electricity Trading Arrangements (NETA) that became effective on March 27, 2001. Most significant of all, privatization led to the creation of a completely new regulatory regime for the industry – the Office of Gas and Electricity Markets (Ofgem). Within a decade, the power industry in England and Wales was both privatized and restructure and a new regulatory regime was created.

In Norway, the reform was motivated by efficiency considerations. The basic aim was to secure low electricity prices, and increased competition was seen as a means to

that objective. Consequently, the degree of public ownership in the electricity supply industry is essentially unaffected by the market reform in Norway. For primarily historical reasons, the Nordic model happened to differ quite significantly from the electricity market model first adopted in England and Wales². In some developed countries, privatization was pursued without structural changes. For instances, in 1992, the Nova Scotia government in Canada privatized the Nova Scotia Power Commission and created Nova Scotia Power Incorporated, which remains a vertically integrated monopoly in all segments of the power industry in the province. Neither was any substantial regulatory changes made. In other developed countries, such as France, no significant changes were made in regards to ownership or structure: Electricité de France (EDF) remains a state-owned company, controlling generation, transmission and distribution of electricity in France. The following Figure 2-1 shows that even among developed countries, neither reforming nor restructuring of the power industry has proceeded at the same speed or in the same form.

Figure 2-1 Changes in Ownership and Industry Structure



Source: Hunt, S. and G. Shuttleworth [1996], Competition and Choice in Electricity, New York: Joan Wiley & Son, p.14.

Meanwhile, despite continued doubts about the appropriateness and practicality of a market-based reform approach in the developed world, a market-based reform approach has fast taken root in many developing countries. Few countries have taken all the steps described above such as Argentina and South Africa; several countries have undertaken some combination of steps toward a market in the electricity sector. The main horse driving electricity reforms is the obtaining of capital for the energy sector in developing and transition economies. Traditionally, much of the developing world has relied heavily on public development finance such as the World Bank in particular, to finance their investments in this sector. By the 1990s, international public financial institutions were increasingly reluctant to continue funding public utilities that were trapped in a cycle of low revenues and declining quality. This led to a steep decline in World Bank funding for investment projects in the electricity sector.

In 1993, a World Bank policy paper made reform in the electricity sector an explicit condition of continued lending for the sector³. The central thrust of the new policy was to encourage borrower nations to restructure their sectors and open them to greater private participation. Towards this end, the World Bank increased lending for policy reform. This shift was not limited to the World Bank, but is echoed in a 1994 energy sector policy paper produced by the Asian Development Bank⁴.

These trends in the electricity arena were part and parcel of a broader political current in the 1980s and 1990s, which presumed a growing faith in the market as an instrument of economic coordination. This shift was accompanied by an expanding role of private corporations and a corresponding questioning and renegotiation of the appropriate role of the state in economic activities. In developing countries, a turn toward markets and away from state-led activities was promoted by two decades of World Bank structural adjustment policies, which are intended to increase resource-use efficiency by enlarging the scope for private sector activity. By the early 1990s, these efforts were targeted at structural reforms in particular sectors, such as electricity, and were aimed at the privatization of state-owned corporations both to introduce fiscal responsibility and to attract private capital.

Restructuring in order to obtain private finance for the electricity sector was no simple task. In most countries, the institutional framework for private investment in the sector did not exist. Developing countries and economics in transition had to pass new laws and establish new institutions to attract capital. In addition, under the public utility model, the sector was organized as an interconnected network. This structure did not lend itself to discrete investments with well-defined profiles of risk and return to private capital. Instead, dependence on private capital exerted a pressure to divide the sector into discrete components⁵. Finally, the poor state of the sector in many potential recipient countries did not promise either reasonable expectation of profit or manageable low risk. Therefore, borrowing countries were in a bind: to attract capital, the sector had to be in good health, and in order to ensure good health, they needed capital.

Institutional reforms across the developing world and transition economies were aimed at overcoming these hurdles, but took different forms in different parts of the world. Private sector finance entered Latin America primarily through a wave of privatization. For countries burdened with debt-heavy utilities – the legacy of a wave of borrowing on international markets during the petro-dollar glut of the 1970s and 1980s – the outright sale of their public utilities was the most effective way to both shed debt and raise some capital. For examples, long before the United Kingdom White Paper was issued in 1989, a pioneering effort in electricity sector reform was well underway in Chile (1982). Nationally owned, vertically integrated companies were separated and power generation plants have been privatized and competition introduced. In Brazil, changes to all three aspects of the power industry – ownership, structure and regulatory regime – have been taking place simultaneously since 1995. Compared with Brazil, ownership and structural reforms in Colombia's power industry have been more gradual.

In Asia, countries invited independent power producers (IPPs) to build and operate power plants and sell the electricity generated to the state utilities⁶. For instance, in China, the government introduced competition trail in power generation by allowing IPPs to compete with the government owned, vertically integrated electric power utility, the State Power Corporation of China (SPCC) in 1998. Other restructuring forms have also taken place in Asian regions. For example, in Thailand, the monopolistic position of the Electricity Generating Authority of Thailand ended and the private sector has been allowed and encouraged to develop power generation projects through various schemes established by the government. The public electricity utilities are in the process of making the transition from publicly owned service utilities to autonomous industries and business groups through corporatization and commercialization⁷.

In Africa, countries have embarked on electricity sector reform as part of a larger program of structural adjustment with a focus on public sector reform. In addition to IPPs, the private sector often entered into management and operation contracts in which the operations of an entire utility was handed over to a private entity. This approach was based on the small size of the sector in many African countries and the lack of strong regulatory frameworks⁸.

In central and Eastern Europe, divestitures along with some IPPs and a small number of management contracts were the order of the day. Divestitures were undertaken as part of a larger process of restructuring along the lines of the United Kingdom model. One important goal of electricity reform was to attract capital to replace and retool the worn out system. The reform process was further complicated by accession to the European Union and the consequent need to standardize systems and regulations, including environmental regulations.

2.2 Lessons Learned from International Experiences

One important message from the reform experiences in both developed countries and developing countries is that ownership reform and restructuring do not have to take place simultaneously and there is no single model which fits all countries, as Table 2-1 illustrates.

Table 2-1 Market Liberalization Models in Selected Countries

Liberalization Model	Country
Third Party Access	Regulated Third Party Access Ireland Belgium Greece Luxemburg Scotland (UK) Japan
Single Buyer System + Third Party Access	Single Buyer System + Regulated Third Party Access Portugal
Power Exchange + Third Party Access	Compulsory Pool + Regulated Third Party Access Australia PJM (U.S.)
	Power Exchange + Regulated Third Party Access Norway Sweden Finland Denmark Spain Netherlands England and Wales (UK) France Italy Austria
	Power Exchange + Negotiated Third Party Access Germany New Zealand
	Cooperative Pool + Negotiated Third Party Access Chile

Source: Nanbu, T. [2003], System Technology and Market Mechanism: System Design of the Electric Power Liberalization, Tokyo: Tokyo University Press, p.37.

So far, it is widely recognized that electricity can be separated commercially as a product from transmission as a service. Producing the product – power generation (supply) – is not by a natural monopoly, and therefore, competition can be introduced by bringing in multiple generators. It is also widely maintained that transmission is by a natural monopoly because it not only transports power from generators to distributors, but also needs coordinate real-time balance between supply (generation) and demand (consumption). The following table demonstrates the intertwined relationship between bundling and unbundling changes in the power industry.

In Table 2-2, countries restructured their power industries differently, depending on their current political and economic developments. Undoubtedly, the power industries in all developed countries have changed in the past 10 to 20 years. Yet, these changes have often been exaggerated. Except in a few cases, the industry has neither been privatized nor deregulated to the degree that the industry is operating in a completely free market

system. Indeed, reforms undertaken are often conditioned more by the changing political and economic environment than by its design. In some countries, changes in ownership, structure and regulatory regimes are pursued simultaneously, whereas in others changes in ownership are not accompanied by changes in structure or regulatory regimes. In addition, in some countries changes in both ownership and structure are pursued in a unified way nationwide, whereas in others different models are adopted at different speeds in different regions. Therefore, there is no one model, which can guarantee the

Table 2-2 Bundling and Unbundling in Selected Countries

Separation of Transmission and Generation	Separation of Distribution and Supply	Country
Completed Separation	Completed Separation	England and Wales (UK) Spain Netherlands Sweden Italy New Zealand
	Internal Separation	Norway Finland Denmark Belgium Portugal Northern Ireland (UK) Australia
	Integrated	Chile Argentina
Internal Separation	Internal Separation	Greece Scotland (UK) Austria Ireland
	Integrated	United States ^{a)} France Germany Luxemburg Japan

a): Distribution differs in each state.
Source: Nanbu, T. [2003], System Technology and Market Mechanism: System Design of the Electric Power Liberalization, Tokyo: Tokyo University Press, p.39.

success of the reforms everywhere. Indeed, the structure of the power industry is so fluid that scholars and practitioners are still searching for a clear conceptual framework for the economic liberalization of the various segments of the industry in order to cope with the ongoing organizational dynamics of the power industry. They have also been looking for ways to simultaneously achieve both economic and political goals. The important lesson of this development is that copying privatization or restructuring models of other countries can lead to negative social and political impacts or even disasters. As pointed out by some experts “not only does one size shoe not fit all feet, but trying to apply one-size-fits-all can severely limit the performance improvements that sector reforms can

achieve”⁹.

3. Reform of China’s Electric Power Industry

3.1 The First Wave of Reform (1985-1993)

Until the early 1980s, all profits and provisions for amortization were transferred by the power enterprises and entities to government financial and planning departments, which in turn, allocated all investment funding on a grant basis and made provisions for any operating losses. One of the first steps of the reform was to convert investment allocations into loans with repayment requirements at low interest rates. In May 1985, the central government approved open capital investments in power generation to other sources such as local and provincial governments and large enterprises by introducing the “new plant, new price” policy. The “new plant, new price” policy ensured generators a cost-based tariff that enabled rapid debt repayments. This approach was used in conjunction with a one-part energy tariff linked to a nominal load factor (typically 5,000 to 5,500 hours of operation at full capacity). In 1988, to ensure that provincial governments would have sufficient access to funds, the central government adopted the “2 cents” policy. That is two cents were charged on each kilowatt of electricity consumed by industrial enterprises (with the exemption of some essential industries) to expand local capacity to finance the expansion of power generation. Also, other complicated systems were devised to mobilize more funds for investment, such as setting higher “out-of-plan prices” for power from new plants¹⁰. As a result, the central government was less and less able to cope with increasing power investment needs (see Table 3-1). In 1981, the share of direct government investment plus loans accounted for 84.4 per cent of the total annual investment in power plant construction, whereas the direct investment share constituted 54.6 per cent. In 1988, however, the government’s share dropped to 43.5 per cent, of which the direct investment share was only 16.7 per cent. By 1993, the share of “self-financing” (25.4 per cent) and that of “other sources” (24.1 per cent) accounted for half of the investment in the power industry.

Table 3-1 Proportion of Local Investment of the Total, 1987-1993

	1987	1988	1989	1990	1991	1992	1993
Total Investment in Million Yuan	13,532	21,487	22,167	26,987	31,601	40,023	55,788
Local Investment in Million Yuan	1,950	7,100	7,300	10,100	10,500	14,300	23,000
Local as % of Total Investment	14.41	33.04	32.93	37.43	33.23	35.73	41.23

Source: The Planning Bureau of the Ministry of Electric Power, Reform and Planning in the Electric Power Industry, Beijing: China Electric Power Publishing, pp. 773, 781.

Until 1980, the power sector was highly centralized, and was fully controlled and managed by a hierarchy of government departments with strong vertical command from central through regional, provincial and local levels. Therefore, decentralization became the main feature of reform in the power industry in the first from 1985 to 1993. Prior to 1988, the power sector had been placed under the jurisdiction of the Ministry of Water Reservation and Electric Power (MWREP)¹¹, however, in 1988, the power industry was split from the MWREP and placed under the newly created Ministry of Energy (EOE) along with the electric machinery portions of the Ministry of Machinery Building Industries, the Ministry of Coal and the Ministry of Petroleum.

In 1993, in the efforts to change leadership and restructure organizations, the Ministry of Energy was replaced by establishing the Ministry of Coal and the Ministry of Electric Power (MEP), separately. With the creation of the MEP, the five regional power bureaux in China, each of which covered several provinces, were all converted into regional power groups in 1993, based on the Company Law adopted in December 1993, which allowed state power companies to be corporatized for the first time (see Figure 3-1)¹².

The creation of the MEP did not indicate a fundamental change in the industry. It did, however, highlight the incongruous interests among energy industries and the special needs of the power industry, especially with regard to its demand for investment, which could not be supplied by government grants alone.

Meanwhile, the five corporatized regional power groups were created without any substantial changes to property rights or organizational structures, in contrast to other some industrial groups, which were vested full property rights over their assets. Therefore, the regional power bureaux changed their names but did not substantially change their authority, functional or organizational structures.

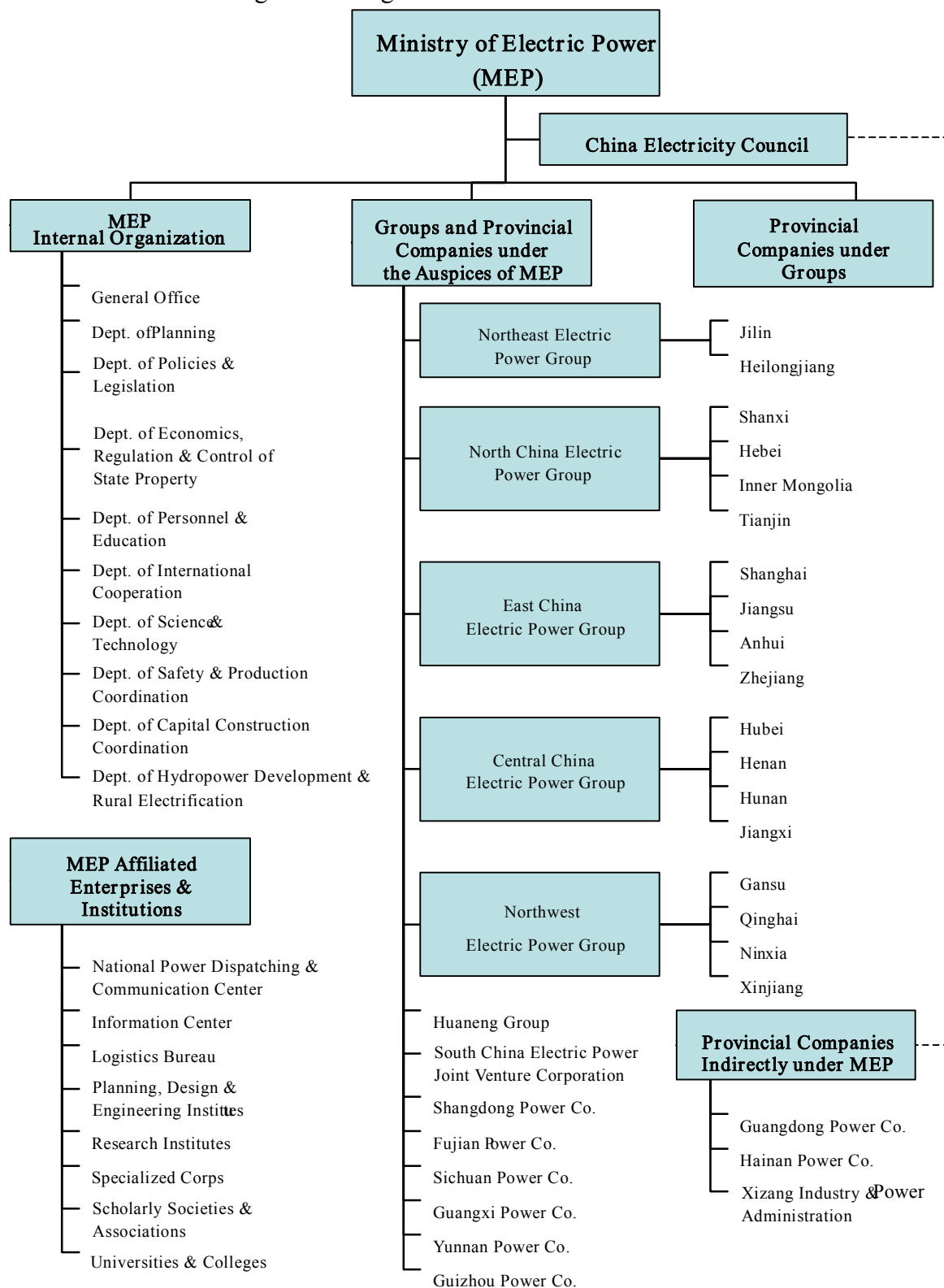
3.2 The Second Wave of Reform (1994-1999)

The reform of the second half of the 1980s, outlined in the above section achieved impressive progress in loosening the centralized management of the power sector and mobilizing financial resources through improved cost recovery and diversification of funding sources. However, despite the strong growth in electricity input, the sector still failed to provide adequate supply to the economy and most areas of China continued to suffer severe shortages. Power was allocated through administrative procedures, and market mechanisms were only just beginning to be introduced in the industry.

There was an increased awareness among the government and all entities involved in power sector operation that the sector's inability to effectively cope with a fast growing demand and its performance failures should be traced to structural and institutional issues. As examined in detail in the following sections, a new broader and deeper reform program was initiated in 1992, which deals with the more issues involved

in restructuring the sector to meet the needs of new market economy. Momentum behind the package of reforms was increased, especially since later 1993.

Figure 3-1 Organization Structure of the MEP



Source: World Bank [1994], China Power Sector Reform: Toward Competition and Improved Performance, Washington, DC: World Bank, p.2.

First of all, foreign direct investment (FDI) was made possible by the changes of general economic guidelines from “socialist planned economy” to “socialist market economy” adopted in 1993 by the central government. “In early 1994, China’s investment and energy authorities began encouraging foreign investments in the power generation sector beyond the extremely modest experimental projects up to that point”¹³. A combination of developments in the power industry at the time provided strong motivation for allowing and attracting foreign investors to China’s power industry – inadequate domestic capital, inability to manufacture efficient, large-size power equipment and the desire to improve “energy efficiency by expediting the transfer of advanced generating technologies and management techniques and by introducing competition. A series of reforms were adopted to create a friendly environment for overseas investors, and a series of laws and regulations for foreign-funded power plants were created in the middle 1990s.

Second, the government promulgated the Electric Power Law of the People’s Republic of China in 1996 for the first time, which legalized the status of power enterprises as commercial entities, and established the legal basis for private ownership. Prior to the enactment of the Company Law and the Electricity Law in 1996, there was no legal basis for private sector participation in developments of the power sector. The central government tightly controlled all aspects of the sector, subject to more than 500 laws, regulations, and administrative directives. The serious power shortages and the economic growth of 1985 to 1990 sparked local governments’ interests in tapping private funds to develop their power sectors. However, the negotiations for potential deals quickly stalled because the FDI laws and regulations lack of long-term market and tariff commitments and lack of an acceptable allocation of project risk. Investor’s worries mainly to the access to foreign exchange to repatriate profits in local currency and administrative limitations on projected returns. Local government agencies, provincial power companies, and foreign developers looked to central government agencies for answers. Consequently, the comprehensive Law was established in 1996 to allow the government to embark on a new wave of reform decisions to create necessary structures, and key principles. These decisions include the creation of the State Power Corporation of China (SPCC), the introduction of competition in generation, the separation of generation from transmission operations, and so on.

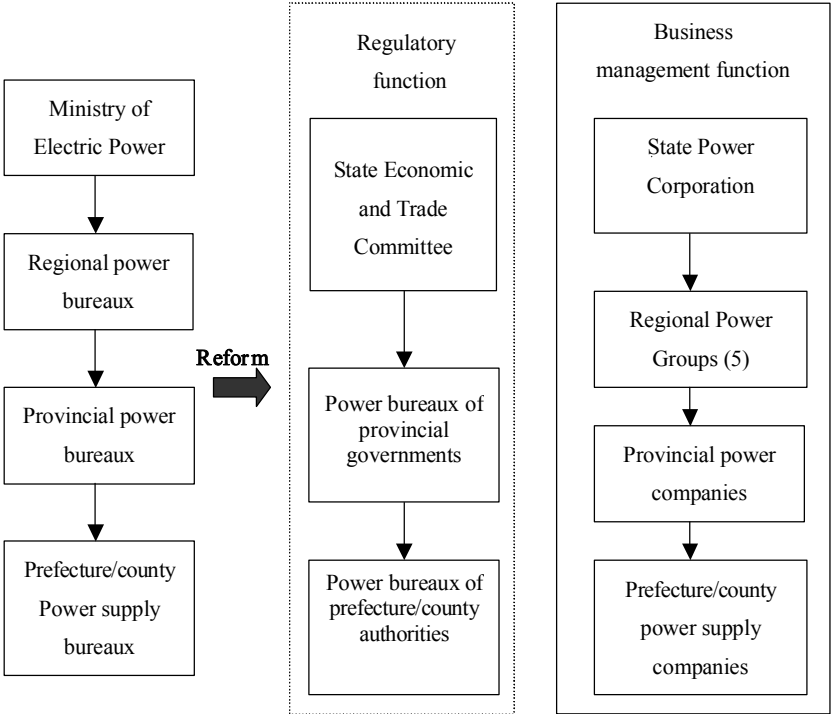
Third, in 1997, the State Power Corporation of China was established to hold the state’s ownership rights in the power sector and to support a commercial asset-holding relationship. As decentralization and corporatization proceeded among power enterprises, the one system structure and the role of the government in charge of the industry had forced to be changed. A market-oriented institutional structure needed to be created with full responsibility of its economic activities, and independent decision-makings. Therefore, in October 1996, the State Council gave permission to the MEP to start the process of converting itself into a corporation in order to gradually give up its role in

allocating resources and to let the market take over some operations. On January 16, 1997, the SPCC was created by the State Council in anticipation that the MEP would be disbanded once the transfer of ownership between the two was completed.

After completion transfer business function from the MEP to the SPCC in March 1998, the MEP was dissolved, and its government and regulatory functions were transferred to the newly expanded the State Economic and Trade Commission (SETC). Dissolving the MEP reflected the changing relationship between the government and the power industry. As a state-owned enterprise, the SPCC would continue to coordinate with these relevant government agencies in decisions considering the industry development, investment and power tariff, however, it would no longer be an equal partner but rather an independent economic entity.

Soon after the SPCC took over the power industry, it projected its reform strategy, pushing forward progress of corporatization and separation of government functions from enterprises so that eventually “all provincial power companies shall transfer their presently responsible administrative functions to the general economic management department under the local government, and instructed and supervised by respective local government”¹⁴, as Figure 3-2 shows.

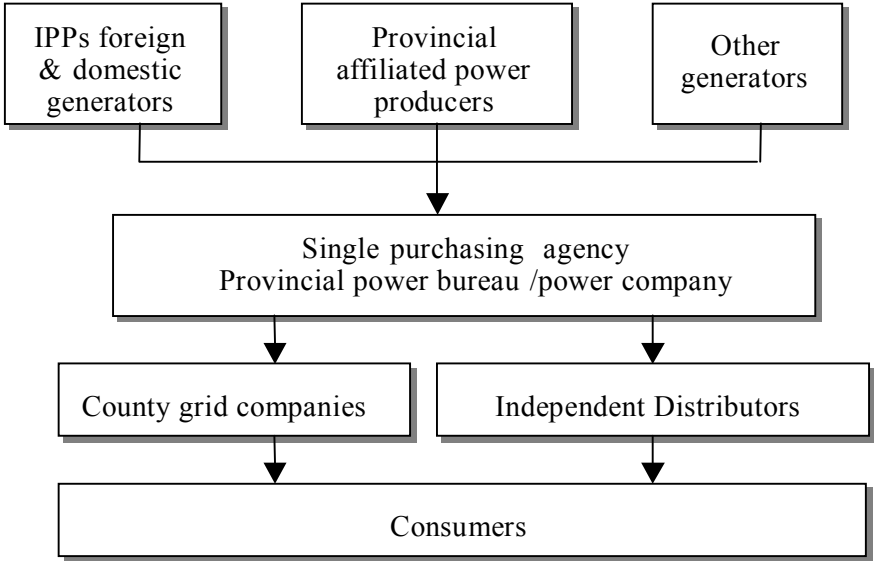
Figure 3-2 Separation of Government Function and Enterprises Management Function in the Electric Power Industry



Fourth, in 1999, the State Council issued a directive to separate generation from transmission and distribution, and chose the single buyer model for restructuring China’s power industry to create generation service market with power suppliers competing

through open bidding. Under the single buyer system, in each specific region (province or region connecting several neighboring provinces) the regional power group and the provincial power company would maintain its monopoly over the transmission and distribution networks and act as a single agency, purchasing power from power generators and selling electricity to end-users through its controlled distribution companies in the region. This single buyer with its monopolized control of both transmission networks and sales to final consumers would be required to choose from a number of different power producers on the basis of merit to encourage competition in power generation (see Figure 3-3). This would require the entrance barriers to be lowered so that independent investors would be able to invest in power generation plants. Power generators including affiliated as well as independent producers within and without their defined service territory must compete to sell their power to a single purchasing agency. This single buyer model is also known as the monopolistic system, and is neither seen as a radical change to the current system nor a final step for restructuring China's power industry.

Figure 3-3 The Single Buyer Model in China's Electric Power Sector



It was rather introduced on the existing structure, because the first step had already been taken toward this structure in many areas of China. Resulting from multi-channel financing, independent power producers from giant power generators such as Huaneng Power International, Beijing Datang to township small- scale generators were throughout the country at that time. The appearance of IPPs eventually forced the power sector to introduce a competition system into the generation market to break down entry barriers, enabling themselves to against affiliated power producers. Also, to encourage overseas developers to invest in China's power generation sector, power purchase agreement was initially introduced to guarantee foreign investors' profits or avoid invest risks. For

instance, in the case of Laibin B build-operate-transfer (BOT) project, the Guangxi Power Bureau, the single buyer agree to buy about 63 per cent of plant output (based on 100 per cent base-load factor), which would guarantee the developers enough cash flow at 63 per cent output to service its debts¹⁵. Therefore, having the accepted international experiences of vertically unbundling the power industry, in August 1998, the State Council decided to start experimenting with the separation of power plants from grids in Zhejiang, Shandong provinces, and Shanghai municipality. Later in the year, the experiment expanded to another three provinces in northeast China, which were Heilongjiang, Jilin, and Liaoning. By early 2001, Zhejiang was the only province that had achieved some success. The provincial power company, which is a direct subsidiary of the SPCC purchases 80 per cent of power by signing long-term bilateral contracts with power producers – affiliated or independent. The contracts were negotiated either at the time when power projects were constructed or with old power generation plants on a long-term, usually ten-year basis. Only 20 per cent of the wholesale market was open for bidding by all power generators in the province. For the rest of the five provinces and the municipality, the emphasis is on separating management and financial responsibilities of power generation units from transmission.

Competition among gradually decentralized generators of electricity in China yet was at the embryonic state by the end of 2000. It was too early to conclude what kind of liberalization policies should be introduced, and how these policies should be conducted to achieve the designed goals. However, changing to the single buyer model was a transition toward a more fully developed market where there are many generators competing for the right to sell many buyers.

3.3 The New Wave of Reform (2000 to present)

When the restructuring experiment was introduced at the end of 1998 and in early 1999, the proposed changes were quite moderate with the emphasis on experimentation and gradualism. A step-by-step approach was adopted: to separate management of power enterprises between generation and transmission; then to create independent financial units by separating their assets and accounts. Once these steps were taken, and especially after power enterprises were corporatized into profit-seeking entities, gradual competition could be introduced by allowing power generators to compete for access to the grids on a merit system. Instead of emphasizing the creation of a spot market for competition, the plan underlined the SPCC's function of helping power enterprises to conduct corporatization, create shareholding companies and coordinate transmission and dispatching. Taking into consideration of the size of the country and its different stages of development, the original plan gave each provincial power company the responsibility for overseeing the implementation of the above tasks, whereas the SPCC would concentrate on cross-province and cross-region transmission. In those provinces where

the experiment was underway, provincial power company, which controlled transmission and dispatching lines were required to buy power from all traditional power producers, which were undergoing the corporatization process and from new producers who had a negotiated long-term contracts on the terms of sale, hoping eventually that the purchasing agency sign contracts with them.

Needless to say, competition was not such important at this stage as clarifying ownership and improving performance. Market competition was unforeseeable in the near future for several reasons: First, power shortages had been alleviated temporarily in some regions in 1998 and 1999, but was expected to continue in those regions and provinces where economic growth rates remained high, such as Guangdong province, Shanghai municipality, and other coastal provinces. Second, inter-provincial transmission networks were still inadequate and fragile.

In the middle of 2001, however, the government realized that monopoly was the main obstacle for market competition and the primary hurdle preventing China from joining the World Trade Organization (WTO). Hence, pushing forward the reform of the monopoly industries was part of the in-depth economic reform in China during the “Tenth Five-year Plan”. A proposal that suggested introducing competition into the power industry by breaking up the SPCC was made by the State Development Planning Commission (SDPC) at that time¹⁶. The SPCC represented such a monopoly with its total control of inter-provincial and inter-regional networks and dominated approximately 65 per cent of the country’s total power generation. The suggested plan required both vertical and horizontal de-integration, and insisted that power generation must be separated from transmission and gradually unbundling transmission and distribution systems. The SDPC’s proposal was supported by the central and provincial governments.

In December 2002, the SPCC underwent a drastic restructuring, occurring as part of the “Plan for the Reform of the Electric Power System”, which was approved by the State Council on April 11, 2002. The SPCC’s grid assets were spilt among six regional companies, and a new operator was brought into control the grid in the southern area of the country. These changes resulted in two separate grid networks – the State Power Grid Corporation of China (SPGCC), and the China Southern Power Grid Corporation Limited (CSPGC). The Sate Power Grid Company consists of the North China, Northeast China, East China, Northwest China, and Central China power grids. The Southern Power Grid Company covers the regional grids in Yunnan, Guizhou, Hainan, and Guangdong provinces. In addition to splitting of the grids, the electricity generation assets of the SPCC were also formed into several enterprise groups – China Huaneng Group, the parent company of the Hong Kong listed Huaneng Power International, China Datang Coporation, China Huadian Corporation, and China Power investment Corporation. During the reorganization, the China Power Engineering Consulting Group Corporation, and China Hydropower Engineering Consulting Group Corporation were created as consultancy companies, whereas the China Water Resources and Hydropower

Construction Group Corporation, and China Gezhouba Group Corporation were formed as construction companies (see Figure 3-4 and Table 3-2)¹⁷. The reform also provided opportunities for locally controlled listed companies to conduct assets restructuring because of the parent-subsidiary relationship they would have with the newly established power groups.

Figure 3-4 Reform of the SPCC in 2002

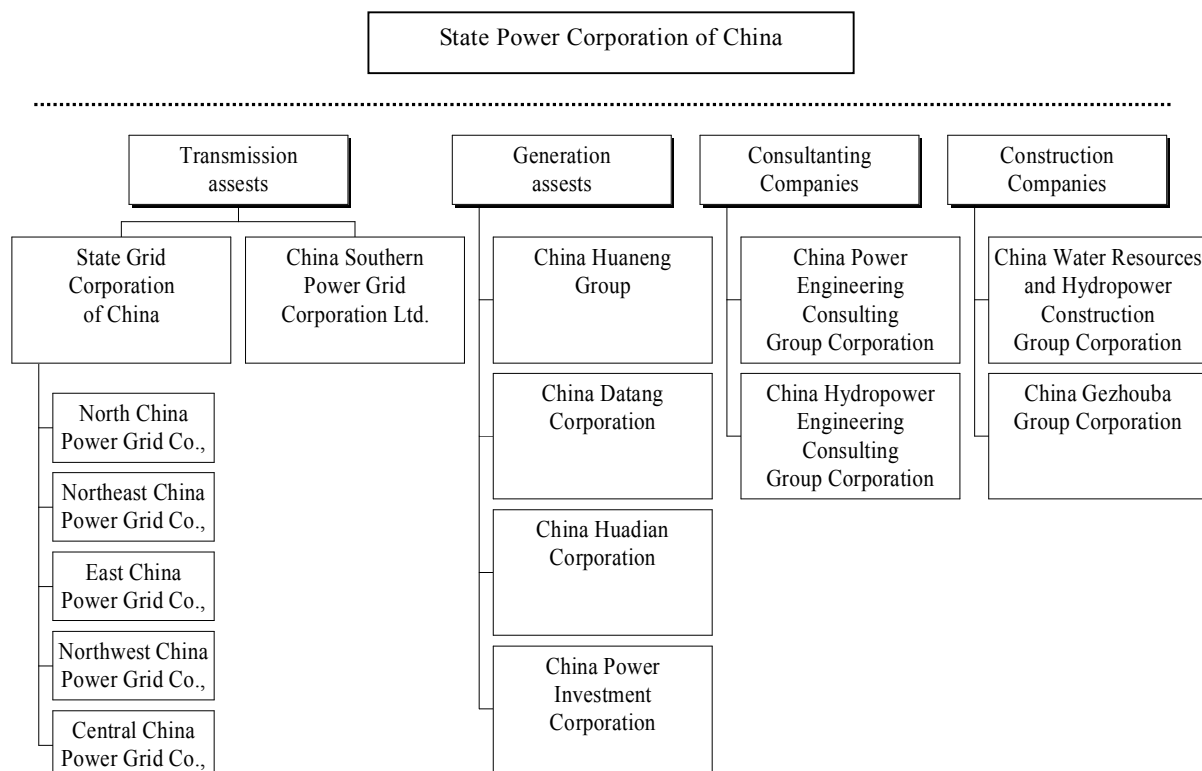


Table 3-2 Regional Power Grid Company with its Service Territory

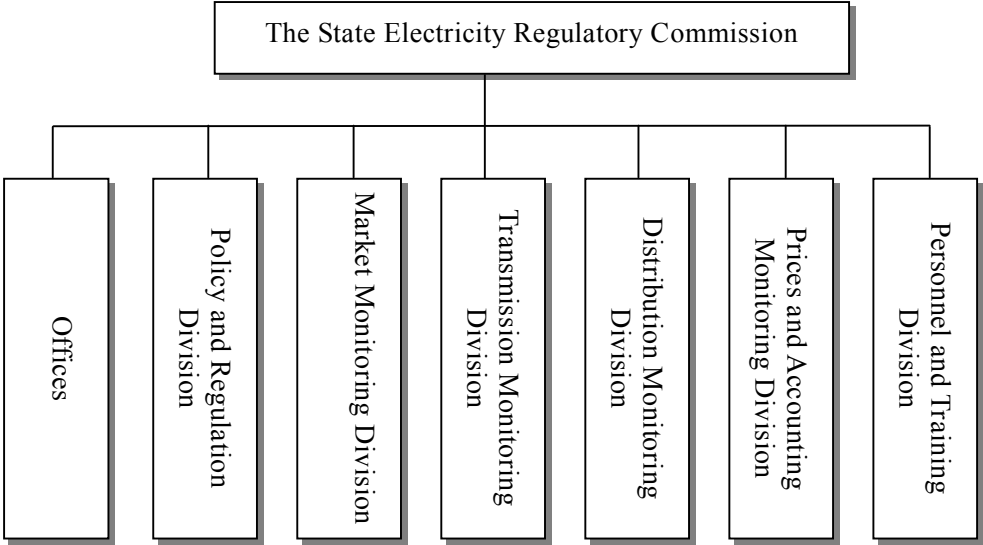
Regional Power Grid Company		Service Territory
State Grid Corporation of China	North China Power Grid Co.	Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia (some parts), Shandong
	Northeast China Power Grid Co.	Liaoning, Jilin, Heilongjiang, Inner Mongolia (some parts),
	East China Power Grid Co.	Shanghai, Jiangsu, Zhejiang, Anhui, Fujian
	Central China Power Grid Co.	Jiangxi, Henan, Hubei, Hunan, Chongqing, Sichuan
	Northwest China Power Grid Co.	Shanxi, Gansu, Qinghai, Ningxia, Xinjiang
	China Southern Power Grid Corporation Ltd.	Guangdong, Guangxi, Hainan, Guizhou, Yunnan

Source: Japan Electric Power Information Center [2004], "Trends of China's Electric Power and Nuclear Power Generation," Electric Utility Industry in the World, Toyo: Japan Electric Power Information Center, p.8.

It is clear that the power industry that resulted from the restructuring is far more complex than that of the SPCC. To cope with this complexity, the State Council

established a power regulatory body for the first time in March 2003, the State Electricity Regulatory Commission (SERC) to oversee the industry and fiercely regulate prices (see Figure 3-5). Despite the SERC was set up to supervise market competition in the power industry and issue licenses to qualified operators, the Commission at this stage lacks enough authority to regulate the industry. Governing authority for approving electricity prices and construction of plants are still scattered among government departments, including the State Development and Reform Commission (SDRC)¹⁸ and the Ministry of Finance, which have diminished the existence of Commission.

Figure 3-5 Organization Structure of the SERC



Source: The State Electricity Regulatory Commission, “About the SERC,” (<http://www.serc.gov.cn/index.jsp>).

Meanwhile, the government and the Commission are amending the Electricity Law for the first time since it was introduced eight years ago. One of the major purposes is to strengthen management to ensure the stability of power supplies and to regulate the power market. In addition, the government is also preparing for establishing an emergency-response procedure for dealing with possible power problems such as power blackouts accidents, which happened in the United States, Canada, and European Continent in 2002 and 2003, respectively. The government worried the possibility of the similar happening in China due to its fragile power system, and has urged power companies and local officials to set up a crisis-response mechanism.

Intent to promote competition and improve distribution, in January 2004 and May 2004, the SERC put a regional power exchange (PX) market into trial operation in China’s northeastern and eastern provinces, respectively. The move was considered historic in the break-up of the monopoly of the electricity sector, and the system is expected to help the economy’s growing demand for power.

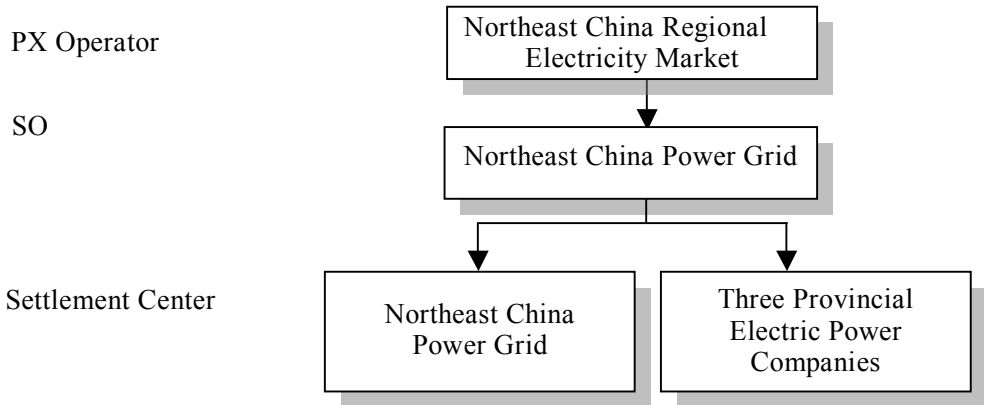
4. Analysis of Pilot Liberalization Models in China’s Electric Power Industry

4.1 Liberalization Experiments: Power Exchange Markets with Single Buyer Systems

The Northeast China Regional Electricity Market: The northeast China regional electricity market takes shape in the northeastern provinces of Liaoning, Jilin, and Heilongjiang, and also covers some areas in the Inner Mongolia autonomous region. The regional electricity market covers a total of 1.2 million square kilometers, which encompasses 100 million residents.

According to the “Plan for Implementation of the Northeast China Regional Electricity Market” issued by the SERC, all power trade will be conducted in the Northeast China Power Exchange (NCPX) that was established by the Northeast China Power Grid in Shengyang, the capital city of northeast China’s Liaoning province, whereas Liaoning, Jilin, and Heilongjiang power companies will act as local settlement centers, responsible for settlement (see Figure 3-6). Generators who bid on thermal units, which are more than 100 megawatts, and are connected to the Northeast China Power Grid are allowed to participate in the power market (excluding combined heat and power producers and self-generators). Currently, 26 generators, of which 22 affiliated power producers of the five major electric power companies, and 4 independent power producers compete with each other to supply electricity to local grids in the northeastern region. Total installed capacity of the 26 generators reached 21,740 megawatts, accounting for 55.2 per cent of the total capacity in the Northeast China Power Grid.

Figure 3-6 Operation Structure of the Northeast China Regional Electricity Market



As the first step in establishing regional power markets, the northeast China electricity power market will begin to trade electricity on a monthly basis, and the market will gradually expanded into other market forms, including one-day-ahead, and real-time markets. The total power exchanged in the power market will account for about 20 per cent of total wholesale generation. At this stage, the Northeast China Power Grid

continues to be the single buyer of all capacity and energy from the NCPX and outside of the NCPX, but it is limited to power purchases, transmission system and market operations. Prices in the monthly market are determined by the pay-as-bid system. Under such a system, the Northeast China Power Grid sets a cut-off price, any bids higher than the cut-off price are disregarded, but low bids are accepted. Bidders (generators) will be paid the price they bid rather than the market-clearing price. In one-day-ahead and real-time markets, electricity will be priced at the marginal cost of that electricity. Price-cap is also implemented for sealing the lowest price, as well as the highest price in the NCPX market. In order to manage the system, given the special characteristics of electricity, the Northeast China Power Grid is responsible for ancillary services. Ancillary services can be provided by the system operator's own reserved capacity, as well as contracted generators. Generators who sell ancillary services will be paid by the system operator. However, at this stage, the fluctuation rates and prices for ancillary services are not clear in the Notification Plan for Implementation in the Northeast China Regional Electricity Market.

Quotas of electricity transmission from northeast China to central China are assigned to the regional power grid, the three provincial power companies, and certain generators. Prices for inter-regional power transactions are still set by government agencies.

After six months of trial operation, in May 2004, a two-part tariffs system was approved to be introduced into the northeast China's regional power exchange market. With the two-part tariffs system, demand charges are determined by government related agencies and energy charges are set based on the NCPX market scheduled to be implemented in July 2004.

The East China Regional Electricity Market: The east China regional electricity market was put into trial in May 2004. The market covers Zhejiang, Jiangsu, Anhui, and Fujian provinces and Shanghai municipality. Market participants include the system operator – the East China Power Grid, provincial power companies, and generators whose bid thermal units are least 100 megawatts, and eligible consumers.

The East China Power Exchange will establish monthly, one-day-ahead, and real-time markets, but may start only with the monthly market. Generation traded in the East China Power Exchange (ECPX) will account for 15 per cent of the total wholesale generation. Prices for the monthly market are based on a pay-as-bid system with a price-cap regulation. However, there is no cap on the lowest price in the ECPX. The price-cap is set for two different periods, in which 0.482 yuan per kilowatt-hour for the peak period (8 a.m. to 22 p.m.) and 0.3212 yuan per kilowatt-hour for the off-peak period. Settlements for monthly, and one-day-ahead markets will be implemented by the East China Power Grid, whereas settlements for the real-time market will be handled by provincial electric power companies.

4.2 Issues Regarding the Two Pilot Programs

Impressive gains were made in waves of reforms – notably the adoption of an increasingly commercial operating framework, unbundling of the generation and transmission sectors, and introduction of competition. Notwithstanding these major achievements, not only the two pilot regions but also the sector as the whole suffer major problems that impede social and economic development throughout the rest of the economy. If these problems are not discussed and resolved, they could jeopardize reforms and undermine many of the gains. In considering feasible liberalization models in China’s power sector, the range of this analysis will focus on the two pilot regions, but the concerns are common issues, which exist throughout in the power sector. The main issues are considered to be:

The first main issue is considered to be inequity and inefficiency in the single buyer structure. In both the northeast China and east China regional electricity markets, the single buyer system was introduced into the generation sector. However, the single buyer system is not a totally new structure. As noted, the east China region had already experienced the single buyer system before it commenced the wholesale market. Practically, separate transmission and generation entities already exist in many provinces and regions since the government embraced the “unbundling” policy in 1999. Expansion of the regional power system has relied on vertically integrated regional grids and provincial power companies operating as the single buyers of all generated electricity, that is, as monopolists. These buyers are obligated to meet all the demand within their own regions. To do so, they must contract for adequate supply and bear all market risks. Accordingly, regional grids and provincial power companies have built up portfolios of their own power plants and contracts with independent power producers.

The single buyer model provided many benefits to China’s rapidly growing power system. Lenders and investors had enough security to finance large capacity additions in order to mitigate the disruptive effects of power shortages. The single buyer’s ability to average the lower prices of old generators (which had recovered their investment costs) and the much higher prices of new generators (which operated under the “new plants, new price” policy) allowed price increases to be phased in gradually – which avoid price spikes at times of capacity or energy shortages. The single buyer structure also gave power utilities time to build management capacity and adapt to a commercial environment.

But in many regards, the single buyer structure has reached its useful limits in the regions because incentives for investment and operating efficiency are weak, and it is difficult to regulate the activities of a single buyer to enhance efficiency. Inefficiencies are evident in rigid pricing and contract structures through the Power Purchasing Agreements (PPAs). Except 15 per cent to 20 per cent of the electricity is traded in the

bidding system, most of the power is contracted by the PPAs between provincial electric power companies and generators. Prices for PPAs are negotiated based on the government pricing methodology. Therefore, there has been little incentive to restrain higher costs, as a consequence costs have been passed on to customers. The ability to pass on such costs dilutes the strict commercial criteria that should be applied to investment decisions.

Problems are also emerging as a result of the single buyer's bargaining power over generators when signing contracts, and their ability to discriminate when dispatching installed capacity. In the two pilot regions, some independent generators are not being dispatched at levels that cover their fixed costs or provide revenues on which their investment decisions were based. For example, in Heilongjiang province, the Hasan Electric Power Company's (an independent power producer) two 600 megawatts units were operated less than 4,000 hours per unit, whereas Fulaerji Electric Power Company's six 200 megawatts units (a power company wholly-owned by Heilongjiang Electric Power Company) reached 5,500 hours per unit for the year in 2003. If the Hasan Electric Power Company wants to sell power on the grid, it has to reduce its price 50 per cent below the on grid price, offered by the provincial power company¹⁹. Such complaints about discriminatory dispatching have already surfaced with a growing perception that plants affiliated with provincial power companies are favored over independent producers.

The worldwide regulatory experience suggests that it is not easy for regulatory authorities to detect and stop these subtle forms of favoritism. However, the favoritism which exists in Heilongjiang province is because the provincial authority worries that affiliated power companies which operate fewer hours may reduce their employees, which in turn cause social instability. Therefore, there is a considerable danger that the single buyer structure will not work in China unless necessary steps are taken to avoid these issues in the two pilot programs.

The second problem considered is inefficient pricing. Although average wholesale prices cover supply costs, power pricing remains flawed under this model. The two-part tariffs system has introduced into the northeast China electricity market, however, demand charges are still determined and adjusted by the government, whereas in the east China electricity market, generation tariffs are still based on a single-part structure linked to a nominal load factor – which leads to uneconomic dispatch. Establishing the cost of power is not the only problem facing regulators. Institutional control of transmission pricing will be one of the most difficult tasks. In both regions, transmission is not recognized as a separate service, which constrains power companies' ability to recover investment in transmission expansion. As a result new transmission capacity is insufficient which leads to sub-optimal use of capacity at the provincial level and limited power trade between provinces. Therefore, a new transparent pricing structure must be introduced so that transmission and distribution costs can be clearly identified. Without

such pricing transparency the regulator will not be able to design proper incentives to reduce costs so that a fully competitive market can be introduced.

The third problem of the current pilot model is “stranded costs”. The issue of “stranded costs” remains controversial in power industry restructuring everywhere in the world. Stranded costs are the costs of plants and equipment that would be rendered obsolete or uncompetitive in a free market. The problem emerged when widespread entry into the generation sector by independent power producers who may lead to financially troubled times for some regulated utilities. In the northeast and east China regions, where there are pilot programs for the generation sector, the grids do not reject electricity from any producers. New power plants sell their electricity on the basis of PPAs, negotiated at the stage when the investment was made, whereas prices for “old” plants remain barely enough to cover operation costs but have paid off their capital costs. Therefore, it will be difficult for “new” power plants to compete with their investment costs derived from the high costs of technology development, environmental requirements, and so on. If stranded costs can be passed on to customers, there will be inevitably dramatic increases in retail power prices. On the contrary, if stranded costs cannot be concerned, it will discourage investment, slowdown generation development, which will further impede the country’s economic activities. “Stranded costs” have not been mentioned in the two pilot programs at this stage because the market is still absent of full on competition. This can only be effectively tackled by establishing a methodology to work out the true costs of power from a plant.

The fourth problem to be considered is how to construct interconnected transmission networks. Competition among power generators cannot be achieved without an integrated transmission and distribution network to provide a critical platform upon which the competition among generators depends. Without interconnected transmission grids, power markets would be geographically segmented. In other words, creating broad regional grids means there is potential for an effectively competitive generation market within each region. Since one network is also interconnected with networks in adjoining regions, an even larger number of power producers can compete for these loads. Moreover, interconnected networks also create opportunities for other potential supplies of power – independent power producers or co-generators – to compete to supply in this regional market. Introducing competition to segments of this chain will therefore affect market organization, prices and the number of players in the market. Because of these advantages of interconnected networks for facilitating competition, there is hardly any incentive for the single purchaser in each region to engage in the construction of interconnected networks. After all, transmission networks are natural monopolies, and their investments are lumpy. It is essential to construct interlocking transmission facilities, which permit adjoining power companies to rely upon each other when their own facilities are inadequate to meet load. In this sense, it means that the SPGCC and the CSPGC must take up the responsibility to “speed up power network construction,

quicken the step of nationwide grid interconnection, implement urban and rural power network construction”²⁰. Investment in transmission will facilitate competition in generation, however, in the current circumstances, it provides a potential conflict of interests, especially between provinces. For example, in the northeast regional electricity market, Liaoning province is the only one reluctant to join the power market, because the province has suffered power shortages for a long time. If a united wholesale market is formed, much cheaper electricity can be purchased from the other two provinces where there is generation. Therefore, low price electricity would not only threaten the business operation of local power companies, but also affect the province’s coal and transportation sectors, which are upstream of the power sector.

Finally, another issue that needs to be noticed is the contradiction of regulation objectives. As noted, any incorrect regulatory policies may cause an energy crisis like the one that happened in California’s energy market. In the two pilot regions, the SERC intends to build the generation sector on market-based transactions, whereas its regulation regime remains to achieve political or social goals rather than as mechanisms for the market. In a competitive market, even the single buyer system is initially a narrow market, power generators should be allowed to choose which one of their plants should enter the competitive market and which plants should go to the contract market, if there is excess capacity which can be sold into the pool. The generator may be set the PPA to recover most costs and seek to cover the remainder in the competitive market. Therefore, the contract part of the market, in which electricity is sold to the single buyer under a PPA, is designed to create investor confidence in building new capacity. At the moment, however, regulations have rather hindered the promotion of investment in new capacity, because operating hours in the PPA need to be approved by the two provincial Economic and Trade Commissions, as well as on grid generation prices. Local protectionism fostered by regulatory governance has resulted in the case of Hasan Electric Power Company and Fulaerji Electric Power Company. In a market-based economy or in a competitive market, the objective of regulatory governance is to achieve transparency and predictability, and thereby make regulatory agencies accountable.

5. Conclusion

The development of the power industry in China did not start until the end of the 1970s. A combination of pragmatic considerations propelled the economic reforms in 1979. In the following twenty years, the central government tried various schemes to change the incentive structures for enterprises in order to force them to become more market-oriented. The principal changes in power enterprises came through the introduction of other sources of investments, which meant the removal of entry barriers through the two-tiered price and contract responsibility systems, both of which removed barriers to enterprise activity and permitted new initiatives. These practical measures

helped alter the incentive structures for power enterprises so that they could change their economic behavior. In 1997, the national power corporation was created as a state-owned shareholding company, taking over all of the economic responsibilities from the Ministry of Electric Power. During the “Tenth-five Year Plan”, China endorsed a restructuring plan for unbundling segments of the power industry with a voluntary electricity exchange market. The primary motivation was the desire to improve the economic performance of power enterprises. Restructuring is still in its experimental stage and it is too early to tell what its effects on the industry and on the economy on the whole will ultimately be. At least some issues which appear in the pilot programs - “favoritism”, “stranded costs”, “inefficient pricing”, and “inefficient regulatory governance” need to be concerned with the restructuring goals of China’s power sector. The approaches absorbed from international experiences are likely to lead to feasible policies only when certain essential pre-conditions are met such as pricing and legislation. Restructuring the power industry by separating generation from transmission and distribution may not generate competition if there is not a new transparent rational pricing structure. Therefore, in the absence of most of pre-conditions, a new pricing structure must be introduced initially to enable the liberalization approaches adopted by the Chinese power sector.

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 - ⁵ Balu, V. [1997], “Issues and Challenges Concerning Privatization and Regulation in the Power Sector,” *Energy for Sustainable Development*, Vol.6, pp.6-13.
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- ¹⁶ The State Development Planning Commission was the successor to the State Planning Commission after reshuffling its function in 1998.
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- ¹⁸ The State Development and Reform Commission is the successor to the State Development and Planning Commission, and also took over some responsibilities of the State Economic and Trade Commission after its reshuffle in May 2003.
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