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REMAKING THE WORLD'S LARGEST COAL MARKET: THE QUEST TO DEVELOP LARGE COAL-POWER BASES IN CHINA

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1. Introduction

China's coal market – already the largest in the world – is increasingly a driving force in the global trade and pricing of coal. China's imports accounted for nearly 15% of all globally traded coal in 2009, and that share is poised to increase in 2010. The coal market has entered an era in which even slight shifts on margins of China's internal market directly impact coal trade and prices globally.

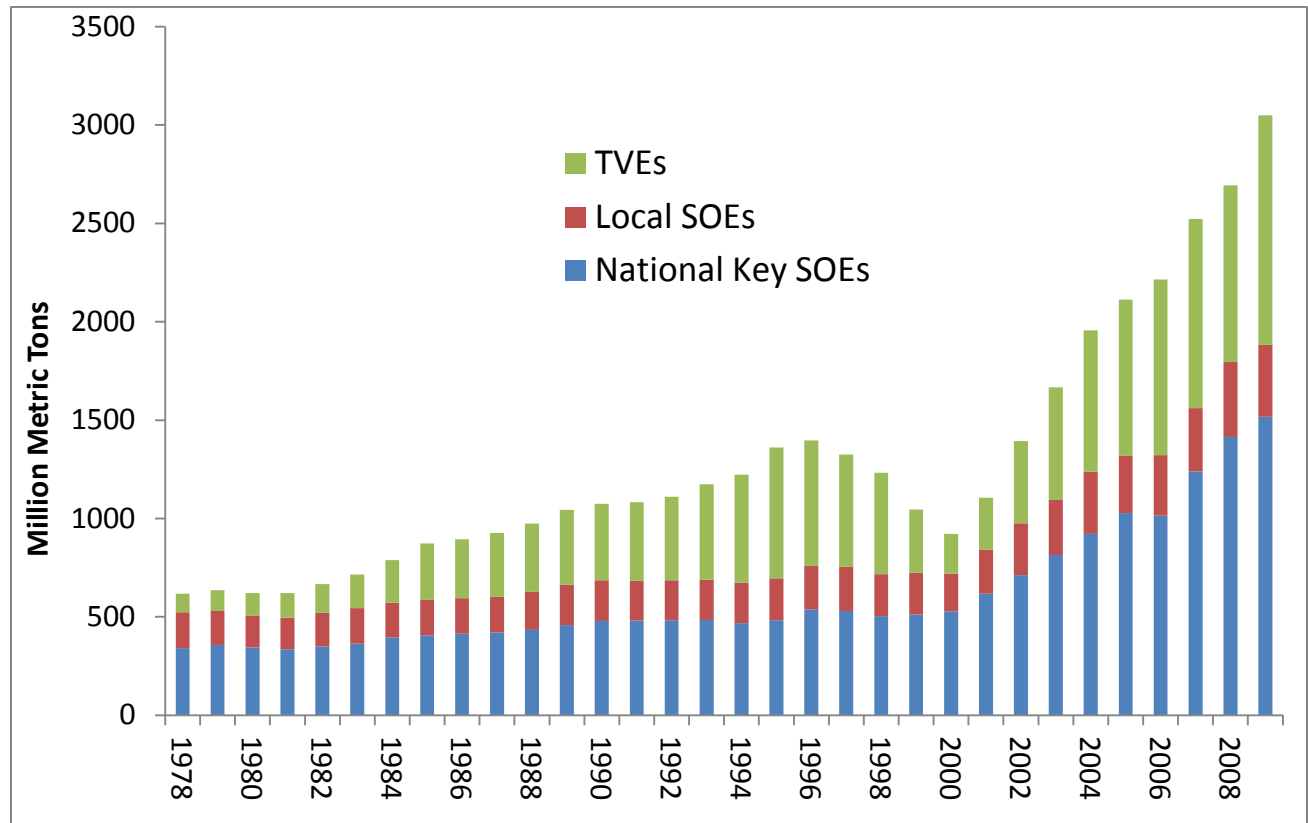
China is now in the midst of a radical restructuring of its coal and power sectors that has the potential to change how coal is produced, traded and consumed both in China and the rest of the world. That restructuring aims to integrate the coal and power sectors at giant “coal-power bases” that combined would churn out more coal annually than all the coal produced in the United States. This paper analyzes the conditions in China's coal market that catalyzed these massive reform and integration efforts, their prospects for success, and the implications for both Chinese and global coal markets.

Coal plays a central role in China's economy, and has been a key ingredient of the economic growth that catapulted the country towards its present position as the world's second largest economic power. To this day, few countries rely on coal to the extent that China does. Despite a dramatic increase in oil and gas production and the rising share of renewable energy sources, including hydro power and nuclear power, by 2008 coal still provided nearly 70 percent of China's primary energy supply and generated 80 percent of China's electricity (NDRC 2008). Moreover, despite large-scale industrial restructuring and government attempts since the 1990s to close down small and inefficient coal mines, coal still provides no less than 4 million jobs directly in the coal sector and millions more in coal-related industries.

Since 1978, China's coal industry has experienced the fastest pace of growth in the history of the world's coal industries, with production multiplying nearly 5 times from 62 million tons in 1978 to 2.79 billion tons in 2008 (Figure 1). China's coal output accounted for 27 percent of the world total in 1998, increasing to 39 percent in 2007. Among the industry's most significant achievements is that it has ended China's decades' long supply shortage of coal and is able to meet the demand of the rapidly developing national economy. Several major developments enabled this accomplishment. Regulation and administration of the sector has been transformed from a command-economy model to market-oriented model. Competition has been introduced to the industry. Production methods have been improved considerably by adopting modern

technology and efficient equipment in many large coal mines. The integration of Chinese coal into the globally traded coal market has accelerated rapidly. Chinese import and export patterns now have significant impacts on international coal prices.

Figure 1. China’s coal production by type of producer output (1978 – 2009)



Source: Rui (2005), China’s Coal Industry Association, various years, McCloskey’s.

But despite coal’s paramount importance to the economy and impressive achievements during the reform era, the coal industry is among the most troubled industries in China. It suffers from a fragile production structure resulting from frequent change in government policy related to stopping small mines’ production, declining government investment in the sector, a poor safety record, environmental pollution problems, bottlenecks in coal transportation (rail and port) and, wide persistence of out-dated technology. Above all, the sector’s development is significantly constrained by the regulatory structure of the related railway and power sectors. Electricity prices for the power sector are not liberalized and the railway networks are still under monopoly control. This situation creates conflicts between the development goals of the coal, power, and railway industries, and considerably impedes the healthy development of the coal industry. While state-owned (also referred to as State Owned Enterprises, or SOEs) coal companies have

for more than a decade been expected to be responsible for their profits or losses, they are not allowed to sell coal to power-generating companies at market prices. The coal sector's largest customer cannot pass its costs through to electricity consumers, and the result is that revenues from electricity production at times do not compensate for coal input costs. In short, either coal or power must accept losses resulting from electricity revenues not covering coal input costs, and the struggle over who will accept these losses is borne out in China in negotiations over the coal price. This conflict is commonly called the "coal-power conflict". Additionally, the monopolized rail network is able to take advantage of its dominant position to extract rents from coal producers who rely on the rail networks to transport and sell their product. These conflicts have resulted in numerous problems for China's coal sector that will be explored in this paper.

Numerous reforms have been attempted or implemented by the Chinese central government in attempts to resolve the conflicts between coal, power, and rail described above. One of the most significant reform efforts now under way is the radical restructuring of these sectors through integrating coal and power businesses at key sites designated as "coal-power bases." This reform has the potential to dramatically change.

This report provides a detailed account of the coal-power base policy as a key strategy of the Chinese government and its potential to dramatically alter how coal is produced, traded, and priced in the Chinese market. The authors analyze the drivers and impacts of large coal-power bases in China and whether the potential imagined by central planners can be realized, and if so, in what form and at what pace.

Creating large "coal-power bases" in this report refers to Chinese firms, guided by government policy stated in the 11th Five Year Plan of China's Coal Industry, forming large-scale, concentrated production bases of both coal production and power generation. According to the 11th Five Year Plan of China's Coal Industry issued by the National Development Reform Commission (NDRC 2007), 13 large coal-power bases have been planned. The policy imagines that each of the 13 mega-bases that would produce over 100 million tonnes (mt) of coal and generate massive amounts of power. These bases involve 14 provinces and prefectures, covering a total area of 287,000 sq. km, comprised more than 98 coalfields. The available coal resources of the bases are to be 690.8 billion tons, representing 70 percent of the total national coal resources. These bases can be developed utilizing three primary "modes" of integration across the existing coal and power value chain: coal firms extending into the power sector, power firms extending to coal the coal sector, or coal and power (or other firms) acquiring shares of each other.

The key arguments of this report are as follows.

First, despite the coal industry's paramount importance to the economy and its impressive restructuring achievements during previous reforms periods in China, the coal industry faces considerable conflicts and challenges. One of the most significant is the conflict between the coal, power, and railway sectors, which are all essential to expanding Chinese energy supply, but whose regulatory and incentive structures are often in direct conflict with each other. These conflict form the basis of the "coal-power conflict", which should be understood as the key underlying driver of Chinese coal reform policy.

Second, one of the most significant reform efforts now under way is an attempt to radically restructure the sector by integrating coal and power businesses at key sites deemed "coal-power bases." Grounded in the fundamental desire to redistribute risk and profits across the coal and power sectors, consolidate the coal, power, and railway industries, and enhance central government control of China's energy system, this reform has the potential to fundamentally alter the structure of the Chinese coal and power markets.

Finally, the authors analyze the potential impact of building up coal-power bases on China's coal market. However, given all the data available, the authors argue that the status quo in China's coal market will not be drastically changed in the near future by coal-power bases (in the next three to five years), but will more likely be dramatically altered in the long term future (on a 10 year timeframe). As this paper will discuss, the central government, the financial sector, the physical nature of energy resource bases, the chemicals industry, local governments, and even management culture at Chinese firms all play important roles in determining how quickly bases can be constructed and the sector can be restructured.

The report is organized as follows. Section two analyzes the major rationales for building up coal-power bases and explores the underlying drivers for the current reform policy. The third section explores China's policy for creating coal-power bases, including a discussion of the government's key objectives. The fourth section demonstrates the "Shenhua model", the ideal industrial structure that many other Chinese firms endeavor to replicate in the development of coal-power bases and a key template for how coal-power base reforms may proceed. The fifth section analyzes the various "modes" (models) of building up coal-power bases in China and examines the feasibility and difficulties of "cloning" the Shenhua model (a case we use to

examine by proxy the feasibility of building major coal-power bases). The final section presents potential impacts of building up large coal power bases on China's coal industry.

2. Underlying drivers for building large coal-power bases in China

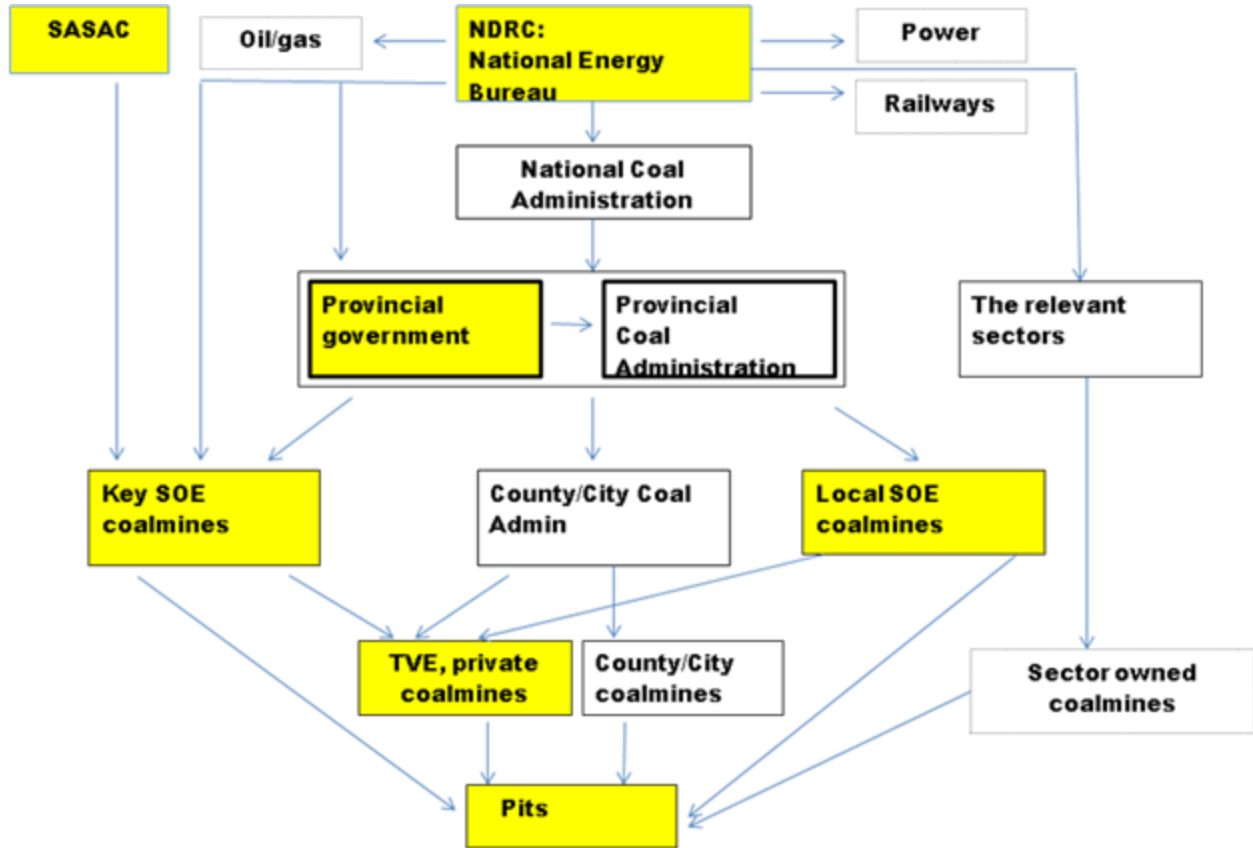
This section presents a history of relevant reform efforts in the coal industry that led to the current industry structure. It provides an overview of historical reform efforts, as well as their drivers, achievements, and lingering issues. The reform efforts since 1978 described below have been broadly grounded in policy trends that have emphasized both the transition to a competitive coal market and consolidation of the coal industry.

2.1 History of major reforms and the role of coal in China

Since the establishment of the People's Republic of China (PRC) in 1949, the government has considered the coal industry to be one of the most strategically important industries. The government maintained a tight grip on the industry under the command economy between 1949 and 1978 by controlling the investment, output, price, transportation, and wage structure of state-owned coal mines (Thomson 2003; Nolan 2001). By the early 1980s many industries in China had undergone market-oriented reforms, but the coal industry was still under tight government control because of its strategic importance as a primary input to the economy and a fear that reform could cause unpredictable outcomes that would harm other industries. For example, given coal's position as the major primary energy source in China, any change in coal prices would lead to reciprocal effects on prices of other industrial products that use coal as a raw material or input fuel. Instead of following the reform trend taking place in other industries, the coal industry maintained the old command structure, which was dominated by state-owned coal companies. In 1978, there were 104 key SOE coal bureaus (shown as "Key SOE coalmines" in Figure 2) and roughly 2,000 local SOE coal producers, which combined produced more than 85 percent of the national output. The remaining 15 percent was produced by commune and brigade (CBE) coal mines, which were officially re-named township- and village-owned coal mines (or TVEs) in 1984 (Rui 2005). However, as in most former command economies, shortages of the most wanted commodities were a common phenomenon. To meet higher and higher demand for coal that arose from the nation's economic boom, the government had no option but to reform the industry starting in the mid-1980s. Since the Ministry of the Coal Industry was abolished in 1998, reforms have mainly been designed and implemented by the National Development Reform Commission (NDRC) and facilitated by provincial governments and the State Coal Administration at its central, provincial, and county levels. Figure 2 is a simplified illustration of

both the evolution and the current status of the administrative structure of China's coal industry.

Figure 2. Illustration of the administrative structure of China's coal industry



Note: This figure is a simplified illustration of both the evolution and the current status of the administrative structure of China's coal industry. Those highlighted in yellow refer to levels of administration which are still functional. Those no highlighted refer to levels of administration which used to play an important role but are no longer functional. SASAC stands for State Asset Supervision and Administration Commission.

Source: Authors' analysis, 2010.

Two key types of reform have been favored since the 1980s: industrial restructuring of coal production and coal price reform. But because these reforms were implemented unevenly in the coal, power, and transport sectors, they eventually led to the emergence of the coal-power conflict, now one of the primary policy motivations for building coal-power bases.

Industrial restructuring

Industrial reforms in China's coal industry since the 1980s mainly focused on ownership privatization. In 1978, key and local SOEs produced 85 percent of all coal while the share of

production by TVEs (non-SOE mines) was only 15 percent. This industrial structure began to shift in the 1980's. TVEs and private coal mines were gradually allowed to develop by central planners starting in 1983 because they helped alleviate coal shortages, contributed to the eradication of rural poverty through job creation, and improved tax revenue. This created a situation in which “the state, collectives, and individuals all work together to develop large, medium, and small mines” (Ye and Zhang 1998, 2). The number of TVE mines jumped from 16,000 in 1982 to 63,000 in 1985 and then peaked at 72,000 in 1997, when TVE mines produced more than half of the total national output — up from 20 percent in 1981 — finally ending the country's decades-long history of coal shortages (Rui 2005).

By 1997 the Chinese government was determined to restructure the coal industry for several reasons. First, state-owned coal mines suffered from large losses brought by fierce competition from growth in TVE mines—losses that were ultimately shouldered by the government. Having been near-monopoly coal producers under the planned economy for decades, SOE coal mines were unfamiliar with market mechanisms and competition from the TVE mines. Higher production costs and inefficient management meant that SOE mines were also unable to compete with TVE mines in price. The financial losses of SOE coal mines peaked in 1998 when the coal industry was the second largest loss-maker among China's industries (Rui 2005). The huge financial loss among key SOE mines was closely related to competition from the TVEs (Rui 2005). Second, the increase in TVE mines' share of production also led to other problems, including poor safety records and inefficient use of coal reserves. Both the poor safety record and the financial losses of SOE mines impelled the government to deal with these problems by restructuring the industry.

The restructuring of China's coal industry was then focused on three major categories of coal producers: tens of thousands of TVE or private mines were closed down; dozens of state-owned loss-making coal companies were declared bankrupt; and large, modern coal corporations such as Shenhua were founded in order to consolidate the industry. The restructuring also went further by abolishing the Ministry of Coal Industry in 1998 and passing its administrative power over key SOE coal mines (except for a few large coal companies including Shenhua and China Coal) to local provincial governments. The Ministry of Coal Industry was eliminated in the belief that the ministerial role it served under the planned economy was no longer relevant, as the market would be appropriate to adjust coal demand, supply, and price.

The coal industry restructuring ended the history of coal supply shortages in China and drove SOE coal companies to improve management, efficiency, and competitiveness, which benefited

the entire economy. However, the abolishment of the Ministry of Coal Industry and the encouragement of the development of non-SOE mines led to tens of thousands of coal companies, an industrial structure that was far more decentralized than under the planned economy. This situation created the initial conditions for the coal-power conflict to emerge. For the first time in China's history, coal shortages were no longer a problem. But the relationship between the coal and power sectors was fundamentally altered. While power plants were able to purchase coal in large quantities from non-SOE coal companies, a newly fragmented coal sector was forced to trade with the highly consolidated power sector made up of just five major power-generating companies which appointed China Fuel Ltd. as an integrated body to negotiate with coal suppliers. This mismatch of negotiating power led to serious difficulties for coal companies in negotiating and determining coal prices, which in turn led to endless disputes between coal and power firms. As we shall see below, the idea of cloning the Shenhua model in coal-power bases is in many ways about re-consolidating those coal producers and arranging long term relations with power companies — for example, through acquisitions to put coal and power under the same ownership — in order to end the conflict with power. The fragmentation of decentralized coal producers is the initial cause of the conflict between coal and power.

Price reform

Moving from a fully planned coal price to a market-based coal price was one of the most difficult reforms in China's coal industry. Given the extreme importance of coal for the national economy, the government had implemented a low price system for coal for decades. For most of the period of 1949–1993, the actual cost of coal production was even higher than the price fixed by the government. To encourage competition and to minimize the negative impact of full coal price liberalization, a dual-track price system was adopted in the coal sector starting in 1985 (Rui 2005). The new system took the planned output of 1984 as a baseline quota. Coal that was produced below this quota would be sold at the planned price, but production volumes above the 1984 quota could be sold at the market price. By 1992 most of the commodities and products in China could be traded at market prices, but coal prices were still controlled by the government and did not reflect the real cost of producing coal. Coal from state-owned companies was eventually allowed in July of 1992 to follow market prices but, crucially, electricity coal (coal sold to power companies to generate electricity) was still subject to the price set (or “guided” after 1996) by the government. The important mechanism through which electricity coal and coal for other key industries was allocated was the well-known Annual Conventional Coal Conference (or Coal Conference hereafter).

The “Coal Conference” was the most important mechanism over the past half century for settling on a price for electricity coal and on transportation contracts with the Ministry of Railways for the distribution of coal to customers. This traditional mechanism was inherited from the planned economy.

During the Conference, coal and power companies signed supply contracts for the next year based on the price set by the government, and the Ministry of Railways (MOR) then allocates transportation quotas for the contracted coal. The State Planning Commission (the predecessor of the NDRC) together with the coal, power, and railway authorities supervised the event to ensure important customers had secured supply from certain producers, which was further endorsed by the railway authority through allocating transportation quotas. However, the task of the Coal Conference became much more complicated after SOE coal producers were allowed to sell part of their coal production at market prices in 1984, and even more so since the hybrid coal-pricing regime for electricity and non-electricity coal began in 1992. In addition to the traditional task described above, the Coal Conference has the duty to negotiate the coal price with power generators and form coal-power contracts on both planned and unplanned terms. Moreover, due to the rise of coal prices since 2003, the Coal Conference has been the most dramatic evidence of the coal-power conflict. Coal prices were liberalized in the market and rose quickly, but the government still controlled electricity coal price and coal producers had to sell their coal to power generators at a price deeply discounted to the market price. It is not hard to see how it became difficult for the Coal Conference negotiations to hold this hybrid-price system together.

Due to the continuing rise of prices and the strong desire of the coal producers to increase the price of electricity coal, the NDRC decided not to set ceiling prices for electricity coal in 2005, but then was called back to intervene in Conference negotiations after coal and power firms were unable to reach an agreement a full four months after the Coal Conference. Eventually, the NDRC implemented a new policy called “coal-power linkage” (*meidian liandong*) of coal and power prices, which allows electricity prices to adjust to match fluctuations of the coal price. However, this new policy also failed because coal prices rose much faster than policy makers were willing to allow electricity prices to rise. Electricity coal prices rose by 77 percent from 268 yuan/ton to 476 yuan/ton between 2004 and 2008, but electricity prices were not allowed to increase in parallel, as cheap electricity is fundamental to the Chinese government’s priority of maintaining rapid economic development and social stability. Under the policy of mutual adjustment between coal and power prices, power-generating companies increased electricity prices only twice by 0.03 yuan/kwh and 0.015 yuan/kwh, while also obtaining 0.02 yuan/kwh passed back from the grid companies to the power companies. As a result the electricity price

rose by 0.066 yuan/kwh in total, which could compensate for about 130 yuan/ton of increased coal price, far below the actual increase of electricity coal price, which exceeded 200 yuan/ton in some cities. The complete failure to sign any formal contracts between coal and the five major power companies in 2009 at the Coal Conference was a telling reflection of the state of the issue — coal companies insisted on increasing the price for electricity coal but power companies refused to accept such increases. There was no government policy that could resolve the dispute and satisfy both coal and power — a fundamental imbalance of reform in the two sectors had created a conflict that could not be resolved by the historical means of the Conference.

2.2 The coal-power conflict

The fact that coal firms are still unable to sell their coal to power firms at market prices is a direct result of the fact that tightly regulated power prices in China have not been liberalized to the same degree as coal price. While coal price reforms accompanied industrial reforms (as described above), this was not the case for power. The NDRC did not allow electricity generators to increase the price of electricity.

Before 2002 China's power generation sector was dominated by the State Power Corporation (SPC), which owned 46 percent of the country's generation assets and 90 percent of the electrical transmission and distribution assets. In December 2002 China's State Council dismantled the corporation to introduce competition into the power industry, separating power grid and generation functions and allowing for increased private investment in generation to speed up the development of the industry. After this restructuring China's power industry was comprised of 11 state-owned companies, including two electric power grid operators, five electric power generation companies, and four relevant business companies.¹ The five power-generating firms — known as the “Big Five” (*wu da fa dian*) — are Huaneng Group, China Power Investment, Datang Group, Guodian Group, and Huadian Group. Each of the Big Five owned less than 20 percent (equivalent to 32 GW of electricity generation capacity in 2002) of China's market share for electric power generation. These reforms were intended to push the power industry towards greater market orientation and competition. But unlike coal sector reforms that allowed coal companies to set some pricing, the Big Five were not allowed to determine prices for electricity sold to the grid, nor to the final price for customers. The NDRC's “provisional regulations on managing selling price of electricity” (*xiaoshou dianjia guanli zanxing banfa*) in April 2005

¹ The rest of the players in the power industry are foreign and private power generation firms, which hold an insignificant share of the market.

clearly stated that the “selling price of electricity is set by the government.” The government keeps such tight control on power prices mainly because changes in power prices have direct impacts on industrial and residential consumers in addition to the large number of foreign manufacturing firms in China that consider cheap electricity as a major cost-saving advantage.

This situation led to dramatic conflict between the coal and power sectors. With a backdrop of rising domestic and international coal prices since 2003, coal supply firms naturally sought to raise the price for electricity coal. If coal companies’ demands were met, power-generating companies would face rising costs on their coal procurement and electricity generation costs would rise. However, the government did not allow a dramatic rise of electricity prices, mainly because electricity is the key input of numerous products, so any minor change of the electricity price will lead to unpredictable fluctuation of the national economy and potential social instability. Power companies were therefore reluctant to accept coal price increases simply because they cannot transfer the increased cost to their customers. This so-called “market coal versus planned electricity” (*shichang mei miandui jihua dian*) situation has led to the well-known coal-power conflict.²

The conflict is most apparent in the outcomes of the Coal Conference. Fewer and fewer contracts were made among coal and power producers, and those that were made at the conference were more and more difficult to enforce. During both 1998 and 2003 coal prices were in a low period below the electricity coal contract price. Power companies all favored market coal and did not fulfill their contracts. In 2004 and 2007 the situation was the opposite, but contracts were also not fulfilled as coal firms preferred to sell coal on the free market. By 2008 market coal prices rose dramatically; most coal firms asked market prices for coal sold to power companies. Electricity coal contracts became useless as the conflict reached its peak in December 2008.

² It is worth noting that the coal-power conflict has its deep roots in the era of planned economy. Although closely connected to each other, the two industries have significantly different levels of income and profit. The salaries of the employees within the two industries were among the highest (power) and the lowest (coal) compared with the national level (Rui 2005). Only during the past decade were coal companies better off when coal was in high demand and coal prices in both domestic and global markets rose rapidly. Even now, the income level of the coal industry, in terms of average salary for employees and profit made by companies, is still far behind that of the power industry. Because of these social inequalities, coal companies were more determined to increase the price of electricity coal.

The annual Coal Conference to negotiate 2009 coal contract prices was held in Fuzhou. Power-generating firms made a total loss of 70 billion yuan on coal-fired power generation in 2008 because they could not pass on the high price of coal to the end-user electricity price. Although this loss was also related to the declining demand for electricity after the financial crisis, it mainly resulted from the rising cost of coal. Costs for coal accounted for more than 70 percent to 80 percent of the total cost for power generators, compared with about 60 percent in previous years. Power companies therefore call this loss a “policy loss,” indicating it resulted from the central government policy of now allowing an increase in electricity prices. Even after mid-2009 the Big Five were still reluctant to update their financial statements by adding this loss to their 2008 performance.

Power generators therefore wanted a 10 percent cut from the 2008 contract price under the 2009 annual contracts. In contrast, with record high coal prices in the market in 2008, coal producers aimed to charge power producers 10 percent more than the contract price of 2008. The difference in the prices demanded by the negotiating parties was as high as 150 yuan/ton. Coal and electricity firms were unable to reach any agreement on coal prices at the Coal Conference. Even the NDRC admitted it was unable to mediate when the expectations from the two sides were so different.

Yet a very interesting phenomenon emerged from the breakdown of coal-power negotiations in 2008: Although no agreement was reached on coal prices at the Coal Conference, power-generating firms did not stop generating power and coal storage levels were also at a record high (Xie 2009). This reveals another side of the story: Although it was reasonable for coal producers to ask for market prices officially at the conference and also understandable that power companies disagreed, they were both practical enough to make individual deals either directly or through traders, at prices which were normally higher than the controlled price at the Coal Conference but lower than the asking price at the Conference (Xie 2009). More importantly, this reflects the fact that China did not have a coal supply shortage. The coal-power conflict also began to influence where coal supply was coming from. It incentivized many thermal power producers to purchase cheaper coal overseas, especially those coastal customers who are closer to coal markets in Indonesia, Vietnam, and Australia (Morse and He, 2010). However, import levels of 40 million tons in 2008 and 126 million tons in 2009 (NDRC 2009) are insignificant in terms of the total coal consumption in China. In the end, despite the difficulties that arise from the coal-power conflict, China’s coal market still tends to have sufficient supply for power generators and finds a way to keep the lights on (Xie 2009).

Yet is not clear whether such a situation of sufficient supply will persist. Overseas resources can only play a supplementary role in supplying Chinese generators because available volumes for import are much less than Chinese demand; import markets are often too volatile for Chinese power generators; and imports are also unfeasible or uneconomic for non-coastal area power generators. This suggests that the conflict between coal and power cannot be solved by an increase in imports. The domestic coal market, which must satisfy the bulk of Chinese demand, may witness shortages as government policies of shutting down small coal mines become tougher.³ Most importantly, when the Coal Conference loses its traditional function to facilitate stable supply contracts between coal and power companies, both large power generators and coal producers may find running these massive businesses without long term, stable contracts to be unacceptable.

These problems are the key motivations for both coal and power producers to consider the integration of coal and power businesses under the government's plan for building 13 large coal-power bases.

2.3 The role of transportation in the coal-power conflict

A key question arises from the above discussion of the coal-power conflict: Why would coal companies still come to the Coal Conference to negotiate with power companies, even though they could sell their coal to the market at a higher price? The short answer is that they come to obtain railway transport capacity. For half a century the Coal Conference has had two functions, one was that coal and power companies made key contracts to secure key customers, and another was that the limited rail transportation quotas were allocated to coal and power companies based on the contracts that they signed. Coal purchased under these contracts could only be transported via rail after the “special stamp for transportation contract” (later changed to be “check stamp for supply of goods”) was awarded by the MOR. The MOR gives priority to this sort of contracted coal, or “inside plan (jihua nei)” coal, over coal transacted in the market. It is this guaranteed transportation that appeals to thousands of coal and power companies that attend the Coal Conference, where negotiation for transportation quotas take place.⁴

³ As witnessed in 2009, small coal mines were forced to close or merge with large coal mines in Shanxi and other provinces.

⁴ It is believed that the conventional Coal Conference will “die” once the transportation constraint is removed. Naturally, the rail constraints could be removed if coal and power cooperate on transporting electricity rather than

Over the last half century, the Ministry of Railways has played a crucial role in China's economy. It is the body with sole and full responsibility for investment, technology upgrading, construction, operation, and maintenance of China's 90,000 km of railways (Ministry of Railways 2009). The MOR's near monopoly position is clearly shown in Table 2, which demonstrates that there is negligible non-state-owned rail capacity. MOR is still the main system for transport of China's most important goods and commodities (Table 3), even by 2009 when highways are very developed and advanced in China. The development pace of railway construction has been impressive since the 1980s and capacity has been considerably improved, as reflected in the railway's coal-transporting capacity (Table 4), but rail capacity growth still cannot match the pace of the economic development and associated demand growth for transport of energy commodities.

Table 2. China's national freight via railways in 2008

Indicators	Units	Achieved	Over the previous year±%
Volume of freight traffic	Million tons	329,035	4.6
National Rail	Million tons	273,932	3.7
Non-controlling joint-venture railways	Million tons	27975	8.2
Local railway	Million tons	27128	11.2
Turnover of freight traffic	100 million ton-km	24,817.46	3.6
National Rail	100 million ton-km	23,360.32	3.4
Non-controlling joint-venture railways	100 million ton-km	1306.26	5.9
Local railway	100 million ton-km	150.88	13.7

Source: Ministry of Railways, 2009.

coal — or all of the three entities are shareholders and work on a cooperative project and share the benefit of the outcome.

Table 3. Volume of freight traffic for key goods and commodities in 2008 (10,000 tons)

Category	Achieved	Over the previous year ±	Over the previous year ±%
Coal	169,146	9257	5.8
Smelting materials	72800	563	0.8
Food	12462	1422	12.9
Oil	14886	528	3.7
Cotton	388	-3	-0.8
Chemical fertilizer and pesticide	8398	-387	-4.4
Container	6863	-487	-6.6

Source: Ministry of Railways, 2009.

Table 4. The coal transporting capacity of China's railways

	Cargo transportation capacity (10,000 t/y)			Coal transportation capacity (10,000 t/y)			Results (10,000t)
	2005	2006	2010	2005	2006	2010	2005
Total	78700	83700	135100	60900	65900	103800	53595
Northern route	43900	48900	75500	40100	45100	70000	35315
Daqin	20000	25000	40000	20000	25000	40000	20200
Fenshada	6800	6800	10000	4300	4300	6300	3849
ShenShuo	13000	13000	20000	13000	13000	20000	9345
Jingyuan	2200	2200	3000	1600	1600	2100	1445
Jitong	1900	1900	2500	1200	1200	1600	467
Middle route	10500	10500	18000	6800	6800	11600	7356
Shitai	7500	7500	10000	5000	5000	6700	6817
Hanzhan	3000	3000	8000	1800	1800	4900	539
Southern Route	24300	24300	41600	14000	14000	22200	10927
Taijiao	5000	5000	9000	3900	3900	7100	4005
Houyue	10000	10000	10000	6500	6500	6500	5212
Longhai	5000	5000	10000	1900	1900	3800	876
Ningxia	2300	2300	5000	900	900	1900	377
Xikang	2000	2000	7600	800	800	2900	457

Source: Beijing Xinhua InfoLink Development Co., Ltd. Quoted from Sagawa and Koizumi (2007).

The importance of the MOR is reinforced by the tight supply of rail capacity in China, because the MOR has the power to allocate the limited capacity to transport goods and commodities to customers. In other words, the operation, reputation, and profits of hundreds of thousands of Chinese companies rely on how much and when the rail transportation quotas are allocated to them. The MOR's control of railway allocation quotas is therefore hugely significant.

The MOR can authorize “outside plan (jihua wai)” transportation, which refers to goods and commodities to be transported via rail without an official stamp and at a lower priority. More importantly, fees charged for transporting “inside plan” goods are fixed by the government and the MOR cannot make a profit from them, but fees charged for “outside plan” goods are decided by the MOR and it can make a profit from them.⁵ As rail capacity expanded rapidly in the past few decades, the MOR has gained greater capacity to allocate goods and commodities to “outside plan”. This has motivated the MOR, mainly through its departments and subsidiary companies, emphasize “outside plan” and charge high fees by taking advantage of short supplies of “inside plan” capacity. Numerous coal companies, especially small ones, have to seek outside plan capacity by paying higher fees.

The Ministry of Railways plays an even more crucial role for the coal and power industries. The coal industry has always been the MOR’s number one customer and more than half of China’s coal has to be transported by rail. But, railway capacity has never been sufficient. In 2008, 1.7 billion tons of coal was transported by rail (Ministry of Railways, 2009). Coal transportation long suffered from the well-known “transportation bottleneck” problem, referring to the situation that coal from production regions (mainly northwest China) could not always get access to rail networks to be transported to consumer regions (mainly south and east China) due to the short supply of rail capacity. However, given the improvement of rail capacity during the last three decades, the rail bottleneck now refers more to the high cost of rail transportation. High transport costs impact demand for coal because adding transportation cost to production costs can make delivered prices too high for the end users of coal. A very large proportion of delivered coal cost is in fact attributable to intermediate transport links, mainly railway linkages. In 2008, the average distance from coal production to consumption regions was 635 km. The average price of rail transport was 0.08 yuan/ton-km (Pu, August 26, 2009). As a result, logistical costs of coal accounted for 30 percent to 60 percent of total cost for power-generating firms (Fan 2009).

The various fees and added taxes levied by circulating processes and local governments drive the delivered prices far higher than the pithead prices. In 2007 inside plan rail transportation capacity for coal should have been 840 Mt, of which 640 Mt should have been electricity coal. However, in fact only 70 percent to 80 percent of inside plan coal was transported, while the total amount of coal being transported via rail was 1.4 billion tons in 2007 (Fan 2009). The well-known

⁵ There is of course no official data available on how much coal is moved inside versus outside plan, but interviewees believed the quantity of outside plan coal transported by the railways was a significant figure.

“secret” is that the Ministry of Railways operates “outside plan” too and much coal can be transported via “outside plan” by paying a much higher price than for inside plan coal. The income from “outside plan” coal transportation goes to small treasuries of the various companies run by railway staff. These “intermediate costs” increases the delivered cost considerably, partly contributing to constraints of coal supply. In 2000 the intermediate fees paid by a private coal company for transporting coal from Shanxi to Tianjin was twice as high as its pithead cost (Rui 2005). In 2008 a state-owned company doubled its cost for coal after adding the intermediate cost of transportation when the coal arrived at Qinhuangdao port from its original Shanxi production area (Fan 2009). This indicates that transportation costs have been a heavy burden for coal companies, especially the small producers that do not own any rail capacity and have to completely rely on the MOR, thus exposing themselves to whatever charges accrue.⁶ SOE coal companies suffer from less transportation costs because most large state-owned coal companies own some rail capacity or are guaranteed transportation quotas, and they can even sell it to small mines or buy coal from small mines at a cheaper price if they have extra capacity.

This transportation structure, which creates high transportation costs and inflates the coal price, is another reason for companies to move towards coal-power bases.

3. Coal-power base policy and key drivers for creating large coal-power bases

There are severe challenges facing China’s coal industry: incomplete price reform, fragmented production structure and diseconomies of scale, and a poor safety record. All of these factors make China’s coal market inefficient and contribute to higher costs and prices. But above all, the coal, power, and railways conflict stands out as a key challenge.

Chinese policy-makers have put forth policy solutions to these challenges that create large coal-power bases that could end the disputes among the coal, power, and railways, and optimize the structure of the coal industry. The key policies of building up coal-power bases and the drivers and objectives of those policies are described below.

⁶ Of course, if possible small coal mines hire tracks to transport coal. The problem is that the various fees and unreasonable charges by road authorities are also unbearable.

3.1 Government policies on building up large coal electricity bases

The evolution of building up large coal-power bases could be traced back to the year 2004 when the government first launched the campaign to vertically integrate coal and power. On September 6, 2005, the State Council issued “Some Opinions of the State Council on Promoting the Healthy Development of Coal Industry” (*Xinhua News*, July 22, 2005), which formally stated the idea of building up large coal-power bases. This document for the first time announced 13 bases rather than the previous policy of seven bases and clearly called for coal-power bases rather than coal only bases, as before. More importantly, this document also raised the important question of how to promote the coordinated development of the coal industry with related industries. It stressed that the construction of large-scale coal-producing bases should be linked with integrated development of shipping and water resources, rail and ports, and local economic development. The government particularly emphasized solving the rail bottleneck issue by means of large coal-power bases and coordination among coal and its related industries. For example, building large-scale thermal power stations near coal mines to relieve the pressure of coal transportation is an obvious option; encouraging large-scale coal enterprises to have joint operations with metallurgical, chemical, construction material, communications, and transport industries is another.

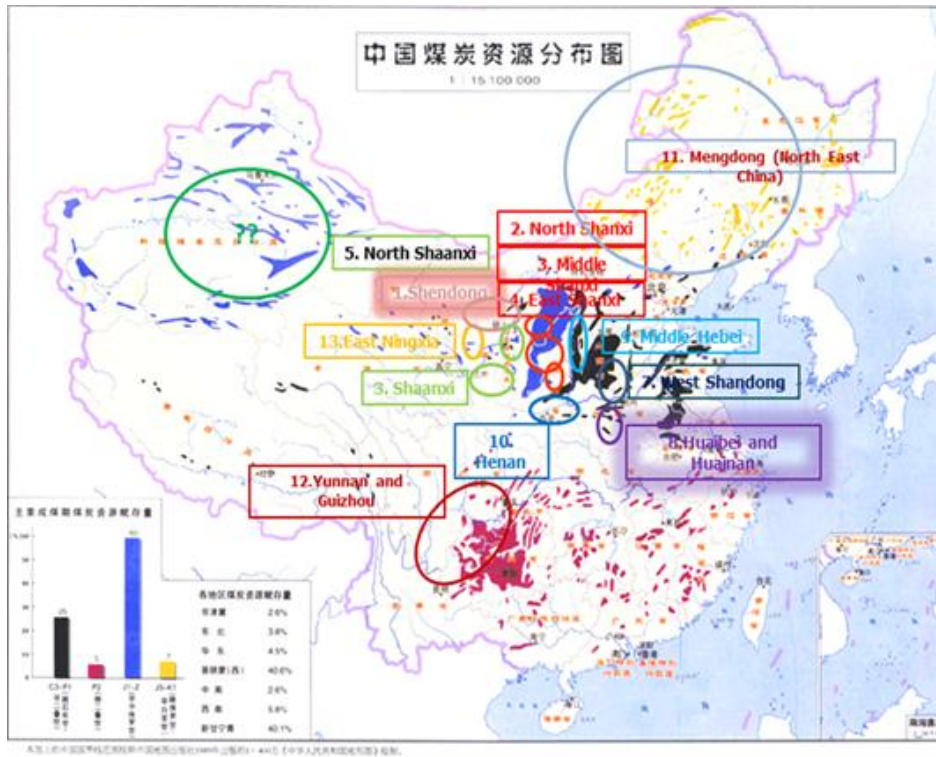
This document also emphasized that the state should continue to stress the construction of large-scale coal-production bases with capital construction funds from the central budget (or government loans) in the form of investment. Government policy banks, state-owned commercial banks, and joint-stock commercial banks were all asked to actively improve their financial services and effectively support the development and construction of such bases. However, the government did not underestimate the difficulties of building coal-power bases across disparate regions and sectors. It called for all the relevant local governments and industries to follow the principal guidance of the central government and voluntarily participate in this integration effort. Most crucially, the government also pointed out that it must break away from regional, industrial, and ownership constraints to accelerate the development of large-scale coal enterprises and enterprise groups, while also regulating small coal mines.

The most updated government document that describes the 13 coal-power bases plan is *the 11th Five Year Plan of the Coal Industrial Development* issued by the NDRC in January 2007 (henceforth the Plan). The 13 coal production bases were listed as follows: Shendong, North Shaanxi, Huanglong (Huating), Northern Shanxi, Central Shanxi, East Shanxi, West Shandong,

Huainan and Huaibei, Central Hebei, Henan, Yungui (Yunnan -Guizhou), East Inner Mongolia (North East of China), and East Ningxia (Figure 3 illustrates the locations of the 13 bases).

The Plan set forth five principles for building large coal electricity bases. The first is orderly and centralized development (*jizhong youxu kaifa*). Essentially, one base is developed by one entity (i.e., the company) in order to make a comprehensive plan and to control the pace of development. The second is an emphasis on innovation, focusing on large coal and power group corporations as the best types of firms to drive technology investment and advancement. The third is an optimal coal production structure based on developing a large scale, modern open-cast mines, improving resource recovery rates, and speeding up the closure of small mines (note that this horizontal integration of the coal production structure, which is emphasized in other policies, has been paired with vertical integration in the coal-power base strategy). The fourth is comprehensive development of coal and power, coal and chemical, and coal and railways and the integration of these industries. The fifth is the development of “the recycling economy”, in which the close connection between upstream and downstream industries ensures the environment can be better protected (NDRC 2007).

Figure 3. Main coal-power bases in China



Source: Originally from Ministry of Land Resources of China, adapted by He.

The 13 coal bases will cover 98 coalfields of around 287,000 sq. km, distributed across 14 provinces. Across these 13 bases, the government will allow six to eight coal-power corporate groups, each with a 100 Mt annual output and eight to 10 companies with a 10 Mt annual output. The output of 13 coal-power bases was expected to reach 2.24 Bt by 2010 (NDRC 2007), indicating that output from these 13 bases will account for about 86 percent of the national total, given the 2.6 Bt of planned national output by 2010 (NDRC 2007).⁷

It should be noted that the 13 coal-power bases in the 11th Five Year Plan have been changed considerably since the initial plan and will be subject to further changes in the future. This is primarily due to the fact that the original coal-power bases were not planned scientifically or are impractical, or new coal resources were discovered. Fang Junshi, head of coal at the National Energy Administration, explained that many of the planned bases were “not practical and scientific” because these bases were found to lack a water resources, a crucial input for extracting coal and washing coal (*Shanghai Stock Exchange Report*, December 5, 2008). New bases were therefore revised afterwards to replace the previous plan. Xinjiang and its abundant coal resources is a prominent new discovery that could replace previous planned cases. Although 11th Five Year Plan did not include Xinjiang as one of the 13 bases, the reserves and condition of the Xinjiang coalfield deserve close examination. As discussed later in this paper, it holds great promise as a new coal-power base.

3.2 The objectives of building up coal-power bases

Reduce price risk and overcome conflict between coal and power firms

Creating coal-power bases could reduce transaction costs for coal and power companies associated with selling or purchasing coal, and allow both industries to capture the value in the supply chain previously captured by the MOR. Second, coal-power bases could spread market risk across the whole value chain. Coal profits could supplement power losses when the coal price is high, and vice versa. Power-generating companies will improve their competitiveness because “if China’s utility companies could supply 30 percent of coal demand with their own

⁷ It is well known that China’s coal output was already at 2.7 billion tons in 2008. The indication might not be that the government underestimated the development speed of coal output in China, but rather that the government expected the slowdown of coal production.

source, they would be less vulnerable to coal price fluctuations”⁸ (Xie, April 21, 2009). Third, integrated coal-power bases would not require expensive contracts with the MOR and transport costs could be returned to coal producers and consumers as cost savings. Finally, establishing more coal-power bases will help overcome conflict among coal and power companies because coal companies will have more secured customers while power companies have a long term secured coal supply.⁹ When more coal companies have their own power businesses and power companies have coal businesses, they both will rely less on the Coal Conference and the railways. In sum, price volatility and transportation dependency are the main risks for both coal and power firms, and as a result risk and profit sharing and transport cost savings are the main drivers of creating coal-power bases.

Optimize industrial structure to nurture large modern coal corporations

Chinese energy policy has made enhancing industrial concentration of the coal sector a top priority. In the current industrial structure, excessive competition among tens of thousands of coal companies results in numerous problems (Rui 2005, chapter 3) — including the coal supply and prices. There are two primary dimensions of optimization at work. The consolidation of the coal production structure is a separate but closely related goal. First, consolidation of coal production aims to achieve horizontal integration of coal production (by consolidating small mines into larger mines). Second, the NDRC had declared that this type of horizontal consolidation of the coal production structure has to be accomplished simultaneously with vertical integration between coal producers and coal consumers.

The government’s desire to build large corporations is an additional key driver for building large coal-power bases. One of the five principles in the 11th Five Year Plan of the Coal Industry is that large corporations will be chosen as the principal enterprises to develop coal-power bases, in order to provide not only a comprehensive plan for the broader industry’s development, but also to secure the best technology and equipment in developing the bases. Coal companies consider technology investment a necessary step to realize economies of scale and to utilize coal resources most efficiently.

⁸ Chinese companies have not taken into account opportunity cost of not selling the coal, as they are still not so advanced in risk management.

⁹ This long term point should be emphasized because we have argued that despite the failure of the conference in 2008 coal and power were all still able to get enough coal and keep the electricity running, but both coal and power firms do not consider that is ideal given the unstable short-term feature of that demand and supply fit.

Coal-power base policy envisions several key gains from optimizing the industrial structure of coal and power through integration. First, achieving integration will ensure that coal resources can be extracted, processed, and transported in a manner that maximizes the value of coal and reduces inefficient resource use by maximizing economies of scale. Second, this should also be easier for limited large coal corporations to make long term agreements in supply or even cooperate in exploration and R&D. Finally, this will contribute to the reduction of market fluctuation and risk, and transport constraints, as explained above.

Reinforce the central government's control over energy markets

The Chinese government has a strategic vision to use large coal and power bases to reinforce its control over the energy sector. Zhang Guobao, the head of the National Energy Bureau, published an important article in the *People's Daily* (December 29, 2008), titled "The current situation: opportunities among the danger" (*dang qian de xingshi: wei zhong zhi ji*). Zhang clearly stated in this article that "large energy enterprise groups are nurtured with the integrative and comprehensive development of coal, power, railways, ports, chemical, and other related industries, so as to toughen the government's influence and control on energy." *Reuters* commented that the article "uncommonly expatiated China's official view on its energy strategy."

The implications of the government exercising greater control over the energy sector should be strongly emphasized. First, if the coal-power bases are successful, the government could much more easily control national coal production, given that these 13 bases may account for as large as 80 percent of the national output (the exact percentage depends on future national production growth and the rate of development of the bases). Second, in the government's view, fewer large coal producers would imply a more stable price for coal. Third, if the 13 bases are mainly state-owned, the government will be able to coordinate energy and industrial policy much more easily. Fourth, the government will be able to more easily predict how much coal is available for export and therefore more easily control export volumes (exports are strictly controlled under a quota system). Finally, given the smaller number of producers, the government will be better able to supervise each corporation's investment in environmental protection, technology and equipment, R&D, and acquisition of new resources both in China and abroad. All of these efforts would be difficult if not impossible in a country with tens of thousands of small coal mines protected by local governments that aimed to maximize short-term profits.

Protect the environment and reduce carbon emissions

One major motive for building coal-power bases is to transform the way energy is moved in China, from the transporting of coal via rail to the transmission of electricity via wire. (also known as coal by wire or *gai shumei wei shudian*). If a “coal by wire” were successful at scale in tandem with coal-power bases, it could make a significant contribution toward improving the environment and save on carbon control costs. The following example of the energy supply and demand balance between Shandong province and Shanxi province illustrates this point.

As predicted by its provincial government, Shandong province will have coal import demand of 190 Mt, 290 Mt, and 350 Mt from other provinces by 2010, 2015, and 2020, respectively. It will also have a supply shortfall of electricity capacity between 3000 MWh and 6000 MWh in 2009 and 2010. The provincial government is therefore working hard to meet the demand for both coal and power. Meanwhile, neighboring Shanxi province has plenty of coal but needs secure customers as well as roads and ports to transport its coal. After negotiations, the two provinces signed an unprecedented “agreement framework on strategic cooperation in energy and transportation” in early 2009. According to the framework, from 2009 to the end of the 12th Five Year Plan, Shanxi will transmit 10,000 MWh every year to Shandong by building coal-power bases and constructing transmission capacity that enables energy to be exported as electricity via wire rather than coal via rail. As a result, Shandong will obtain electricity from Shanxi at a price 0.10 yuan/kwh lower than the local Shandong grid price. Shanxi will gain access to new markets for its coal after it builds up railways from its central and south region to Shandong’s port of Rizhao. Most experts believe this will be a win-win agreement. Due to the significance of the power grid in this agreement, the State Grid Corporation also joined the partnership. In November 2008 Shandong signed an agreement with the State Grid Corporation in which the latter will build six super high-voltage transmission lines by 2020 in order to transmit electricity from 52,000 MW of dedicated generation capacity to Shandong, a number equivalent to 20 percent of Shandong’s total installed capacity. It should be noted that there is still debate over the cost advantage of constructing a new railway to transport coal versus transmission lines to transport electricity.¹⁰ However, in the case of Shandong and Shanxi, the cost of transporting electricity will be lower due to the use of existing transmission lines and the network of the State Grid Corporation.

¹⁰ It is reported that an annual 200 million tons of rail traffic is equivalent to 20 to 34 circles of 1,000 kV UHV AC transmission lines, i.e., they provide an equivalent amount of energy to end-user customers. However, the former's investment is less than 1,000 billion yuan, while the latter's investment is between 2,400 and 4,080 billion yuan, a huge gap between the scales of investment (Chen 2008).

There are additional benefits beyond the secure supply of electricity and the savings on electricity costs. If the goal of “outside electricity entering Shandong” can be realized, Shandong will benefit enormously from protecting the environment. It will save 128 Mt per year on coal consumption, reduce SO₂ emissions by 2.06 Mt, and cut CO₂ emissions by 256 Mt.¹¹ This could create much more space for Shandong’s industrial development in the future. The framework is regarded as “unprecedented” because it crosses multiple provinces and industries. It will considerably optimize the energy structures of the two provinces and open the closed grid system of Shandong, thereby balancing the power supply shortage in Shandong with the surplus in Shanxi (*Xinhua News*, January 12, 2009).

Improve technology through R&D at large enterprises

Coal or power companies located in coal-power bases are required to build modern, safe, and high-efficiency coal mines or power plants. This will stimulate the application of advanced technology and high-efficiency equipment and promote R&D.

The best precedent available for evaluating whether these reforms will be successful, and thus what impacts they could have on the Chinese coal and power sectors, is to compare them with China’s only and most important vertically integrated coal power business: Shenhua. As shown below, the government has successfully built up Shenhua, the best showcase of a large, integrated, modern corporation in China with all the coal-related businesses. Shenhua is the model upon which the coal-power base plan is crafted, and therefore serves as an instructive case that can be used to judge the prospects for restructuring the entire coal sector around the “Shenhua model”.

4. The Shenhua model: origin and future prospects

Shenhua Group Corporation Limited (Shenhua hereafter) was born in 1995; today it is China’s top coal producer (Table 5) as well as one of the world’s top coal producers. It is a state-owned enterprise founded with the approval of the State Council. In many ways Shenhua is a unique, diversified energy company with integrated business segments that include coal production and

¹¹It is arguable that while Shandong will be less polluted, Shanxi will be more so. It is difficult to calculate the net effect on Shanxi and Shandong, but it is certain that the pollution emerged from the transportation itself will be eliminated.

sales, electricity and thermal generation, coal liquefaction and coal chemicals, and railway and port transportation. By 2009 Shenhua owned 54 coal mines with a total annual production capacity of 328 million tons, 1,369 kilometers of dedicated railways with a total transportation capacity of 128 million tons/kilometer, and power plants with a total installed capacity of 16,080 MW. A map to show Shenhua's assets is provided below (Figure 4).

Table 5. China's top 10 coal companies in 2006 and 2008 (Million tons)

Rank	Coal companies	Production (2006)		Coal companies	Production (2008)	
		Million tons	% national total		Million tons	% national total
1	Shenhua Group	149.7	6.3	Shenhua Group	281.3	10.1
2	China National Coal	71.9	3.0	China National Group	114.1	4.1
3	Shanxi Coking Coal	60.8	2.6	Shanxi Coking Coal	80.3	2.9
4	Shanxi Datong Coal Mining Group	56.7	2.4	Shanxi Datong Coal Mining Group	68.9	2.5
5	Heilongjiang Longmei Holdings Co., Ltd.	52.7	2.2	Shaanxi Coal and Chemical Industry	60.4	2.2
6	Yan Mining Group	37.0	1.6	Anhui Huainan Mining	56.7	2.0
7	Shanxi Yanquan Coal (Group)	32.5	1.4	Heilongjiang Longmei Holdings Co., Ltd.	55.0	2.0
8	Anhui Huainan Mining	32.4	1.4	Henan Coal and Chemical Industry	44.7	1.6
9	Henan Pingdingshan Coal (Group)	32.1	1.4	Shanxi Lu'an Mining	42.1	1.5
10	Shaanxi Coal Group	30.8	1.3	Pingmei Shenma Energy Chemical Group	41.2	1.5
	National Total	2,373	100	National Total	2,793	100

Source: China's Coal Industry Association, various years.

Figure 4. Illustration of core assets of Shenhua Group



Source: Shenhua Group Ltd. Web Page.

Shenhua's leading position in China's coal industry was established under a combination of uniquely favorable conditions never before enjoyed by any other companies.

First, unlike most large coal companies in China which had existed for decades, Shenhua was only established in the mid-1990s under the government mandate to transform China's coal production base from the east to the west region (*dong mei xi yi zhanlue*). Shenhua was planned as China's most important future production base, as north and central China's coal had been substantially depleted. Following this plan, Shenhua was granted the largest quantity of coal reserves ever granted by the government to a company. It was given a mandate to extract coal from the Shenfu Dongshen Coalfield, with a total recoverable reserve of 16 billion tons, a geological reserve of as much as 223 billion tons, with possible resources of 1,000 billion tons — based on the Chinese official survey source in 1998 (Shenhua 1998). This compares with a national total of 115 billion tons of recoverable coal reserves.

Second, Shenhua was unique in that it was also granted the largest ever amount of loans from the government. The central government, through the State Development Bank, granted the Shenhua preferential lower interest-rate loans of more than \$9.2 billion USD from 1985 to 2005. This made the Shenhua construction project the third largest investment project in China and one of the world's largest overall. Taking advantage of such a large amount of capital as well as its position as a new entity, Shenhua was able to closely follow the model of the world's leading coal producers and was less impeded by the historical problems that still plagued the industry.

Very much contrary to the conditions that established the coal-power conflict, Shenhua was given a dedicated railway to transport coal from the Shenfu Dongshen Coalfield to the dedicated port facility at Huanghua. It was also assigned dozens of power plants from the State Planning Commission to consume millions of tons of coal from its own field.

Third, Shenhua had utilized advanced exploration technology and equipment from the very beginning (more details in Rui 2005, 115). China's coal industry is relatively backwards by worldwide comparisons, but this did not prevent the government from importing advanced equipment for Shenhua. In addition to having more than 98 percent of its equipment imported, Shenhua has installed a reliable automated dispatching system for underground mining. Much labor has been saved by Shenhua's high level of mechanization. A comparison with other Chinese SOE coal mines illustrates the resulting productivity improvement. In 1999 the 350 employees in Shenhua's Daliuta Mine produced 8 million tons of coal, while more than 10,000 employees in Jixi's Xiao Henshan Mine, a traditional state-owned coal company, produced 3.5 million tons of coal.

Finally, the core of the Shenhua model is a high degree of horizontal and vertical integration of the coal, power, chemical, and transportation sectors. Horizontal integration refers to a "horizontal business chain," which focuses on the integration of mines, railway, and ports so as to ensure optimal coal production and sales. Vertical integration refers to a "vertical business chain," which focuses on the integration of coal, power, coal-to-oil, and coal chemical so as to ensure optimal coal conversion and processing. Expansion and diversification of Shenhua's businesses helped the company to realize its economy of scale and scope, but only when all these businesses are closely integrated has Shenhua been able to benefit from such expansion and diversification. Shenhua is the sole Chinese coal company horizontally and vertically integrated to this degree. In other words, simultaneous *horizontal integration* and *vertical integration* provide Shenhua its most important competitive advantage and distinguish it from tens of thousands of other Chinese coal companies.

To a large extent, building coal-power bases is an attempt by other Chinese firms to clone the Shenhua model — to pursue such integration in their own businesses.

Horizontal integration

Horizontal integration is defined here as the consolidation of coal producers. To pursue horizontal integration Shenhua has integrated its coal businesses. Under the leadership of Ye

Qing since 1998, Shenhua has been actively acquiring existing coal mines, expanding its own mines, and building new mines.

First, Shenhua Group successfully expanded the Shendong production base to more than 100 million tons of annual output by adopting advanced technology and equipment and improving productivity.

Second, it restructured inefficient small mines that extracted coal at Shenfu Dongshen coalfield through “renting” them (more details in Rui 2004). This not only improved the economy of scale of Shenhua’s coal output but also ensured that modern and high efficiency techniques were utilized in its coalfield.

Third, Shenhua has been acquiring coal mines, coalfields, or equity stakes in coal assets across all regions in China and internationally.

The pace of horizontal integration has not slowed. Although in 2008 Shenhua’s listed company Shenhua Energy produced 281 Mt and sold 311 Mt of coal, it plans to invest \$39.5 billion through 2013 to expand production capacity. If this plan is implemented, Shenhua Energy could double its annual capacity to 500 Mt in five years. The company also plans to build strategic coal reserves of 30 Mt in the eastern, southern, and central parts of China. According to Zhang Xiwu, the Chairman of Shenhua Energy, building coal reserve bases “not only secures national energy safety but facilitates our integrated operations” (*Reuters*, September 1, 2009). Moreover, Shenhua has invested in coal mines in Indonesia and Australia and currently is interested in Mongolia’s Tavan Tolgoi deposits. Shenhua is one of the 10 bidders keen on a stake in what is known as the world’s biggest untapped coking coal deposit, with a coal reserve of 6.5 billion tons in the Gobi Desert (*Reuters*, September 1, 2009).

Shenhua’s horizontal integration includes mines, railways, and ports, which helps to optimize coal production and sales. The following example shows why horizontal integration across transportation networks makes sense for coal firms. When Ye Qing was appointed president of Shenhua in 1998, the company was still concentrating on mine construction but was delaying rail and port construction. Considering that China’s coal market was at the time in a state of surplus but rail transportation was still a bottleneck leading to high transport costs for Shenhua’s coal, Ye suspended the mine construction and accelerated its dedicated rail and port construction. The effect of such a shift in strategy was very clear: Shenhua’s railway and port construction was completed in 2001, two years ahead of schedule, which saved 40 yuan per ton of coal in freight

costs, not to mention the potential to sidestep transportation bottlenecks associated with the rail monopoly in China. Despite already owning 1,369 kilometers of dedicated railways¹², Shenhua is still planning a huge expansion of its rail network to integrate its mines fully with Huanghua and Qinhuangdao ports. Work on a new railway from Batuta — where Shenhua operates small mines — to Diandaigou in Inner Mongolia began on April 8, 2009, with a 2.7 billion yuan investment and is expected to be completed in 2012. Shenhua also has four additional railway projects included in a railway network plan issued by the NDRC in October 2008¹³ (China Coal 2009). Although other coal-power bases will be granted permission for captive rail accordingly (e.g., Guodian and Huaneng are permitted to build up railways to connect coal to power or ports) Shenhua is the sole company that owns more than 1,000 km of railways in addition to a dedicated coal port.

Vertical integration

Vertical integration is defined here as the consolidation of coal consuming industries with upstream input providers and coal transport networks. Shenhua's vertical integration occurs across multiple sectors.

First, vertical integration in Shenhua is exemplified by its coal and power business integration. Shenhua “acquired” power companies to vertically integrate into its coal value chain. These power plants were previously owned by the NDRC (it was then known as the State Planning Commission) and subsequently required to be divested under the policy of “separating business from government.” Many assumed at the time that taking over these power plants was a burden, given that they were state owned and very inefficient. Ye Qing, however, considered acquiring these power plants to be opportunity for Shenhua's business, given that the coal market was surplus at that time and that these power plants could consume Shenhua's coal and minimize transaction costs (Ye Qing, interviewed in 2001 and 2003). As indicated at the beginning of this section, Shenhua's power business has expanded to a total installed capacity of 16,080 MW as of 2009.

¹² These are Baotou to Shenmu, with a capacity of 22mt/yr; Shenmu to Shuozhou; and a linked line from Shuozhou to Shenhua's Huanghua port, with a 110mt/yr capacity; Datong to Zhungeer, with a capacity of 50mt/yr; and Huanghua port to Wanjia terminal at 40mt/yr.

¹³ These include a new railway from Datong to Zhungeer; an upgrade to the existing line from Shenmu to Huanghua via Shuozhou; a new railway to Zhungeer with Shenchu, just east of Shuozhou on the line to Huanghua; and a new line from Huanghua to Wanjia terminal at the port of Tianjin.

Second, the vertical integration of Shenhua is also reflected in its coal and liquefaction business integration. Coal liquefaction is a technology through which coal is transformed to oil (for more detail see Nolan et al. 2004). In 1993 China became a net oil importer and the importation of oil has increased year by year since then. The Chinese government's strategy was to reduce oil import dependency. It therefore strongly supported coal to oil (CTL) R&D that could potentially contribute to the national security of oil supply. Shenhua was therefore awarded almost all the nation's funding for "substituting coal for oil" to implement its coal liquefaction program. Ye Qing predicted in 2003 that by 2020 Shenhua would be more of an oil-producing company than a purely coal-producing company (Nolan et al. 2004).

Lastly, vertical integration in Shenhua is reflected in its coal and chemicals projects. For example, Shenhua Ningxia Coal (Group) Industry Corporation's is developing a methanol project with a capacity of 250 thousand tons per year. All the civil engineering and most of the installation were completed by 2009. The 220-ton boiler passed commissioning. A number of other vertically integrated projects in the olefins, tar, transport fuel, and chemical sectors are also underway.¹⁴

As demonstrated here, Shenhua is both horizontally and vertically integrated. This integration comes from unique historical circumstances. While coal and power companies in China have stated their ambition to replicate the Shenhua model, they may be not fully aware of the difficulty in doing so.

Few companies could acquire another coal asset like the Shenfu Dongshen Coalfield, which is blessed with low-cost and high-quality abundant coal. This coal asset is the foundation of Shenhua's competitiveness. Even though companies may acquire coal assets from various owners, they may not be as integrated as Shenhua's, given the unique historical circumstances that allowed Shenhua to acquire its assets. Moreover, other companies are not likely to receive the same level of government support as Shenhua. The government has indicated the possibility

¹⁴ A coal to olefins project in Baotou has been approved by related governmental authorities. Phase one of Wuhai coal tar processing project with a capacity of 300 thousand tons per year has commenced trial operation. Meanwhile, Shenhua Group is actively working with SASOL on the feasibility study of indirect coal to liquid (ICL) projects in Ningxia and Shaanxi. It is also working with Dow Chemicals on the prefeasibility study of Yulin coal chemicals project. More preparatory work on coal chemicals projects has also been carried out in Xinjiang, Hulunbeier, and Tongliao.

that companies involved in coal-power bases may be allowed to build railways and receive loans; however, the government policy on what kind of preferential treatment they will receive has never been clear. More crucially, they may lack the strong capable leadership Shenhua had during its peak time of integration. Strong leadership and skilled management capability are critical successfully building large integrative corporations in China. For more than a decade, from 1986 to 1998, Ye Qing was former deputy director of the State Planning Commission (the predecessor of the NDRC) in charge of energy and communication. This background reinforced his capability to manage Shenhua because the structure of this conglomerate requires both the authority and ability to coordinate at least six sectors (coal, power, railways, port, coal liquefaction, and coal chemical) in at least five provinces (Shaanxi, Inner Mongolia, Shanxi, Hebei, and Beijing). Shenhua's performance was the result of not only the government's support but also its own management capabilities. Power-generating companies like China Datang Corporation admitted that extending their businesses into coal is a big challenge for them because the leadership now must understand not only electricity but also the coal industry, as well as the process of coordinating the two. They are particularly concerned that China's coal mines have such poor safety records and managing the mines will be risky.

In short, even though many firms possess both coal and power assets or other coal-related businesses, they may still not be as integrative as Shenhua, as suggested by the next section which discusses the implications of this analysis for building coal-power bases.

5. “Cloning” the Shenhua model in China: establishing coal-power bases

This section examines the applicability of the Shenhua's model of horizontal and vertical to the development of other coal-power bases now planned or underway in China. This analysis will help determine how quickly and completely the vision of 13 integrated coal electricity bases can be realized and what impacts they might have on the coal market.

There are three possible modes of setting up a coal-power base.

The first mode is “coal to power”: coal companies expanding their businesses into the power business. The major coal companies including China Coal, Yanzhou, Datong, and Lu'an have all started to expand their businesses not only to power but also to coal chemical and other related businesses.

The second mode is “power to coal”: power-generating companies expanding their businesses into coal. The Big Five power-generating companies including Datang, Huaneng, Huadian, Guodian, and China Power Investment are all actively acquiring coalfields and even old coal bureaus¹⁵ such as Hulinhe, Dayan, and Xinzhuang. Many independent power-generating companies such as China Resources Power Holdings spent a large amount of capital to acquire coal mines near their plants during the last few years.

The third mode is the “equity sharing mode,”: coal and power firms acquiring equity stakes in each other and/or creating joint ventures with various shareholding agreements. For example, Huainan Mining Group set up joint-venture power plants with China Power Investment Ltd. and Zhejiang Power Ltd., respectively.

Overall, the dominant trend thus far is “power to coal” over the “coal to power” mode. The major cases for each of these modes of integration and the motivation for the firms to pursue each mode are explored below in order to indicate the probable development of the coal-power bases and thus the broader Chinese coal sector. We shall see that coal and power companies do have distinct motivations for pursuing a certain type of mode.

5.1 Coal to power mode

What follows are brief discussions of major Chinese coal firms that are pursuing vertical integration and coal power bases through the “coal to power mode”.

China Coal Group, the second largest coal company in China, has achieved significant growth since its major restructuring 10 years ago. After a decade of restructuring, the company’s coal production volume increased by 4.9 times, total sales revenue increased by 4.7 times; total assets increased by 4.8 times, reaching 125 million tons by 2009. The company set its development goal in the next five years to expand not only its coal business but also its core businesses of coal to chemical, power generation, and coal mining equipment manufacturing. It first aims to reach 200 million tons of coal production volume by building five major coal production bases¹⁶ in

¹⁵ Traditional state-owned coal companies were called “coal bureaus” under a planned economic system in China. After the reform many of them have been changed to limited companies and so on, but there are still some “bureaus” existing.

¹⁶ It is not yet to know if they will be part of the 13 bases.

Shanxi, Jiangsu, and Heilongjiang provinces and Inner Mongolia and Xinjiang Autonomous Regions.¹⁷ It then intends to develop further integrated coal and power businesses through the development of pit-mouth power plants. It has adopted circulating fluidized bed (CFB) combustion technology and has built environmentally friendly pit-mouth power plants by consuming coal refuse, coal slurry, and middling. The company's current installed power generation capacity is 526 MW (Wang 2009).

Datong Coal Group was China's largest coal producer during the era of planned economy. Despite this notable position, Datong, like most other state-owned coal companies, suffered from financial difficulties during the reform era, given its large social welfare burden and unfamiliarity with market competition. Its situation has been better off in recent years, benefitted by China's rapid economic growth and high demand for coal. However, Datong's leadership is aware that the current prosperity may not last long, given the uncertainty of market demand for coal and the possibility that coal prices may drop over time. The company's long term success must be "adding a higher value to coal." For example, extending Datong's business from coal to power and chemical businesses is considered a key strategy to overcome market problems and to pursue development sustainability (Wu 2009). Consistent with this long term strategy, Datong launched Tashan Cyclic Economic Park, the most important expansion project of the company, with a total investment of 17 billion RMB. This project aims for "sustainable" and "comprehensive" use of resources. Moreover, the company is expanding to power and chemical businesses through cooperation with power, coal to chemical, and other firms with expertise outside of coal (Wu 2009). In fact, the current 29 key projects under construction in Datong are all developed via modes of cooperation, including joint ventures, project contracts, and other methods.

Lu An Group is ranked eighth among China's largest coal companies in terms of its coal output and profit. Lu An's Five Year Plan (2008-2012) aims to build the company into a 100 Mt coal enterprise so that it can develop greater power in the coal market, including enhanced price negotiation power with customers. In addition, Lu An has made considerable efforts to develop other coal-related businesses. It has made great progress in building new green energy enterprises. It is developing coal-power-chemical, coal-coke-chemical, and coal-oil-chemical projects, building four recycling economic parks focused on power-chemical, coke-chemical, coal-power, and coal-oil, and developing broad capabilities in the coal, power, oil, chemical, and

¹⁷ Not all of them have been approved as the official developer of these bases.

silicon sectors. The company also aims to strengthen international cooperation and to develop the overseas coal reserves and an IGCC project (Ren 2009).

Among all of these efforts, building up its coal-power base is the most important one, as Lu An is located in the coal-power base in central Shanxi province. By April 2009 Lu An Group had a total installed power-generating capacity of 540 MW. It sped up the construction of the 2400 MW Gaohe Power Plant and the 1200 MW Xiangyuan Power Plant, forming the foundation of a coal power base. Meanwhile, the company has successfully produced the first barrel of oil from its coal liquefaction program.

These investment and growth strategies of China's large coal companies are not only to expand into power but also into other value-added coal businesses, just as Shenhua did.

5.2 Power to coal mode

Power-generating firms enter the coal business utilizing two primary models. One is to use a "green field mode" to acquire coalfields and coal mines to extract coal, which is often through cooperation with governments; the other is to acquire non-state-owned coal mines.

The green field mode has the advantage that power-generating firms maintain a high degree of control over the coal resources and management of the coal mines. But it has the disadvantage of long waiting periods to obtain the proper permits and rights to start a mine. In contrast, while coal prices remain high power companies obtain quickly, which makes the acquisition mode comparatively more attractive because ownership of coal resources can be achieved much faster. However, the limited availability of coal resources and mining companies for acquisition forces power companies to use whichever option is available.

What follows are brief discussions of the major power generating firms that are pursuing vertical integration by acquiring assets in the coal sector.

Huaneng Group, the oldest power-generating company among the current Big Five, was established in 1985. By June 2009 it had invested in 26 provinces and autonomous regions as well as overseas. It has 130 wholly owned or controlled power plants, with 88,967 MW of installed capacity. It aims to reach 100,000 MW installed capacity by 2010 and 60 Mt coal output per year.

Huaneng acquired a 40 percent share in Huating Coal Group in October 2008 from Gansu provincial asset administration commission. It acquired another 9 percent in June 2009 so as to become the largest shareholder with control over the company. As a result, Huaneng planned to invest as much as 30 billion yuan in Gansu to build up a comprehensive base with coordinated coal, power, and transportation. Many argue that this is an ideal model as power companies provide capital and advanced management while the local governments provide resources. First, coal resources in these poor regions such as Gansu can now be extracted utilizing investment capital from power-generating companies. Second, these coal mines will benefit from more advanced management systems provided by power-generating companies, which is related to the Chinese assumption that power companies' management is superior to that of coal companies (see below for more details). Third, with this model power-generating companies are able to better manage price risk in the highly volatile coal market.

Huadian Group is China's fourth largest power generator. Its Shanghai-listed subsidiary Huadian International Power Co., Ltd. mainly adopted the acquisition method (acquiring non-state-owned coal mines) to improve coal supply. It has 69.02GW installed capacity, of which 59.88GW or 86.76 percent is thermal power, and consumed 128 Mt of coal in 2008. The company is targeting 100GW of installed power generation capacity by 2013. It was announced on July 6, 2009 that the company spent 760 million yuan to acquire a 70 percent stake in both Shanxi Shuozhou Wantongyuan Erpu Coal Mining Co., Ltd. and Shanxi Dongyi Zhonghou Coal Industry Co., Ltd, through its subsidiary Shanxi Maohua Energy Investment Co. Ltd. Both coal mines are currently under construction and expected to supply Huadian's power plants in Shandong. On June 30, 2009, Huadian International also announced plans to buy a 70 percent stake in the Xingbian mine in Heilongjiang province for 479 million yuan, straight after it acquired Xinwen Mining Group's Changcheng and Fucheng mines in Inner Mongolia.

However, Huadian International also adopted other methods to increase its coal resources. In September 2009 it announced the intention to spend 600 million yuan to increase its stake in Yinxin Coal Ltd. to 45 percent. According to the agreement, Huadian International has priority rights to acquire 45 percent of coal output at market price after the coal mine is put in use. The company plans to have 30 Mt of coal output by 2013.

China Datang Corporation (CDT) is now the largest power-generating firm not only in China but also in Asia. It was established after the divesting of the State Power Corporation of China in 2002, with a registered capital of 15.39 billion yuan, and major businesses in Northern and Northwest China. By 2008 it had total assets of 407.6 billion yuan and revenue of 101 billion

yuan. The installed capacity of CDT by June 2009 reached 90,061 MW, from its initial capacity of 23,847 MW in 2002. Its power generation in 2008 amounted to 352 billion kWh, up from 117 billion kWh in 2002. Datang's market share of national power generation increased from 7.1 percent in 2002 to 10.3 percent in 2008.

In 2005 the CDT set its strategy to extend its value chain and took coal business as a core among its diversified businesses. In 2009, after being permitted to expand into the coal-mining business by the State-Owned Assets Supervision and Administration Commission (SASAC), Datang Coal Ltd. was established to be responsible for managing the coal business. By June 2009, the CDT owned or managed six coal mines, owned or shared 9.69 billion tons of coal reserves, and had 13 Mt of annual coal output.

China Power Investment Corporation (CPI) was established from part of the constituent businesses of the former State Power Corporation of China, with a registered capital of 12 billion yuan. Its controllable installed capacity reached 51,990 MW, and equity installed capacity reached 40,116 MW. The CPI owns total assets of 284.2 billion yuan as of the end of 2008. Among these, there are six A-share listed companies, with Shanghai Electric Power Co. Ltd. as one of them (more details below for its coal-power project).

Of CPI's total power capacity, 41,123 MW or 79.1 percent is from thermal units. It consumed 103 Mt of standard coal in 2008, indicating coal's significance to CPI's business and profits. CPI has pursued strategic acquisition and joint development of coal mines since 2005. The company's strategy is to prioritize electric power as the core business, use coal mine development as a strategic foundation, and to pursue further diversification going forward. Utilizing this strategy, the CPI acquired Mengdong Group Co., Ltd., a large-scale coal company in Inner Mongolia. It also owns Huolinhe Coal Power Company, which owns railways, coal mines, and water reservoirs and enjoys good sales and production. It was listed on Shenzhen Stock Exchange in 2007 as one of the largest open cast coal mines in Inner Mongolia. The CPI also cooperated with other companies to operate Baihuayin Coal Power Company.

Many power-generating companies have already invested in rail and extended the "power to coal" mode to rail cooperation. For example, on the March 21, 2008, Chifeng-Jinzhou Railway Project implemented by CPI was ratified by the NDRC. The main line is 282 km long. The total investment is 7.185 billion yuan, of which 52 percent, 16 percent, 16 percent, 16 percent are contributed respectively by Baiyinhua Coal Power Co., Ltd.; Datang International Power Generation Co., Ltd.; China Guodian Corporation; and China Resources Power Holdings

Company Limited. The project will be completed within 36 months. Chifeng-Jinzhou Railway will be mainly used to transport coal produced from Baiyinhua and its surrounding coal mines in Xilinguole of Inner Mongolia to the West Liaoning area and Jinzhou port. This progress, though small given the limited length of railways, will impact the dominant position of the Ministry of Railways by slowly eroding its control.

5.3 Equity sharing mode: the case of the Huainan and Huaibei coal-power base

China's first coal-power base, the Huainan and Huaibei coal power base in East Anhui, was developed using the "equity sharing mode."¹⁸ Analysis of the necessary conditions for building this base indicates how future coal and power bases might develop under a third mode.

Under the "equity sharing mode," coal and power companies exchange shares with each other and/or acquire shares from railway operating authorities. The main advantage of this mode is that two or more entities reap mutual gains from utilizing each other's comparative advantages.

China's first coal-power base was initiated under precisely these conditions. In 2003, the Huainan mining group was searching for customers for its coal while Shanghai Electric Power was searching for suitable sites to build power plants due to the severe shortage of electricity at the time. The two companies easily reached a deal to build up a power plant at the site of the Huainan Mining Group's Tiji coal mine. The two phase, 4×600 MW Tiji power project was approved in March 2005. The first phase of the project started generating power on July 26, 2007, and the second on October 15, 2007. The design of Tiji power plant won the Lu Ban Prize, the Prize for High Quality Engineering in China. Electricity will be transmitted via super high-voltage transmission lines and will feed into the East China Grid. Huainan Mining Group also reached a similar deal with Zhejiang Energy Ltd. to set up a power plant with a capacity of 2×600 MW around the same time.

¹⁸ Equity sharing mode often includes two kinds: One is that two companies take direct equity stakes in each other, and another is that two companies take equity stakes in a third, separate asset or joint venture. The case in this instance is the second kind, in which an independent joint venture was established.

The completion and commissioning ceremony of Huainan and Huaibei Coal Power Base was held by Huainan Mining Group Ltd. on December 5, 2008, with attendees from the Huainan and Huaibei Mining Group corporations, NDRC, Ministry of Railways, China Power Investment, and the National Power Grid. This is regarded as the first completed base among the 13 planned coal-electricity bases (Huainan Daily, December 6, 2008). It is located in East China's Anhui Province. On the base there are two locally dominated coal companies, namely Huainan and Huaibei Mining Group corporations. The base has rich water supplies and a total of 25.2 billion tons of coal reserves, or 45 percent of the total reserves in East China. Consistent with the coal-power base policy, 12 pairs of new mines (24 in total) and eight power-generating plants have been built or expanded at the Huaibei and Huainan base. Coal output reached 120 Mt in 2008, from less than 50 Mt in 2000. The installed electric capacity reached 13,000 MW in 2008, from 4,000 MW in 2000. Three transmission lines under the policy of "transmit electricity of Anhui to East China" have been installed. Although the project represents China's first coal-power base, there is no single legal entity that represents this base or any outward sign to show the coordination of the numerous companies and organizations operating at the base. Except the successfully established two joint-venture power plants at Huainan, this coal-power base, like all the other bases in China, is mostly a geographical, not a legal or institutional entity. There is no single organization controlling the base.

This mode of coal-power base development offers several advantages for both coal and power firms.

First, it reduces transportation costs. Traditionally, coal from Huainan needed to be transported by a company's own railways and then by the national rail system. There are dozens of sub-national rail networks all over China, and each uses its own rail equipment, facilities, employees, schedules and timetables. Although Anhui to Shanghai is only five hours by train, the rail between them belongs to two different networks. Bypassing the rail network in the coal supply chain can therefore generate substantial cost savings.

Second, equity sharing joint ventures benefit both sides through risk sharing. Tiji is a 50-50 joint venture and both power and coal companies equally share the profits as well as the risks. Power companies gain security of supply and cheaper coal procurement costs by eliminating transport costs and exposure to VAT taxes. By purchasing coal from a joint venture (JV) partner instead of on the open market the power plant avoids VAT, which is 17 percent. This contributes to the reduction of the total cost of power generation. The overall cost of each kWh of electricity

generated in the Tianji power plant is 1 cent (RMB) lower than that in Shanghai. In addition to better access to capital, coal companies gain long-term customers in a traditionally volatile market where many mines often have to open and close in response to market conditions.

Third, this cooperation is also said to facilitate the improvement of management systems in the coal company. It is traditionally believed in China that management systems in power companies are far more advanced than that of coal companies, and that coal company management can learn from power company management.

Beyond these general advantages to cooperation, it should be noted several specific factors also facilitated the base's development.

First, all of the Big 5 were expanding rapidly at the time and it was described as "*pao ma quan di*" (racing to claim market share). Achieving scale and scope was seen as vital for increasing their competitiveness and influence in China's power market. The Big 5 as well as power-generating firms were making aggressive efforts to build power plants. Locations near coal thus became very attractive.

Second, it is a relatively short distance between Shanghai Power and Huainan Mining Group, which made logistical coordination of the two companies relatively easy. The availability of the best-quality highways and trains linking the base to Shanghai made it easy for employees of the Tiji power plant to get back to the parent company in Shanghai.

Third, access to high-quality, high-voltage transmission lines made transporting electricity much more efficient and cost effective. According to Lu Yanshun, the former Deputy Minister of the then Ministry of the Machinery Industry, building coal-power bases would be impossible or impractical without high-quality transmission lines as costs due to line loss over long distances would be prohibitive.

Fourth, Shanghai Electric Power was willing to cooperate with Anhui because of the environmental benefits to Shanghai. In recent years Shanghai has become extremely short of land and has suffered from increasing pollution. Shanghai seeks to maintain growth of its advanced industries without growing pollution and is enthusiastic about allowing its companies to locate polluted businesses outside Shanghai.

Fifth, the leadership vision and strategies of both cooperating companies were consistent. Many companies expressed their interests in similar joint ventures, but Wang Yuan, the head of Huainan Group, aggressively searched for suitable co-operators. Coal prices change all the time in China. Some coal companies consider cooperating with power companies only when coal prices are low and change their minds when coal prices are high. Successful cooperation requires taking a long-term view of sharing of both profit and risk.

Finally, the relationship between the two provincial governments was supportive. The Anhui provincial government supported this project as part of its large project called “Transmit Anhui’s Electricity to East China” (*wan dian dong song*), which enabled the base to gain priority access to the power grid. The Shanghai city government, on the other hand, considered Anhui a “rare garden” that can recruit industries that are necessary to the Shanghai economy but for multiple reasons are not optimal to site in Shanghai. Shanghai’s focus on high technology and advanced sectors requires a series of supporting industries, including raw materials, power generation, construction, and other inputs. Spurred by the demand for cheap labor and raw materials and the desire to avoid high taxes and other fees associated charged to polluters, many Shanghai firms have moved to Anhui in recent years. Meanwhile, Anhui is keen on gaining advanced technologies through cooperation from Shanghai.

6. The impact of the coal-power bases on the future of China’s coal market

This section offers a forward-looking analysis of how coal-power policy and integration of the Chinese coal and power sectors will impact China’s coal market.

The broad direction of reform and industrial restructuring policy in the Chinese coal and power sectors is towards consolidation of coal production, integration of coal and power sectors, and greater concentration of control over the coal sector by major coal and power SOEs (and thus indirectly the central government). Evidence of these policy mandates can already be found in the coal and power markets. Targeted integration of existing coal and power assets under the “equity sharing mode”, the “power to coal”, and the “coal to power mode”, as demonstrated above, is already underway in many locations, and coal policy is aggressively pursuing consolidation of the mining sector in tandem. Yet these early integration efforts are only the initial signs of the wholesale restructuring of coal and power that is envisioned. The coal-power

base policy aims to fundamentally restructure the coal to power value chain in China by developing upwards of 13 coal-power bases controlled by key SOEs that would produce a large share China's total coal production (roughly 30-50%). The question of whether these dramatic reforms can be accomplished at this scale – and what impacts it might have on China's coal markets – is still open.

Building on the frameworks for coal-power integration described above, this paper offers several arguments for how coal-power bases are likely to develop and what impacts that development could have on the coal market.

First, in section 6.1 we discuss why the timeframe for coal-power base reforms to have a demonstrable impact on the structure of the Chinese coal industry is in the medium to longer term (after 2020). While some integration is already underway, a wholesale restructuring of the industry along the lines of the Shenhua model that could fundamentally alter how coal is produced, traded, and priced – as envisioned by the 11th Five Year Plan of China's Coal Industry – faces a set of key obstacles that must be overcome before restructuring can be successful on a large scale. We discuss those obstacles below and establish conditions that are necessary for success of coal-power base policies. This analysis, however, is sensitive to the larger macroeconomic climate, which has significant impacts on the pace of integration. When either the coal or power sector is experiencing significant financial risks, they will have incentives to push for integration. We explore those incentive mechanisms below.

Second, in section 6.2 we pose two specific, direct impacts of coal-power base policy that are likely in the medium term. One is that coal power bases could contribute to a reduction of the MOR's monopoly on coal transport by reducing demand for rail capacity and creating political space for limited private rail networks to be deployed. Another is the development of coal resources in Xinjiang under the coal-power base model, a scenario which is likely to turn Xinjiang into a major contributor to China's future coal supply.

6.1 Key near-term obstacles to coal-power base development

In the near-term, key obstacles to the coal-power base reform policy prevent coal-power integration from achieving a wholesale restructuring of the coal and power sectors to a degree that would significantly alter coal production, transport, or prices. We define wholesale restructuring as a shift in the industrial structure of coal production such that more than one-third

of China's coal is produced at integrated bases modeled after Shenhua. While this is certainly the aim of Chinese policy, we argue that it is unlikely that the entire Shenhua model – vertical and horizontal integration – can be fully deployed across China's coal sector in the near-term given the obstacles facing such a restructuring. We explore those obstacles below.

This does not mean, however, that broader reform efforts to build large coal-power bases and concentrate a large share of China's coal production at government controlled bases will not be successful over time. Instead, rather replicating the Shenhua template, the evolution of the bases is likely to be less uniform and will have to adapt to the particular conditions of local coal geology, politics, and firms in order to succeed. If all thirteen bases are successful producing over 100 mt of coal using an array of integration modes, there is still a very real possibility that between one-third to one-half of all China's coal could be produced at such bases after 2020.

There are several reasons that reform and integration efforts to restructure the Chinese coal sector using coal-power bases are likely to fall short of replicating Shenhua's development path (and thus fall short of wholesale restructuring of the coal and power sectors in the short term).

First, Shenhua was offered unique advantages by the government to set up its coal production and transport businesses. The government granted it massive high-quality coal mines and coal reserves, which reduces its production costs. Further, the company benefits from the government's unprecedented support provided in the form of large government loans that made Shenhua's integrated port and rail projects possible. No other Chinese companies have been granted such support.

Second, obtaining and developing power assets to integrate with coal production also requires political support from the provincial or central government. Shenhua's early management was in a rare position to gain unprecedented amounts of such support due to its connections across the industries and key government agencies. It was Shenhua CEO Ye Qing's superior management skill, entrepreneurial vision, and political background that enabled Shenhua to become integrative after 1998 (Nolan and Rui 2004). Due to his background as deputy director of NPC, Ye Qing was asked to accept the transfer of power generation assets that were formerly administered by the NPC. This enabled Shenhua to get the licenses necessary to enter the power industry. Comparatively, such politically-supported integration was easier for Shenhua than for other traditional SOEs, which are unable to attract the government's support, and are hampered by local governments' contradictory interests (such as preventing cross-province mergers and acquisitions). As discussed above, while most coal companies belong to local governments and

power companies belong to the central government, coal and power companies are a challenge to merge or to develop into large coal and power joint ventures, unless the central government intervenes — effectively. So far, joint ventures have been on a small scale. In the cases of diverse or conflicting interests between provinces, a coordinating authority is likely required. By and large, it is a question of who can best adjust conflicting interests among coal, power, and railways. In general, involvement of the central government is necessary to overcome such conflicting interests and to facilitate the integration.

Third, establishing integrated coal-power bases requires that small mines be closed and integrated into large corporations. The government's gift of coal assets to Shenhua meant that the company did not have to acquire or merge with smaller mining companies in order to develop a base. While government policy has supported this kind of mine consolidation independently of coal-power base policy (most dramatically in Shanxi), it cannot be assumed that it will happen quickly and without obstacles elsewhere. History demonstrates how difficult mining consolidation policy can be to implement. From 1998 on the government consistently appealed for the closure of such small coal mines. Although the numbers of small mines were reported to have decreased year by year, the share of national coal output produced by small mines was still about 40 percent in 2009, compared with the peak share of about 50 percent. This reflects the political reality that closure of small mines by the central government cannot happen by fiat. At first glance, the difficulty in closing the mines is mainly due to local protectionism, as small mines are a main contributor to local government revenue in many areas. But more fundamentally, small mines often cannot be closed in underdeveloped regions in which coal exploration is a crucial income source for locals (Rui 2005). Finally, it should be noted while consolidation and integration through acquisition is feasible for big companies that can absorb smaller mines, it may not be realistic for small companies as they will not have the necessary capital or political support.

However, over the long term, large coal and power firms could certainly overcome many of these obstacles and increase their integration, though they will likely pursue modes of integration best adapted to local circumstances instead of trying to purely replicate Shenhua.

The broader macroeconomic environment and level of government involvement are two critical factors driving the pace of integration. Rapid macroeconomic growth accompanied by high coal price environments that exacerbate the coal-power conflict and create losses for power SOEs. This scenario, which occurred in 2008 and 2010, gives the central government (which owns the Big 5) incentives to push harder and faster for integration in order to mitigate losses.

Alternatively, weak economic growth will push the government to consolidate the coal sector and coal firms to seek integration. This kind of scenario could be triggered by a slowdown of government investment in the economy. The rapid growth of the coal industry during the 11th Five Year Plan (2006-2010) was supported by the government's ambitious fixed capital investment in the Chinese coal sector. For the first three years of the 11th plan, the investment was 538.33 billion yuan, 297 billion yuan more than the total investment in the 10th Five Year Plan, which was 240.48 billion yuan (Pu 2009). If such investment is reduced in the 12th Five Year Plan or after, given the financial crisis or slower economic development, coal demand could decline, which would create a supply surplus and trigger more aggressive consolidation of the mining sector (which could in turn reduce the surplus for a time). The most significant recent example is the massive restructuring of the coal industry in Shanxi province toward small coal mines merging with large-scale companies since April 2009, which has cut the total number of coal mines to 1,053 from 2,600 and the number of coal-mining companies to 130 from more than 2,000 (China Power Network 2009). Unlike numerous previous examples of small mine closure in China, Shanxi's restructuring since April 2009 demonstrated that central and provincial governments' could be determined and efficient in terms of the scale, pace, and impact of small mine closure. This will be further reinforced by the recently renewed policy on the closure of small coal mines, which is aimed to increase industrial concentration and to work in tandem with the coal-power base policy. Future consolidation could occur either through large coal producers acquiring smaller producers, or through power firms acquiring coal assets, and is expected to be rolled out in additional provinces in the coming years. According to Wu Yin, deputy administrator of the National Energy Administration, "The merger and restructuring will not just happen in Shanxi; we have applied to the State Council to push further concentration of the industry across the country since it is appropriate for the development trend of the industry."

6.2 Integration, the MOR monopoly, and transport costs

Railways will still play a crucial role in the coal-power base building, and the active participation of the MOR is important for several reasons. First, some power plants will continue to be sited far enough from production areas to require rail transport. Second, coal by wire is not necessarily more economic than transporting coal by rail in all circumstances. Ability to control rail capacity and capacity expansion will therefore be important to the development both of coal-power bases and China's broader coal sector.

The liberalization of the rail networks and reduction of the MOR monopoly through expansion of private rail networks in tandem with coal-power bases could help alleviate rail constraints for two reasons. First, if a large share of coal production is sited together with major consumers, transport demand per ton consumed will decrease. This could alleviate stress on the nation MOR rail networks. Second, the development of major coal-power bases by government-favored SOEs might create political space for increased development of captive rail. Although some companies have already started to build up railways or take shares of railway construction, captive development of railways is still very limited and has not kept pace with coal production and demand. If coal-power bases gain full support from the central government, they may be allowed to develop captive rail networks similar to that of Shenhua, which could accelerate captive rail development. If these two developments occur, the delivered cost of coal to end users would drop, which in turn will significantly impact China's coal market. However, Ministry of Railways has been a monopoly in operating China's railways for more than half a century. It has built up entrenched monopoly MOR interests, as exemplified by the inside plan and outside plan transportation system and various fees collected over the decades. It has the vital role of safely maintaining the nation's railways and has connected almost every industry in China. Although coal-power base construction could accelerate liberalization, the process will be gradual. Ultimately, this is one of the most unpredictable parts of creating China's coal-power bases, because reforming China's railways industry has been expected for a long time but progress has been historically slow.

6.3 Developing Xinjiang under the coal-power base model

The biggest wild card that could drastically change China's coal industry and market in the near future is the development of coal resources in the Xinjiang Uygur Autonomous Region, likely utilizing a coal-power base model. In 2010, NDRC indicated it was considering developing Xinjiang as the 14th coal-power base.

Though currently underdeveloped, Xinjiang has great potential to become a large coal-power base due to its extremely attractive coal reserves. It is predicted to have 2,350 billion tons of coal resources, accounting for 40 percent of China's total resources. Of this, 1,300 billion tons are reliable resources, accounting for 53 percent of the national total. By 2006 the proven reserves were set at 161 billion tons, behind only Inner Mongolia and Shanxi. Both the amount of coal and also its excellent quality have raised Xinjiang's position as a major coal production base in China. Most of the coal discovered in Xinjiang is low in ash (some even super-low in ash

such as 3 percent to 5 percent), super-low in sulphur and phosphor, and medium- to high-calorific value steam coal, suitable for liquefaction, gasification, and making chemical products.

Figure 5. Newly discovered coalfields in Xinjiang, China



Source: *China Daily*, December 2, 2008.

Moreover, the coal reserves are relatively shallow and suitable for building super large-scale and high-productivity, high-efficiency and open cast mines. Finally, Xinjiang's coal is also relatively concentrated, mainly in three large coalfields, namely Zhunger (estimated reserve of 710 billion tons), Turpan-Hami (660 billion tons), and Yili (470 billion tons). The three coalfields possess a total of 1,840 billion tons, 79 percent of the total coal reserves in Xinjiang (Internal document 2008, 48). Reserve estimates have been further reinforced by the continuing discoveries of large coal reserves, especially since 2004, as a result of soaring energy prices in China and intensified coal exploration in Xinjiang (see Figure 5).¹⁹ With the start of a dramatic decline in eastern

¹⁹ As shown in Figure 5, Dananhu Coalfield was discovered in 2004 with 7.2 billion tons of proven reserves. Fuyuan Coalfield was discovered in 2006 with a much larger proven reserve base of 46.6 billion tons. Furthermore, Zhundong Coalfield was discovered in 2006, covering an area of 21,800 sq. km, with proven reserves of 68.5 billion tons. With the estimated 390 billion tons of total estimated reserves, it will become the largest coalfield in China. In 2008, Xinjiang revealed another surprise when the local Department of Land and Resources announced that a

China's coal reserves, Xinjiang is likely to become the next important base for coal development in China.

Xinjiang Autonomous Region government plans to develop its coal resources through large corporations.²⁰ It has attracted dozens of large promising corporations from all over China to enter Xinjiang, which is consistent with the policy goal to merge and restructure local coal firms.²¹ The coal mines under construction in Xinjiang are all very large, high-output, and efficient mines.

According to the development plan of the Xinjiang government, coal output capacity will reach 130 Mt, 1.04 billion tons, and 1.4 billion tons by 2010, 2020, and 2030, respectively. By 2020 the coal liquefaction capacity will reach 31 Mt, coal to methanol capacity will reach 23 Mt, coal to gas capacity 24 billion cubic meters and coal to ammonia capacity 3.9 Mt, and coal to coke capacity 10.50 Mt (Internal document 2008, 52). This is an ambitious plan, although the basis for this ambition does exist. Xinjiang has rich coal resources with easy access for production. Crucially, it has already attracted dozens of large companies, which provide the foundation for large-scale production.

It is well understood in Xinjiang that developing Xinjiang's coal resources is subject to two principal constraints: water and railway capacity. Among the three major coalfields only Yili has

coalfield with 23 billion tons in reserves was discovered. This was the Sha'Er Lake coalfield, about 800 meters underground, covering an area of more than 300 sq. km in Shanshan county in the Turpan Basin (China Daily, December 2, 2008).

²⁰ Xinjiang has followed the central government policy to improve the region's coal production concentration. More than 1,500 small mines were closed before 2008. Currently about 300 mines remain with an average coal output of 200,000 tons. These small mines account for 25 percent of total coal output in Xinjiang, while the remaining 75 percent is produced by the Autonomous Region owned key coal mines and local state-owned mines.

²¹ Xuzhou Mining Group was the first large coal company to enter Xinjiang. The development mode was to restructure existing small mines by fully accepting small mines' debt and employees and by injecting new capital, technology, and management systems. Other coal major coal consumers have also entered Xinjiang to develop coal mines or transform coal to other products such as electricity: Shanghai Baosteel, Shandong Luneng Group, China Power Investment, and Hubei Yihua are all investing in the region. This has resulted in the great improvement in technology and equipment in local coal mines. For example, Shenhua established Xinjiang Energy Corporation through the acquisition of the Urumqi Coal Bureau.

access to water resources. The cost of long-distance transportation of Xinjiang's coal remains high. Currently, Lanzhou-Xinjiang railway is the only rail line connecting Xinjiang to the inland cities. Fortunately, the newly discovered Sha'Er coalfield is close to the Lanzhou-Xinjiang railway but other coalfields such as the region's largest Zhundong coal production base are at least 800 km farther than Sha'Er to China's inland provinces; this could add to the transportation cost by 40 yuan per ton.

The Xinjiang government has been investing or attracting outside investors in water and railways construction. Newly built reservoirs that transport water from water-rich areas have been completed or are close to completion. It is expected that water resources in the two coalfields could reach 2.5 billion m³/year. In recent years, Xinjiang has also sped up railway construction. Newly built railways include Jinhe – Yinin – Huerguosi, Wuxi - Jinhe II Line, Kuitun – Beitun, and so on. Other railway lines under construction include Urumchi – Zhunger, Kashgar – Hetian, Korle – Aksu.

However, these are all railways inside Xinjiang. Xinjiang's coal is planned to be the major energy source for inland China, and can either be transported via railways or turned into electricity and transported through transmission lines to inland China. After examining costs for constructing railways compared to power transmission lines, Chinese experts have tended to adopt the railway option. A large-capacity and high-efficiency railway connecting Xinjiang and inland China is planned to start from Kumul City (Xinjiang) to Xi'an City (Shaanxi).²² The estimated investment required for constructing railways from Kumul to Xian is 63.8 billion yuan. According to the International Energy Agency, local governments predict rail capacity will be sufficient to export 500 Mt in 2015 and 1,000 Mt in 2020.²³

Therefore the experts predict Xinjiang's coal output will be 80 Mt, 500 Mt, and 1 billion tons by 2010, 2020, and 2030, respectively (Internal document 2008, 53). Table 6 demonstrates this

²² The estimated cost of railways from Hami to Xian will be 180 yuan/ton. In 2008 coal costs in Xinjiang were 90-100 yuan/ton and the selling price was 100-105 yuan/ton. This was far below the domestic market price due to Xinjiang's isolation the majority of buyers in the national market. Compared with 370 yuan/ton coal price in Xian, Xinjiang's coal still will be competitive.

²³ IEA's World Energy Outlook 2010 discusses the significant role Xinjiang could play in both Chinese and global coal production: "By [2020], Xinjiang's contribution to global coal production could be double the contribution that Ghawar — the world's largest oil field — currently makes to global oil production." (p. 208).

revised projection of coal output in Xinjiang given the constraints described above (though in the past government estimate of coal production have proven to be conservative).

Table 6. Projected output of Xinjiang (million tons)

Year	2010	2020	2030
Coalfields			
Zhunger	45	290	590
Turpan-Hami	15	150	300
Yili	10	40	85
Kubai – Nanjiang	10	20	25
Total	80	500	1,000

Source: Internal document 2008.

Considering the deteriorating capacity in coal mines in east and central China, some Chinese firms and policy makers have appealed to the government to speed up the development of Xinjiang coal resources and list Zhundong, Tulufan-Hami, and Yili coalfields as China’s 14th, 15th, and 16th large coal-power bases (Internal document 2008, 58). Developing Xinjiang using coal-power bases would indicate a commitment to make the region China’s next major coal production base. However, it is well understood in Xinjiang that the exploration of the coalfields in the region and the speed of further development depend on the country’s pace of economic development and its overall energy demand. All other things equal, there is a wide consensus that Xinjiang will become a strategic energy base for China in the long term, even though it may not become a huge energy producer in the short term.

7. Conclusion

Coal-power integration is now a focal point of the Chinese government’s energy policy, driven by the coal-power conflict. Major coal firms, power firms, and the central government are broadly aligned in working towards a more consolidated and integrated structure for the coal and power sectors.

Yet there are many paths to integration (which have been described in detail here), and it is still unclear to what extent and under what “modes” integration will occur. Shenhua offers a successful model that in many ways is the template that inspired coal power integration, but our analysis suggests that future development of coal-power bases will not completely follow the Shenhua precedent. Going forward, two crucial factors that will drive integration and which

models it will favor are the degree to which the central government takes an aggressive role supporting integration and the broader macroeconomic environment.

If successful, coal power-base policy will establish upwards of 13 major coal-power bases, each producing over 100 mt of coal with consuming industries on-site. This restructuring has significant implications for the way energy is consumed in China. Most dramatically, roughly half of China's coal production could be produced at a handful major coal-power base sites that are controlled by key SOEs (which are in turn directly controlled by the central government).

This shift away from China's fragmented coal production structure would have major impacts on both the way coal is traded and priced in China.

First, a concentration of production at major bases that are integrated with power would likely help to alleviate the transport bottlenecks that have long plagued the Chinese coal sector and could reduce the monopoly power of the MOR. Siting a large share of national coal production next to consumers, combined with an increased emphasis on coal by wire, would reduce demand for coal transport on the rail networks compared to continued growth of the industry under a more fragmented industry structure. This could relax transport capacity constraints and moderate coal transportation costs nationally, in turn moderating key prices indices at ports like Qinhuangdao. Additionally, if coal-power bases are allowed to develop their own rail networks under their own control, the MOR's tight grip on coal transportation pricing could be loosened.

Second, the implementation of coal-power bases would enhance central government's control over the coal sector and over coal prices. As we have seen, a large share of coal production has historically been regulated and controlled at the provincial level (both TVE production and local SOE production), and central government efforts to reign in small mines have had mixed success. Yet coal's biggest consumer, the power sector, is largely controlled by the central government. Because the central government has been unwilling to let power prices rise, major power generating SOEs have suffered heavy losses in 2008 and 2010.²⁴ This caused the central government to attempt, on multiple occasions in 2008 and 2010, to implement coal price caps. Under the current organization of the coal and power industries, coal firms are allowed to retain profits in high coal price environments while power companies suffer losses. Were the central government to directly control a larger share of coal production through its control of SOEs at

²⁴ See the China Electricity Council for Estimates of power sector losses during high coal price environments: <http://www.cec.org.cn/cec-en/index.htm>.

coal-power bases, the central government would likely have greater control over coal prices. Power sector losses could be mitigated by mandating lower coal transaction prices within integrated SOEs. Using this kind of internal transfer pricing at below market prices would represent a meaningful shift in how coal is priced in China. If a large share of China's coal were transacted in this manner, it might create an unofficial two-tiered pricing structure in the coal market.²⁵ While SOE power generators would obtain large volumes of coal at internal transfer prices (likely below market), the rest of the coal market may be left to unfettered market pricing as the central government will no longer have strong incentives to protect power generators through implementation of coal price caps.

Third, coal-power base policy would bring about modernization and mechanization of a larger share of China's coal production, in theory bringing larger economies of scale to the sector. While up-front capital investment per ton produced will certainly increase compared to a TVE-dominated production structure, the marginal cost of coal production should decrease, all other things equal. It should be noted however that as China's coal production moves further from load centers in the east, as in the case of Xinjiang, cost reductions in production could be outweighed by increased coal transport costs (where production is consumed outside of a coal-power base).

Finally, the massive rebalancing of China's coal market implied by coal-power bases is poised to have important impacts on the globally traded coal market. Since 2009, China's import behavior has become a dominant factor determining the price of globally traded coal.²⁶ In simple terms, when Chinese domestic prices are higher than global prices, the country imports.²⁷ When domestic prices are lower, it tends to export. In 2009 China imported nearly 15% of all globally traded coal, and the Chinese arbitrage between domestic and international coal supply has had the effect of linking the global price of coal to the Chinese domestic price.²⁸ The development of coal-power bases could radically alter coal price formation in China, and therefore has the potential to alter coal price formation globally. If in the long-term coal-power base reforms put

²⁵ Two-tiered pricing already exists to some extent, as NDRC "guides" annual coal contract prices for some key power generators.

²⁶ For further detail see Stanford PESD's "The World's Greatest Coal Arbitrage: China's Coal Import Behavior and Implications for the Global Coal Market" by Richard Morse and Gang He.

²⁷ Ibid.

²⁸ Ibid.

downward pressure on Chinese domestic prices and allow large SOEs to acquire coal at below-market prices, Chinese coal imports and by proxy global coal prices would be directly impacted.

Whether or not coal power bases will overcome key obstacles and bring about a wholesale restructuring of the Chinese coal and power sectors through aggressive horizontal and vertical integration remains to be seen. But given the pressures on the coal and power market to solve the coal-power conflict through reform of the relationship between the coal and power industries in China, change in the industrial organization of the Chinese coal and power sectors appears imminent.

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