Discussion Paper

Industrial Organization of the Chinese Coal Industry

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Executive Summary

To help understand the Chinese coal industry and its role in the global coal trade, the author was entrusted by the Program on Energy and Sustainable Development (PESD) at Stanford University in 2009 to conduct a research on the industrial organization of the Chinese coal industry.

Historical Development

- Since the inception of the People's Republic of China (PRC) in 1949, the governance structure of the Chinese coal industry has been under constant changes. For instance, the Ministry of Coal Industry was created and abolished for several times. Currently, the management responsibilities of the Chinese coal industry was fragmented among many governmental agencies;
- Since Deng Xiaoping opened the Chinese economy to the outside world in 1978, state-owned coal mines became encumbered by heavy welfare obligations to their bloated workforces and millions of retired workers. Unable to meet the burgeoning demand for domestic coal, Beijing was forced to allow private investment into the coal industry. In 1983, the State Council issued the *Notice to Encourage the Private Sector's Investment in the Mining Industry*, which marked the beginning of the so called "let the water flow" policy. Since then, the share of coal production by township and village enterprises (TVE) grew from 15.4% in 1978 to 46.2% in 1995.
- The central government was unwilling to establish a transparent entry mechanisms or legal frameworks to protect private investment in this sector, as evidenced by Beijing's 1998 decision to close small TVE mines across the country due to the temporary over-supply of coal caused by the Asian Financial Crisis. Without any long-term legal guarantees of ownership rights, private mine owners are generally unwilling to invest in the necessary safety requirements, resulting in terrible working conditions for the miners in the TVE coal mines. Unsurprisingly, TVE coal mines currently account for about three quarters of the coal mine-related fatalities, though their share of national coal production is only slightly over one third of national total.
- In 1998, the MOCI was abolished. With the emergence of the National Energy Administration (NEA) under the National Development and Reform Commission (NDRC) in 2008, the era of the centralized governance for the Chinese coal sector has been permanently ended.
- Currently, the management responsibility of the Chinese coal industry is fragmented amongst many governmental agencies.

Table 1: Historical Development of the Chinese Coal Industry since 1949

Period	Major Event	Ave. Annual Production (Mt)	Average Annual Fatalities	Output % of TVE Mines
Recovery Period (1949-1952)	The PRC was founded in 1949. The Administration of the Coal Industry (ACI) was created under the Ministry of Fossil Fuels (MFF).	48.7	530	4.5
1st FYP (1953-1957)	Number of Greenfield mines under construction reached 194, with total capacity of 75.37 Mt. Number of completed mines reached 205, with total capacity of 63.76 Mt. Setting the target of raising annual national coal output to 131 Mt, which was the exact production level in 1957.	98.5	700	4.6
1955	MFF was abolished and the ACI was upgraded as the Ministry of Coal	98.3	677	4.8

Period	Major Event	Ave. Annual Production (Mt)	Average Annual Fatalities	Output % of TVE Mines
	Industry (MCI).			
2nd FYP (1958-1962)	The Great Leap Forward started in 1958 and ended in 1961. As a result, the national coal production target was revised upward to an unrealistic level of 900 Mt. Not surprisingly, over-reporting became rampant across the country, and the national economy entered a period of chaos.	306.6	4,120	6.8
1958	15 major coal producing provinces have established regional ACIs.	270.0	2,662	12.8
Adjustment Period (1963-1965)	The coal industry was not recovered until 1965 when the output grew again.	221.1	1,261	4.1
3rd FYP (1966-1970)	Setting the target of increasing national coal production capacity by 68.06 Mt, and the coal production actually grew as high as 7.1 percent annually during this period. Nevertheless, the political turmoil across the country soon forced the military take over the management responsibility of the coal industry in August 1967	259.3	1,848	5.9
1966	The beginning of the Cultural Revolution	251.5	1,478	2.3
1970	The MCI was abolished, and the Ministry of Fuels and Chemical Industry (MFCI) was created.	354.0	2,903	8.9
4th FYP (1971-1975)	Setting the target of raising national coal output to 400-430 Mt by 1975. As the average annual production growth rate was 4.2 percent during this period, this target was easily met, which indicates that the coal industry actually still functioned well in spite of the political turmoil.	423.0	3,837	11.3
1975	The MCI was re-created.	482.2	4,526	13.1
5th FYP (1976-1980)	Setting the target of establishing 8 large-scale coal production bases.	581.6	5,325	16.2
1976	The end of the Cultural Revolution.	483.5	4,826	14.8
1978	Deng Xiaoping opened the Chinese economy.	617.8	5,830	15.4
6th FYP (1981-1985)	The start of the resurgence of the TVE mines in China.	732.8	5,534	25.7
1983	The State Council issued the *Notice to Encourage the Private Sector's Investment in the Mining Industry*, which marked the beginning of the so called "let the water flow" policy.	714.5	5,431	23.8
7th FYP (1986-1990)	Setting the target of raising annual national coal production level to 1,000 Mt. With the private sector's rapid development, this target was met in 1990, when national output reached 1,080 Mt.	987.1	7,015	35.7
1988	The Ministry of Energy (MOE) was created, and the MCI was abolished. The creation of three key central level coal enterprises.	979.9	6,751	35.9
8th FYP (1991-1995)	The private sector's market share peaked at the expenses of the state-owned enterprises, tax revenue losses, mounting environmental degradation and daunting safety record.	1,190.8	5,817	42.1
1993	The MOE and the three central level coal enterprises were all abolished. The MCI was re-created. Since 1993, coal produced by TVE and private mines has been freely sold in the market. But the former State Planning Commission still issued guidance prices for coal supplied to power plants and negotiators at the national coal-ordering conference simply used these in place of the earlier benchmark prices.	1,150	5,152	42.5
1995	The market share of TVE mines peaked at 46.2 percent.	1,361.0	6,222	46.2
9th FYP (1995-2000)	In 1997/98, the ongoing national Campaign to close small coal mines formally started, with detrimental impacts on statistical collection.	1,319.8	6,049	38.3
1998	The MCI was downgraded as the State Coal Industry Bureau (SCIB) under the State Economic and Trade Commission (SETC), and authority over key state-owned mines was devolved to local governments.	1,250.0	6,304	41.9
10th FYP (2001-2005)	Serious under-reporting of national coal production occurred.	1,751.0	6,272	34.6
2001	The SCIB was abolished and most of its functions were handed over to the State Administration of Work Safety (SAWS). The State Administration of Coal Mine Safety (SACMS), under SAWS, oversees safety at coal mines.	1,381	5,670	23.9
2004	At the 2004 Coal-ordering conference, the guideline price for utility coal was removed by the NDRC, but power prices remained fixed while coal	1,992	6,027	38.0

Period	Major Event	Ave. Annual Production (Mt)	Average Annual Fatalities	Output % of TVE Mines
	prices soared.			
11th FYP (2006-2010)	The coal production target set for 2010 is 2.6 billion tonnes, which has already been exceeded in 2008.	2,686	3,595	37.8
2006	The former Energy Bureau of the NDRC worked with the National Bureau of Statistics (NBS) to revise national coal statistics since 1999. Shanxi's first resource consolidation campaign, setting minimum coal mine capacity as 0.3 Mt/annum.	2,373	4,746	38.3
2007	In Jan. 2007, the 11th FYP for coal industry was issued by the NDRC.	2,526	3,786	38.0
2008	The National Energy Administration (NEA) replaced the Energy Bureau of the NDRC.	2,793	3,215	36.6
2009	Shanxi's second resource consolidation, setting minimum coal mine capacity as 0.9 Mt/annum. A prolonged dispute on contracted thermal coal prices between major coal enterprises and utilities. The complete deregulation of coal prices at the central government level	3,050	2,631	38.2

Coal Resource and Reserves

- China's coal resources cover a land area of 600 thousand km^2, encompassing 6% of the country's 9.6 million km^2. There are five major coal endowment districts in China: Northeast, North China, South China, Northwest, and Tibet and Yunnan. The China Geological Survey reported that China's inferred coal resources total 5,555 billion tonnes (Gt). Over 90 percent of identified coal reserves in China are in less-developed, arid areas that are environmentally vulnerable.
- 89 percent of China's gross coal resources have been found in 12 provinces (or municipalities or autonomous regions) to the west of Daxinganling-Taihangshan-Xuefengshan serial of mountain ranges, these provinces include Shanxi, Shaanxi, Inner Mongolia, Ningxia, Gansu, Qinghai, Xinjiang, Sichuan, Chongqing, Guizhou, Yunnan and Tibet. 20 provinces (or municipalities or autonomous regions) to the east of the above mountain ranges account for only 11 percent of gross coal resources in China.
- Similarly, 93.6 percent of gross coal reserves in China have been found in 18 provinces to the north of the Kunlunshan-Qinling-Dabieshan serial of mountain ranges, these provinces include Beijing, Tianjin, Hebei, Liaoning, Jilin, Heilongjiang, Shandong, Jiangsu, Anhui, Shanghai, Henan, Shanxi, Shaanxi, Inner-Mongolia, Ningxia, Gansu, Qinghai, and Xinjiang. Only 6.4 percent of gross coal reserves lie in 14 provinces to the south of these mountain ranges. Not surprisingly, the unbalanced resource distribution dominated by geologic conditions largely determines the pattern of coal transportation in China that generally follows routes from north to south, and from west to east.
- In 2006, the Ministry of Land and Resources (MLR), in accordance with international norms for coal resources classification, reported that China's total coal reserves stood at 1,160 Gt across the country's 7,965 mining districts, comprising 334 Gt of "basic reserves" and 826 Gt of "prognostic reserves". China's "Proven reserves" were reported as 183 Gt, which is significantly higher than the similar statistics of 114.5 Gt provided by British Petroleum.

Table 2: Coal Resources and Reserves in China at the End of 2006 (Gt)

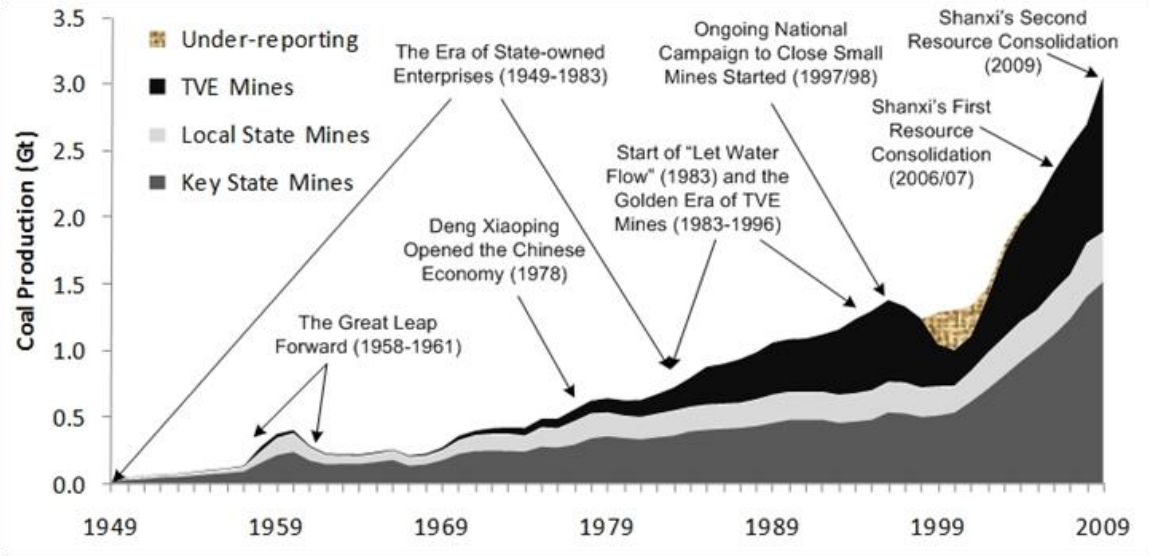
Planning Area (Province/Municipalities/Autonomous Region)	No. of Mining Districts	Proven Reserves	Basic Reserves*	Prognostic Reserves*	Total Reserves*
Jing-Jin-Ji (Beijing, Tianjin, Hebei)	277	2.70	7.69	9.57	17.25
Northeast (Liaoning, Jilin, Heilongjiang)	1,208	5.45	14.45	17.57	32.03
East China (Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong)	1,440	11.01	25.38	31.17	56.54
Central South + Hainan (Henan, Hubei, Hunan, Guangdong, Guangxi, Hainan)	1,576	8.37	15.79	17.12	32.91
Jin-Shang-Meng-Ning (Shanxi, Shaanxi, Inner Mongolia, Ningxia)	1,320	126.51	220.16	532.15	752.31
Southwest (Chongqing, Sichuan, Guizhou, Yunnan)	1,454	18.25	29.04	62.93	91.96
Xin-Gan-Qing + Tibet (Gansu, Qinghai, Xinjiang, Tibet)	690	10.25	20.98	155.80	176.77
Total Coal	**7,965**	**182.54**	**333.48**	**826.30**	**1,159.78**
Coking Coal		**64.3**	**124.2**	**150.3**	**274.8**

Coal Production

- At the inception of the People's Republic of China in 1949, China's coal output was only 32.43 Mt. In 2009, the similar statistics was 2.96 billion tonnes, which accounted for more than 40 percent of the world total.
- There are three types of coal mines in China – key state enterprises accounted for 52 percent of national coal output of 2.793 Gt in 2008. Coal production and sales of Shenhua Group, the largest state-owned coal mining company in China, reached 282 and 320 Mt in 2008. In comparison, Peabody Energy Corp., the world's largest private-owned coal mining company, only produced 174.5 Mt of coal in the same year. Moreover, Shenhua's fatality rate was 0.018 death/Mt of coal in 2008, which is significantly lower than the similar index of 0.027 death/Mt of coal in the U.S. in the same year. Not surprisingly, Beijing is trying to promote the Shenhua model to the rest of the Chinese coal industry.
- China's numerous TVE mines have caused many regulatory challenges such as environmental degradation, tax evasion and mining accidents, their number once exceeded 100,000 in 1991. So the central government is trying to dramatically reduce the number of operating TVE mines across the country to 10,000 by 2010. TVE mines accounted for 33 percent of national coal output in 2008. Local state mines are owned by local instead of central government, their market share shows a declining trend in recent years.
- In late 1990s, Beijing launched a national campaign to close TVE mines (most are private and small). Nevertheless, conflicts of interests between the local and central governments and vested interests of many local officials made Beijing's regulatory effort largely unsuccessful. Coal production underreporting became rampant at local levels. As a result, coal statistical distortion has imposed heavy constraints on China's energy sector in recent years. For instance, energy planning and forecast in 1990s and early 2000s generally show substantial discrepancy with the reality in later years.
- Only about 5-10 percent of China's coal output is produced by surface mining operations. China's heavy reliance on underground mines is an important factor

underlying both the low productivity and notorious safety record of the Chinese coal industry. In recent years, the industry has invested heavily on surface mines. The production share of surface mines is expected to increase in the future.

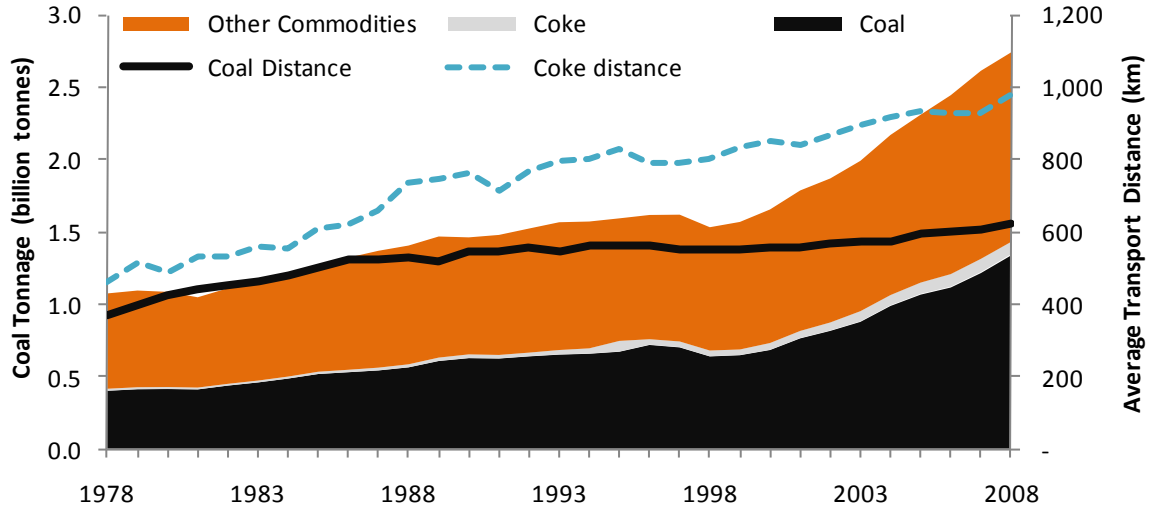
Figure 1: China's Coal Production by Type of Enterprises, 1949-2009



Coal Transport

- China's coal reserves lie largely in the north, northwest and southwest parts of the country. In comparison, major coal consuming centres in the east and south coastal regions have only limited coal endowments especially when compared with their consumption levels. As a result, the long distance between China's coal production regions in the hinterland and consuming centres in the coastal areas make transportation one of the most important issues in China's coal industry.

Figure 2: China's Coal Transportation by National Rail Network, 1978-2008

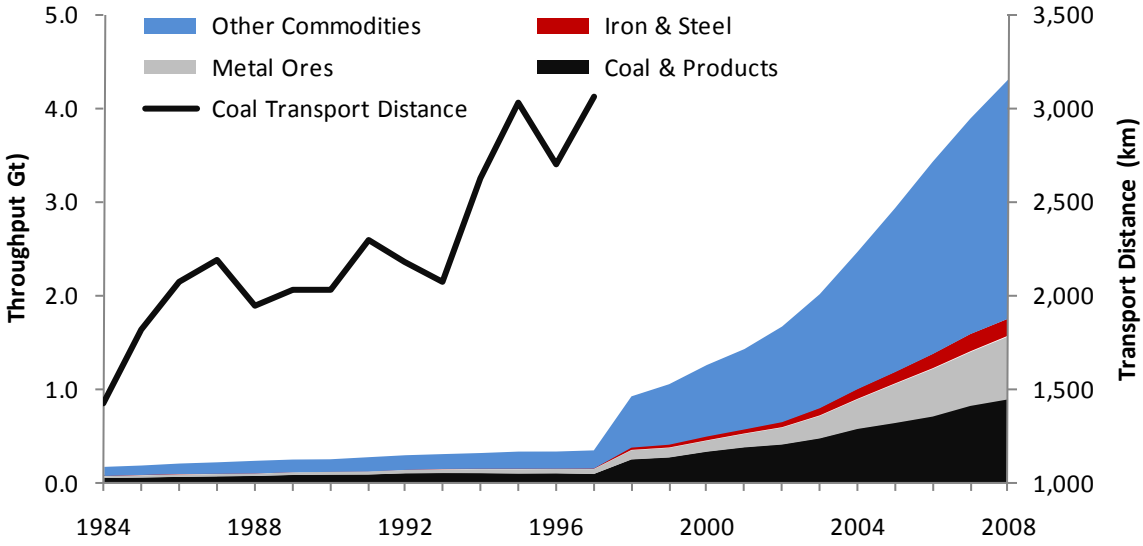


- Coal transportation by rail is so far the most important mode for moving coal within China. The amount of coal and coke transported by rail increased steadily from 417

Mt in 1978 to 1,431 Mt in 2008, a 4.2 percent increase annually during the study period. In comparison, national coal output grew 5.2 percent annually since 1978. The lower rate of coal transportation by rail compared with national coal output growth suggests that the bottleneck of railway infrastructure has become a serious constraint in China's coal value chain.

- The average distance of coal and coke transported by train shows an upward trend, which makes the infrastructure bottleneck issue even more serious in recent years. In addition, the incremental environmental implications such as dust emissions and energy consumption have also become quite serious.
- Since late 1990s, the rapid capacity expansion of major ports across the country made the total throughput processed by major coastal ports increase from 347 Mt in 1997 to 4,296 Mt in 2008, the equivalent of 26 percent growth annually during the study period.
- Since 1997, coal and coal products handled by major ports increased from 86 Mt in 1997 to 889 Mt in 2008.
- The average distance of coal transported through waterway increased rapidly in the past. And the port capacity expansion is expected to sustain in the foreseeable future across China.

Figure 3: China's Coal Transportation by Major Coastal Ports, 1984-2008

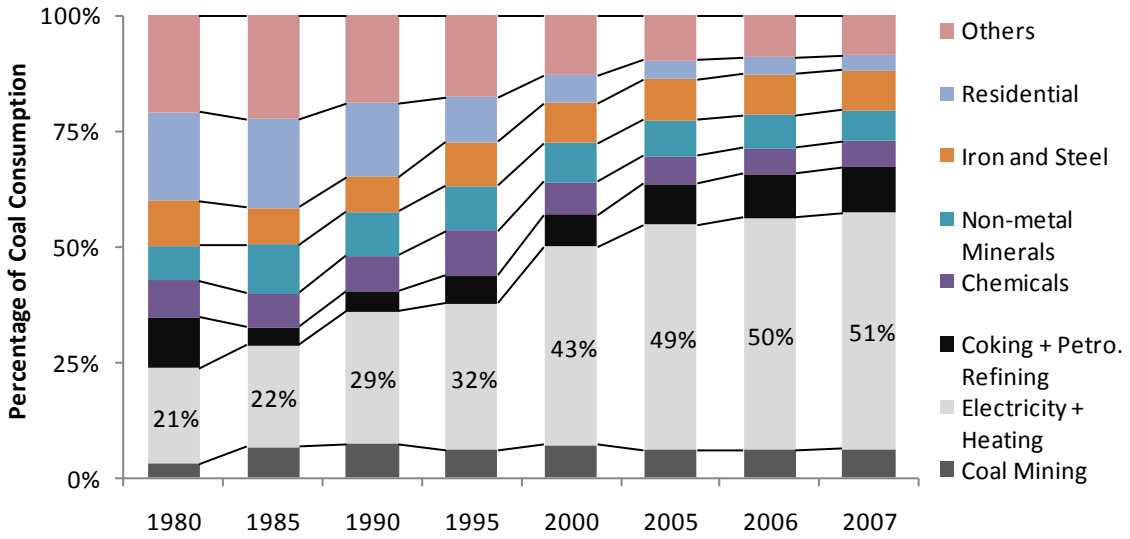


- Coal transportation by truck is another important method to move coal within China especially at the local levels. Normally, coal transport distance by truck is within 500 km. Nevertheless, in rare circumstances (e.g. Datong to Qinhuangdao: 638 km), this distance can be significantly longer if highway connection is available and the price differentiation is high enough.
- Coal transportation imposes significantly environmental challenges especially in terms of air pollutant and GHG releases related to refined petroleum product consumption and coal dust emissions.

Coal Consumption

- With limited domestic petroleum endowment, coal accounted for 96.3 percent of China's primary energy consumption in 1949, 93.9 percent in 1960, 80.9 percent in 1970, 72.2 percent in 1980, 76.2 percent in 1990, 67.8 percent in 2000, 68.7 percent in 2008.
- In 1980, electricity generation, other transformation industries (e.g. coking, heating, coal washing), industrial end use (e.g. iron & steel), and other end use (e.g. construction, commercial, residential, transportation, agriculture) accounted for 22, 12, 37 and 29 percent of national coal consumption, respectively.
- The power industry's share of national coal consumption has increased steadily to 50 percent in 2007, which is expected to keep rising in the future.
- Other transformation industries' share of national coal consumption has increased to 25 percent in 2007, which is primarily driven by rising coke and heating demand.
- Industrial share of national coal consumption first peaked at 47 percent in 1996, then shows a declining trend thereafter, reaching 19 percent in 2007.
- Other end use's share of national coal consumption shows a declining trend over time, lowering to 5 percent in 2007. This is primarily driven by environmental concerns.

Figure 4: Percentage of Coal Consumption by Sector in China

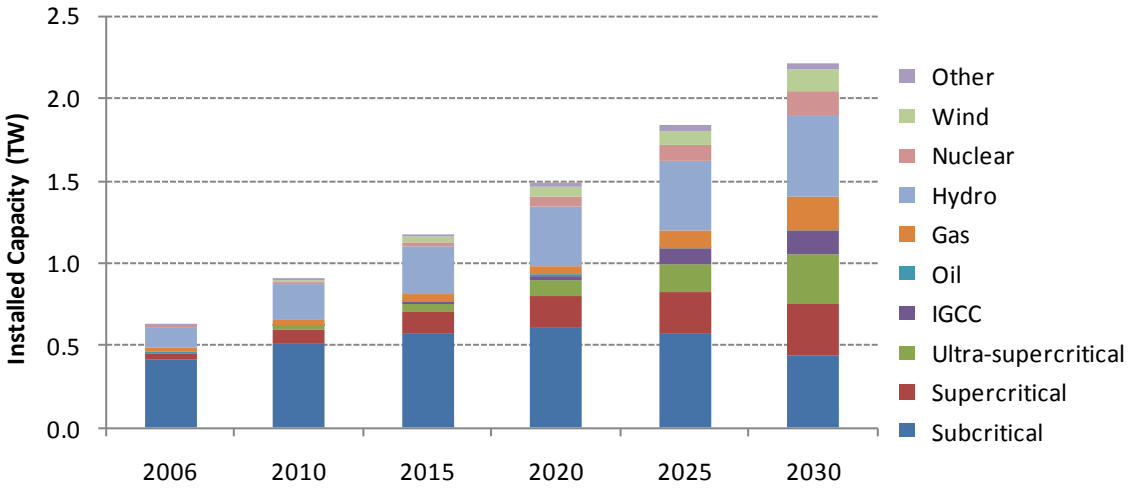


- In the past decades, thermal electricity generation efficiency in China has improved significantly by the installation of advanced Greenfield generation plants and accelerated retirement of small inefficient units. Nevertheless, compared with international best practices in the developed world, there is still sufficient room for China to further improve the generation efficiency of its generation fleet.
- Given the long life span of a coal power plant and China's large annual installation, China needs to act quickly to avoid regrettable investment decision that may last at least for several decades to make fundamental changes.
- Compared with utilities in developed world, quality control on feedstock by power generation companies in China have not achieved the optimal level especially given

the tight supply/demand situation in recent years. Nevertheless, level of quality inspection and demand for compliance coal are expected to increase in the future.

- Since 2006, total installed generation capacity in China is expected to grow by 5.4 percent annually, reaching 2.2 TW in 2030. Amongst all the generation technologies, wind mills are expected to show the strongest growth at19 percent annually during the study period. In comparison, installed capacity of coal-fired units is expected to expand moderately at 4 percent annually to meet rising domestic demand and build a sufficient reserve margin in the coming decades. Nuclear's share in China's electricity capacity mixture is expected to increase over time due to strong support by the Chinese government. As a result, its share in total installed capacity is expected to increase from 1 percent in 2006 to near 7 percent in 2030. Natural gas-fired generation is projected to be developed quickly during the study period to 1) alleviate air pollution in the urban centres; and 2) meet peak load demand. Oil-fired unit is the only generation type that will witness market retreat in the Chinese electricity industry. By 2030, oil-fired generation is expected to be almost entirely phased out.

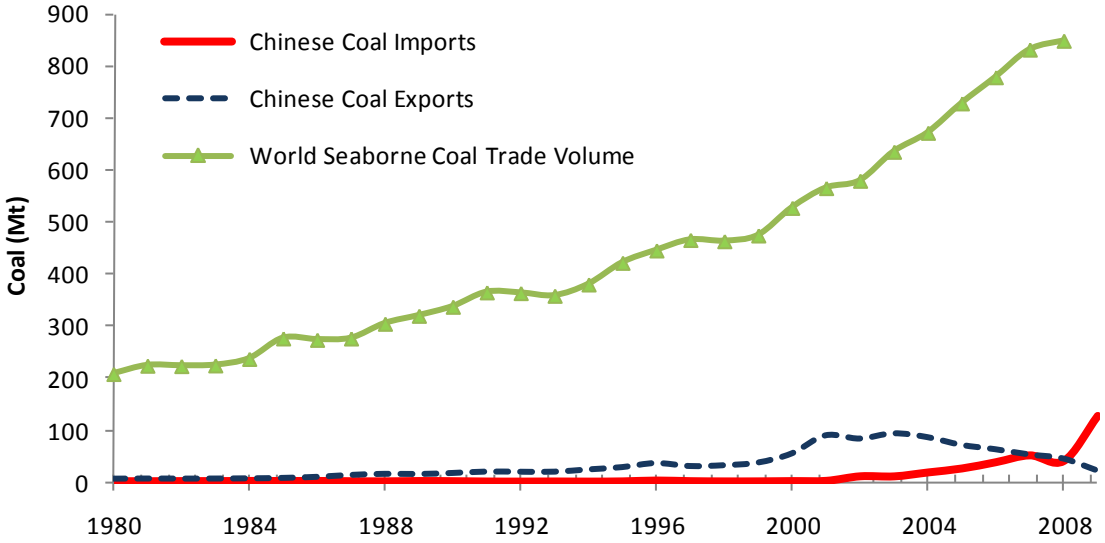
Figure 5: Reference Electricity Generation Capacity Mixture in China by 2030



Imports and Exports

- Since late 1990s. China's Coal exports increased rapidly and peaked at 94.03 Mt in 2003. Since then, coal exports are subject to a mandatory permit system set by the central government and show continuously declining trend. In comparison, China's coal imports show an overall upward trend in the past.
- According to the IEA, world seaborne hard coal trade volume was 849.3 Mt in 2008. In comparison, China's coal production and consumption were 2,793 Mt and 2,740 Mt in the same year, respectively.
- Given the enormous size of China's coal mining industry compared with the amount of coal traded in the international market, the dynamic interplay between China's coal imports and exports (i.e. whether China will become a net coal importer) casts significant uncertainty on global coal trade in the decades to come.
- China imported more coal than its coal exports for the first time in 2009, which indicates that China is likely to be a net coal importer in the years to come.

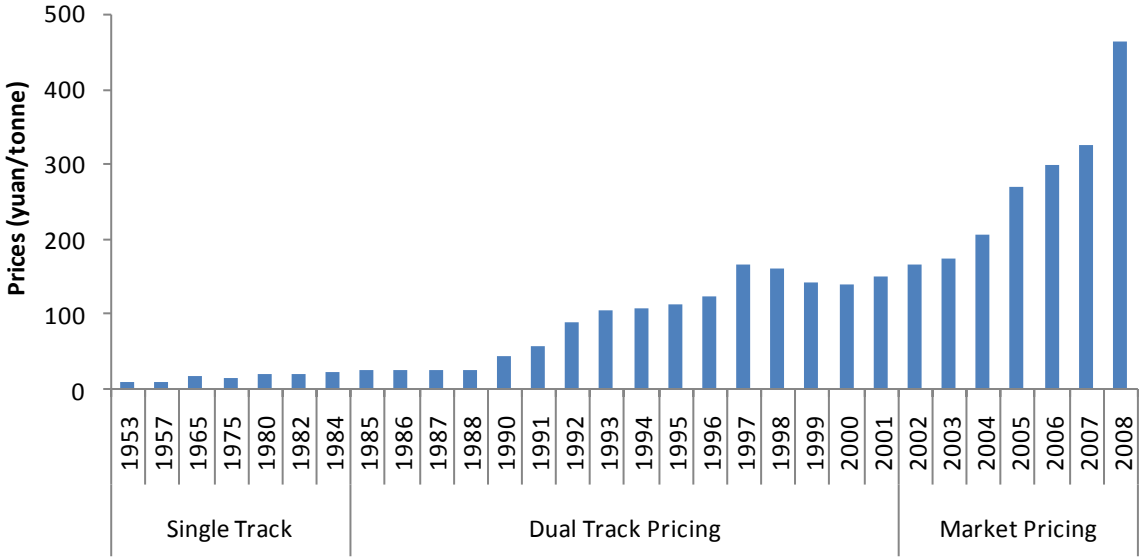
Figure 6: China's Coal Imports and Exports in the International Context, 1980-2009



Coal Prices

- Single track pricing period (1949 - 1985): at the inception of the PRC, the commodity pricing in China were dominated by the theory promoted by the former Soviet Union. According to this approach, part of value-added income in the heavy industry should be materialized in the light industry or other production sectors, so prices of raw materials including coal were set at arbitrarily low levels. Although coal production costs in China increased over time, coal prices had only been adjusted marginally for several times between 1949 and 1984, as a result, the Chinese coal mining industry run deficit during most of this period.
- Dual track pricing period (1985 – 2002): To meet the surging coal demand, Beijing had no choice but to encourage the development of small coal mines and to deregulate prices for coal produced by TVE mines. In addition, state-owned mines were allowed to sale their above-capacity output at market prices. Since 1993, the Chinese government has gradually deregulated coal retail prices in most sectors. Nevertheless, it still imposed "supervised prices" for thermal coal consumed by power plants between 1994 and 2001.
- Market-oriented pricing period (2002 - present): In 2002, the Chinese government abolished the "supervised thermal coal prices" implemented since 1994. To facilitate the thermal coal contract negotiation for utility use, the state still issued reference coal prices at annual coal trade fair. In 2006, the NDRC finally allowed prices of thermal coal for utility use fully subject to market pricing. According to the *Guidelines regarding Improving the Linkage amongst Coal Production, Transport and Demand* issued by the NDRC on December 14, 2009, thermal coal contract for utility uses will be directly and independently negotiated between coal producing enterprises and power plants without state intervention, which marks the complete deregulation of coal pricing regime at the central government level in China.

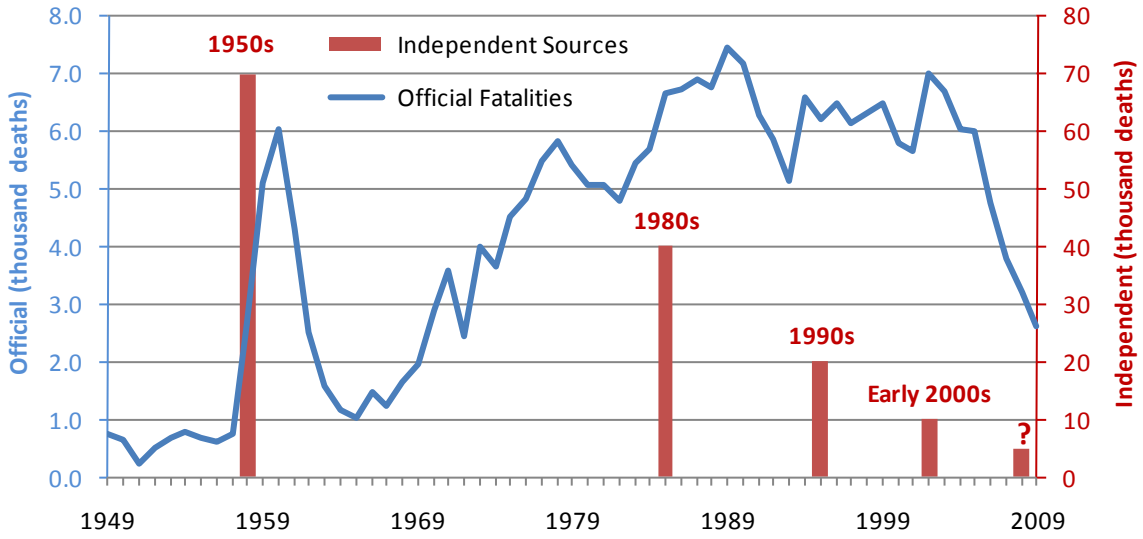
Figure 7: Average Minemouth Sales Price for Coal Produced by Key SOEs in China



Coal Mine Safety

- According to official statistics, more than 250,000 coal miners have died in China's numerous mining accidents since 1949. In comparison, independent sources put much higher coal mining fatalities than official statistics. Nevertheless, the Chinese government government's safety campaign has significantly lowered official coal mining fatality rate from 5.06 death/Mt of coal in 1999 to 0.892 death/Mt of coal in 2009, the equivalent of an 85 percent improvement on safety record within a decade.
- A methane gas explosion in 1942 killed 1,549 miners at the Benxihu mine in Liaoning province, which is the most deadly coal mining accident in the world. 682 Chinese miners died from the 1960 explosion at the Laobaidong mine in Shanxi province, which is the most deadly coal mining accident since the inception of PRC.

Figure 8: Coal Mining Safety in China: Official Statistics vs. Independent Estimations

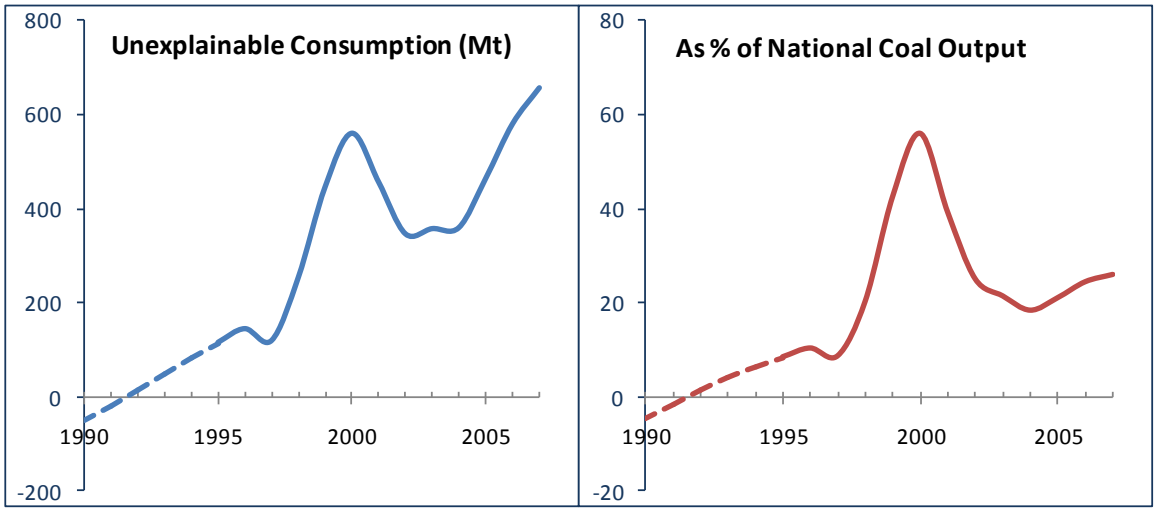


- Key driving forces underlying China's notorious coal mining safety record include: heavy reliance on underground mining operations; gaseous nature of Chinese coal mines; too many small mines; collusion between local officials and colliery owners; lack of law enforcement; lack of media monitoring; absence of local NGOs and unionization of workers; conflict of interests amongst key stakeholders, and etc.
- Solutions of China's coal mining safety challenge may lie outside its coal industry. For instance, drivers such as rampant corruption and lack of sufficient media monitoring cannot be solved within the Chinese coal industry alone.

Grey Market and Coal Statistical Distortion

- A grey market is the trade of a commodity through distribution channels which, while legal, are unofficial, unauthorized, or unintended by the original manufacturer. In contrast, a black market is the trade of goods and services that are illegal in themselves and / or distributed through illegal channels, such as the selling of stolen goods, certain drugs or unregistered handguns. In the context of the Chinese coal industry, the boundary between grey market and black market is often difficult to be distinguished, as those so called "illegal" coal mines almost always operate with adequate recognition of local governmental officials. As a result, the black coal market in China has also been categorized as one type of grey markets in this study.
- Currently, national coal production in China equals to the summation of coal output in all producing provinces and autonomous regions. While one would expect that similar relation holds for national coal consumption, it is actual not the case in China. According to China Energy Yearbook, the summation of coal consumption in all Chinese provinces and autonomous regions are significantly higher than aggregate coal consumption data at national level reported by the NBS in recent years.

Figure 9: Unexplainable Coal Consumption at Provincial Level in China



- Taking coal imports/exports, storage change and losses in coal washing and dressing into consideration, unexplained amounts of coal consumption at provincial level in China have increased rapidly since 1990, and first peaked at 561 Mt in 2001, when under-reporting of coal statistics has been officially recognized as one of the most serious ones later in 2006. Since then, the grey picture of coal statistical distortion in

China has only improved marginally until 2004, after which unexplainable coal consumption at provincial level in China has increased rapidly, reaching 658 Mt in 2007. As a result, the unexplainable coal consumption in China was as high as 26 percent of national coal output (original statistics reported by NBS) in 2007.

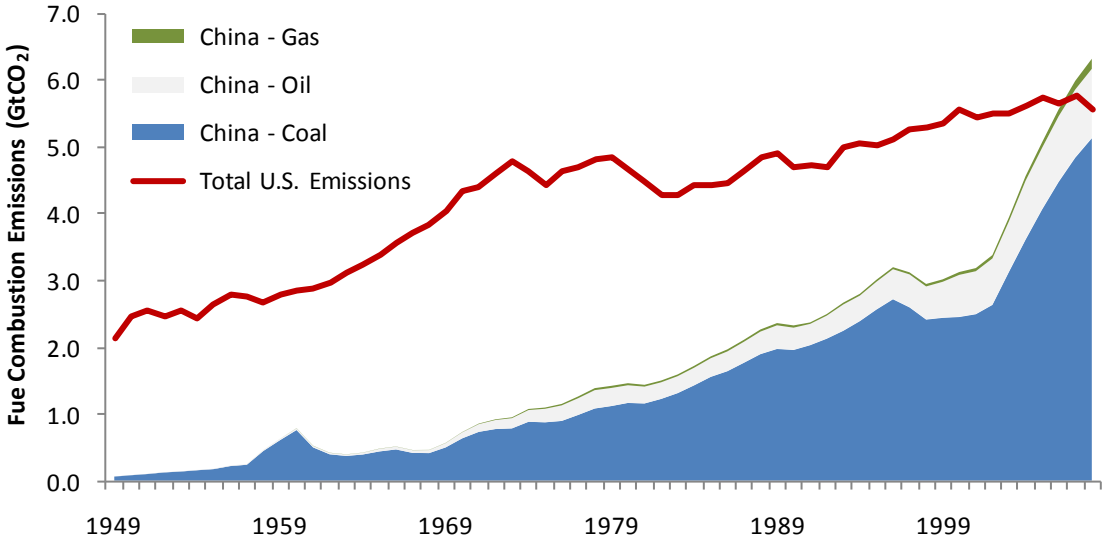
- Based on a detailed assessment, the author has proposed several hypotheses regarding China's coal statistical reporting status. While it is beyond the scope of the author's current contract with the PESD to further explore these issues, it is highly recommended that the hypotheses below should be assessed with rigor by researchers, ideally with permission and encouragement from the Chinese government:
  - Since mid-1990s, coal statistical distortion has become a systematic error in China's statistical collection system. It is caused by the existence of grey coal market in China;
  - The coal statistical revision by the Energy Bureau and NBS in 2006 has not fully reflected the actual size of grey coal market in China. In addition, the 2006 revision did not cover all problematic years with coal statistical distortion;
  - Up to 100 - 200 Mt of coal output might be underreported in Shanxi in recent years, which may need to be corrected by the Shanxi Bureau of Statistics; and
  - Up to 400 – 700 Mt of coal output might be underreported at national level in recent years, which may need to be corrected by the National Bureau of Statistics.
- Currently, the size of grey coal markets in China seems to have grown to dangerous levels that are too significant to be ignored, it is recommended that the Chinese government should consider to seriously assess the current situation and fix any inconsistency within its statistical reporting system. Otherwise, ongoing coal statistical distortion in China is likely to not only severely undermine Beijing's policy initiatives on energy conservation and carbon abatement in the years to come but also make the government's commitments less compatible with the measurable, reportable and verifiable (MRV) principle favoured by many countries in the international community.

Climate Change and the Future of Coal in China

- While the coal resource, because of its magnitude and low cost, has been a sustained contributor to China's economic and social development, its extraction, processing, transport and utilization are all associated with major sustainability challenges. Currently, spiking carbon emissions primarily caused by coal has become an increasingly important policy concern for China's decision makers especially after China overtook the U.S. as the world's leading carbon emitter in 2007.
- Given the necessity of balancing economic growth with portraying itself as a responsible power, China understands that it cannot escape the responsibility of curbing its spiking carbon emissions forever, so it has bid its time developing an increasingly proactive and comprehensive climate policy. In November 2009, China proposed to reduce its carbon intensity by 40 to 45 percent of 2005 levels by 2020.
- While the recent carbon intensity abatement approach proposed by Beijing in December 2009 is only the BAU trajectory of its coal industry, the commitment has nevertheless sent a clear and strong policy signal to all stakeholders in the Chinese coal industry including local governments. As a result of the new international promise, coal production and consumption levels in China are expected to be

significantly lower than otherwise it should be, though Chinese decision makers will still continuously rely on carbon-intensive coal to fuel the country's booming economy in the decades to come.

Figure 10: Fuel Combustion Carbon Emissions: China vs. United States



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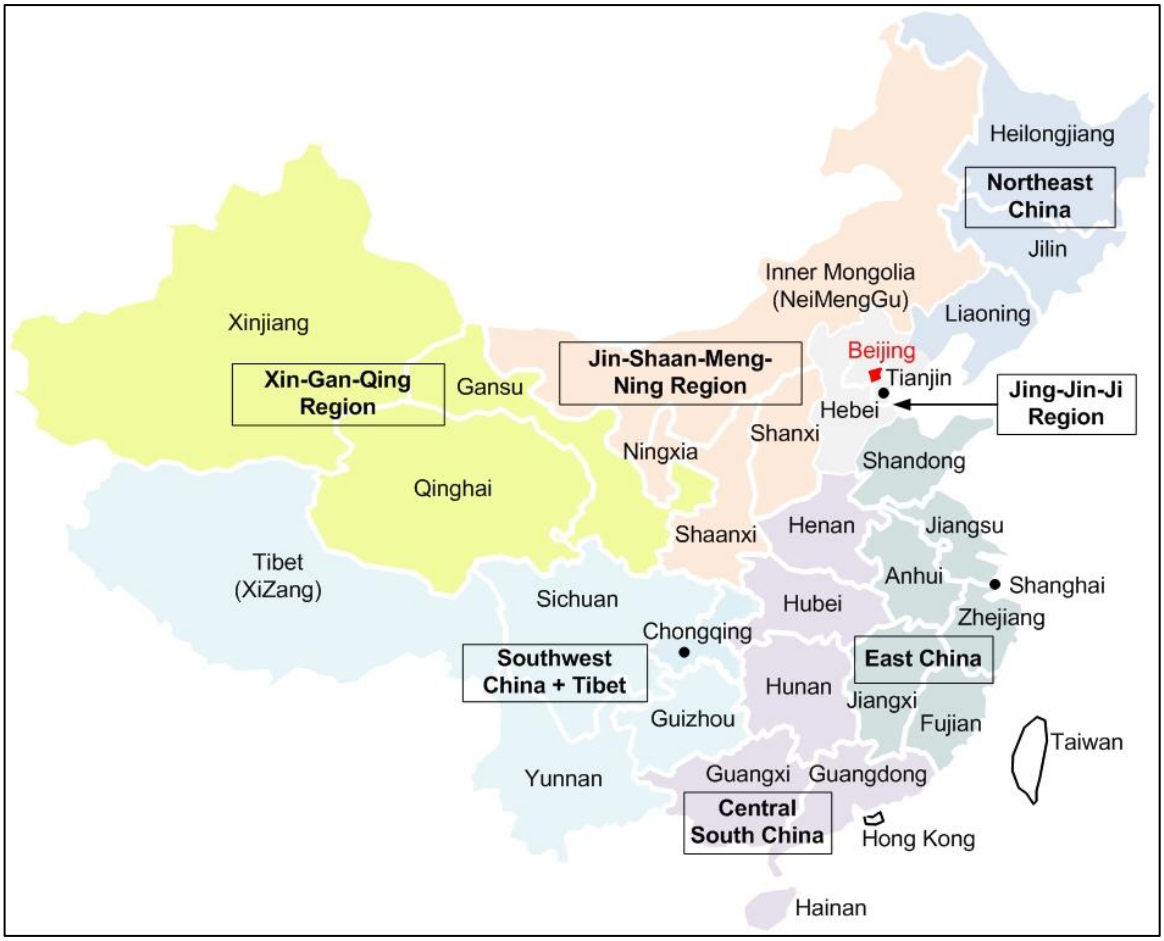
Illustrative Chinese Map with Major Coal Planning Regions



Note: the above map is for illustrative purpose only.
The boundaries and names shown and the designations used on any map included in this publication do not imply official endorsement or acceptance by the PESD at Stanford University.

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Kevin JianJun Tu is a Vancouver-based senior energy and environment consultant who began his professional career as a technical supervisor and then project manager for Sinopec, the national oil company of China. Before moving to Canada in 2001, Kevin was the director of marine operations at Shenzen Sino-Benny, China's largest LPG distributor. Since then, much of his work has involved providing energy, greenhouse gas and criteria air contaminant emissions analysis for Canadian industrial associations and all levels of government. Kevin is an experienced researcher and energy-economy modeller and specializes in operations strategy and policy analysis of coal mining, petroleum and electricity industries.

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本报告作者涂建军是加拿大温哥华 MKJA 公司资深能源与环境咨询顾问，以及加拿大工业终端能源数据中心的研究人员。他的职业咨询与学术研究方向包括国家及行业气候变化政策评估、空气污染物减排、能源效率及相关技术路线、碳固存（CCS）、发展中国家可持续能源发展政策、煤炭安全、化石燃料行业及相关产业链分析。

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