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The Dragon Steps on the Gas

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Discovery of the Merits of Natural Gas amid Heavy Pollution

Natural gas has been an insignificant source of primary energy in the PRC in the past 50 years, accounting for less than 3% of the annual total primary energy source since 1985¹. Natural gas was largely used as feedstock for fertilizer plants prior to the 1990s, and commercial and residential use of natural gas has only started in some municipalities since the mid 1990s. Currently there is no gas-fired combined cycle power generation plant in operation in the PRC although a number of such plants are under construction.

Historically, the PRC's energy source has been dominated by coal and oil, which account for approximately 68% and 23% of the total primary energy mix respectively (Table 1). The heavy reliance on coal in the past half century has caused two enormous problems: unprecedented environmental pollution and huge transportation costs, as coal is mainly located in north China's inland regions while the consumption centers are in the southeast coastal regions.

Table 1: Primary Energy Mix of the PRC in 2003

Source of Primary Energy	MM TOE	% of Total
Oil	275.2	23.4
Coal	799.7	67.9
Natural Gas	29.5	2.5
Nuclear Energy	9.8	0.8
Hydro Electric	64.0	5.4
Total	1178.2	100.0

Source: BP's Statistical Review of World Energy 2004

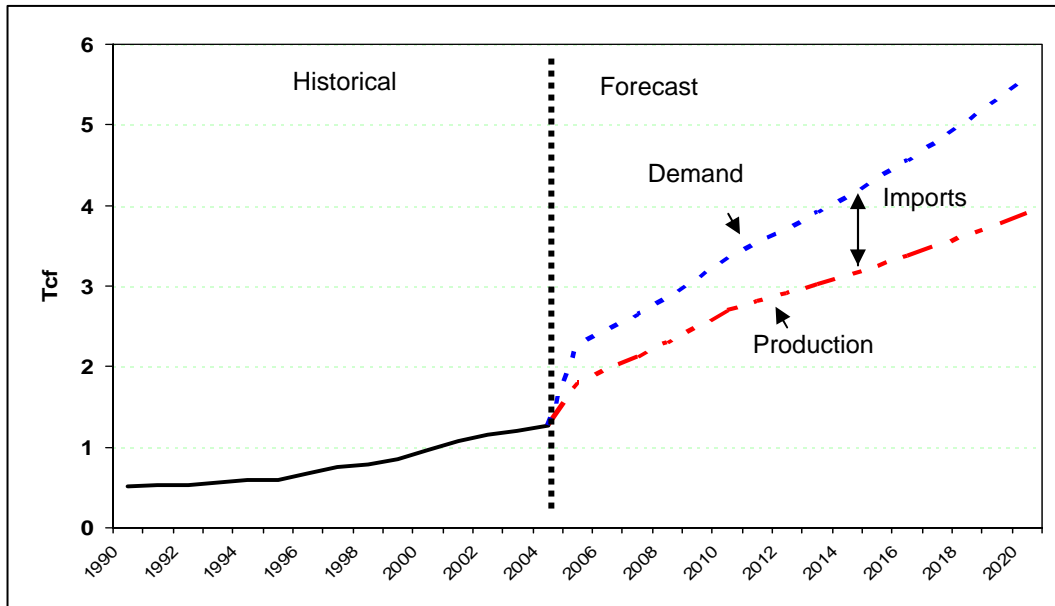
Natural gas is an environmentally friendly clean fuel. Its merits were discovered by policy makers in the Chinese government in the 1990s and a strategy was formulated to develop the natural gas industry, including investments in upstream exploration and production, mid-stream and downstream infrastructure building. In addition to indigenous gas reserves, foreign natural reserves are also tapped through a plan to import LNG and pipeline gas from other countries. The 10th Five Year Plan (2001-2005) also sets the goal of doubling the share of natural gas in the total energy mix by the end of this decade.

This strategy has borne some fruits. Large deposits of natural gas in Xinjiang in western China and Inner Mongolia in northern China have been found in the late 1990s. Following the gas discoveries, more than 2,600 miles of natural gas trunk lines have been built to transport gas to major cities for

residential and industrial use. According to the National Development and Reform Commission, the share of natural gas in China's total energy mix will increase from the current 3% to approximately 6% by 2010, and 11-12% by 2020, and the demand for natural gas will increase by more than 10% per annum from today to the end of 2020.

China's total natural gas consumption was 1.21 Tcf in 2003. It is forecasted to increase to 3.5 to 4.2 Tcf in 2010 and 6-7 Tcf in 2020. The growth in natural supplies is expected to come from the natural gas deposits in western and offshore China, complemented by imported LNG and pipeline gas from abroad. (Chart 1)

Chart 1: Historical and Projected Natural Gas Production and Demand in the PRC

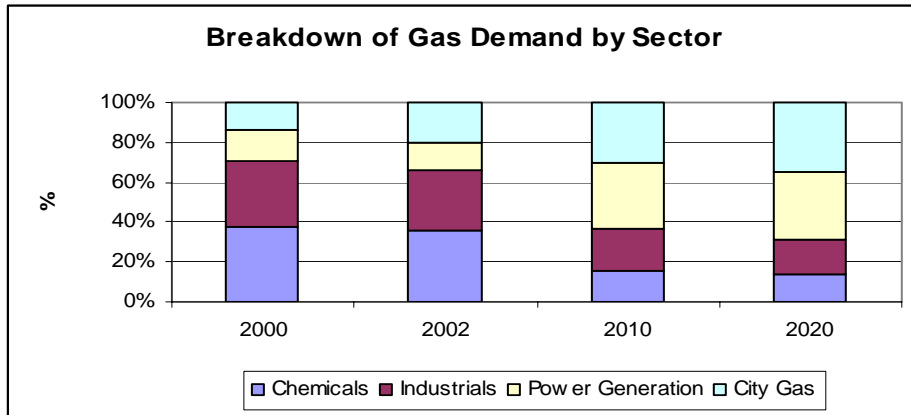


Source: National Development and Reform Commission, DOE/EIA.

The jump in consumption in 2005 reflects the impact of the full commercial operation of the West-East Pipeline.

Future growth in natural gas demand is expected to come mainly from two sectors: power generation and city gas use. As of the end of 2002, consumption by the petrochemical industry and industrials accounted for 36%, and 30% of the total, respectively, while city gas use and power industry account for 20% and 14% of the total, respectively. However, it is expected that the aggregate gas consumption by the power and city gas sectors will increase to more than 60% of the total by 2010, and closely to 70% of the total by 2020 (Chart 2).

Chart 2: Breakdown of Gas Demand by Sector

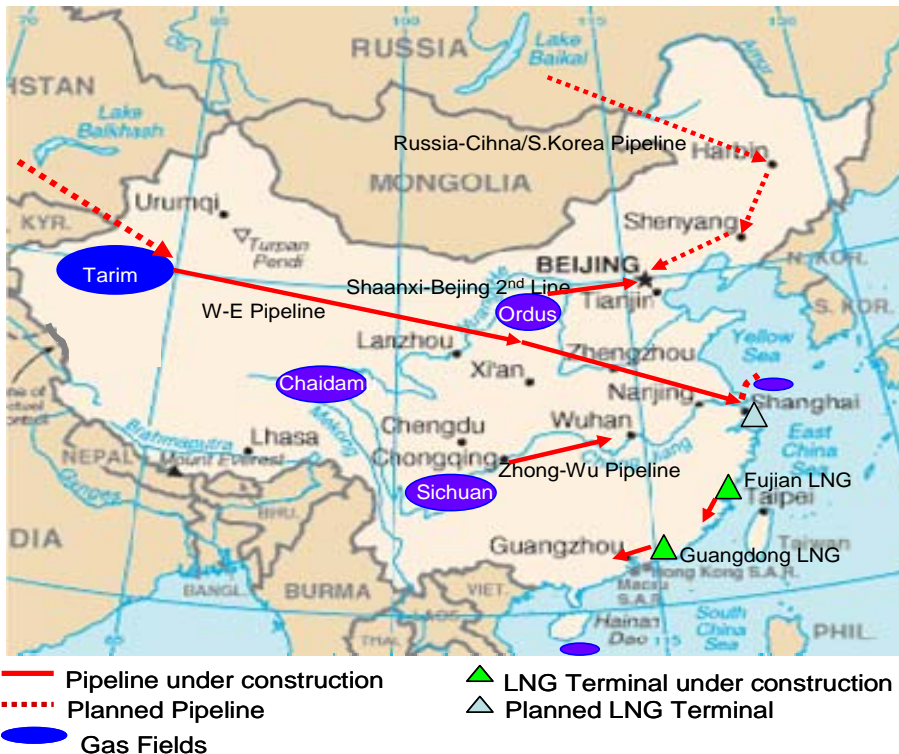


Source: National Development and Reform Commission

Natural Gas Reserves and Major Gas Projects under Construction

Total proved natural reserves of the PRC were estimated at 53.3 Tcf as of the end of 2002 according to the EIA. Chart 3 illustrates the major natural gas deposits in China:

Chart 3: Major Gas Production Centers and Gas Pipelines



Source: EIA, PetroChina, National Development and Reform Commission

The Tarim Basin in Xinjiang is the largest gas discovery, with estimated proved reserves of 11 Tcf, which is slated to supply Shanghai and its surrounding regions through the West-East Gas Pipeline.

The Ordus Basin in Inner Mongolia and northern Shannxi Province is another major area of gas discovery, and is currently supplying gas to Shaanxi Province and Beijing through pipelines. A second pipeline linking the Ordus Basin producing fields with Beijing is currently under construction and will be completed in 2005.

The third major gas producing area is the Sichuan Basin in south central China. A gas pipeline, the Zhong-Wu Pipeline, is under construction and will supply natural gas to Wuhan City in central China by the end of 2004.

The fourth major gas discovery area is in the Chaidamu Basin in Qinghai Province.

Furthermore, there is a natural discovery in the East China Sea, which is currently supplying gas to Shanghai through a pipeline. There is another offshore discovery in the South China Sea, which is currently supplying gas to Hainan Island and Hong Kong through a pipeline.

In the mid stream, more than 2,600 miles of gas pipelines have been completed since 1995 and new pipelines totaling more than 3,800 miles are under construction. Table 2 shows the pipelines under construction and planning.

Table 2: Pipelines under Construction and Planned Pipelines

Pipelines	Status	Length (miles)	Capacity (mmcf/d)	Expected Date of Operation
West-East Pipeline	Under Construction	2500	1,162	2005
Zhong-Wu Pipeline	Under Construction	460	387	2004
Shaanxi-Beijing Second Pipeline	Under Construction	536	320	2005
Guangdong LNG-associated Pipeline	Under Construction	133	409	2005
Fujian LNG-associated Pipeline	Under Construction	196	340	2006
Russia-China/South Korea Pipeline	Planned	N/A	2,900	2010
East China Sea Pipeline	Planned	N/A	N/A	2006
South China Sea Pipeline	Planned	N/A	N/A	2008

Source: National Development and Reform Commission, GDLNG and Fujian LNG

The West-East Pipeline is a high profiled project. Its total length is 2,500 miles consisting of the western section from Xinjiang to the Ordos Basin of 1,551 miles and the eastern section from the Ordos Basin to Shanghai of 949 miles. Its total capital cost is approximately US\$8.5 billion with upstream E&P cost of US\$3.3 billion and pipeline cost of US\$5.2 billion. It initially offered equity participation to foreign oil and gas companies through invitation to bid. A consortium consisting of Shell, ExxonMobil and Gazprom won the contest initially, but no final agreement was reached. PetroChina, the main sponsor, eventually carried it forward on its own. Construction started in July 2002, and the eastern section from Jingbian in central China to Shanghai entered operation in early 2004. The western section is expected to be completed in 2005. Its capacity is initially at 1,162 mmcf/d and can be expanded to 1,742 mmcf/d in the future.

The 460 mile long Zhong-Wu Pipeline linking south central China with central China is under construction and is expected to start operation in late 2004. It sources gas from the Sichuan Basin in south central China and transmits it to population centers in Wuhan City in central China. Its capacity is 387 mmcf/d.

The 536 mile long Shaanxi-Beijing Second Pipeline is under construction and completion is expected at the end of 2005. Its capacity is 320 mmcf/d. The first Shaanxi-Beijing entered operation in 1997.

The Guangdong LNG and the associated pipelines are under construction and are expected to enter operation in 2005.

The Fujian LNG and the associated pipelines are in an early stage of construction and are expected to enter operation in late 2007.

In the downstream, there are more than 10 gas-fired combined cycle power generation plants under planning with total capacity of 8,420 MW. This includes six 320-MW gas-fired power plants downstream to the Guangdong LNG project with total capacity of 1,920 MW, five gas-fired power projects downstream to the Fujian LNG project with total capacity of 3,500 MW, and five gas-fired power projects along the West-Wast Pipeline with total capacity of more than 3,000 MW.

Planned Major Gas Projects

The largest gas pipeline project under planning is the Russia-China/South Korean Gas Pipeline. It plans to transmit natural gas from the Kovykta gas fields near Irkutsk in Siberia to China and South Korea. The proved reserves at the Kovykta fields are more than 50 Tcf. The project is estimated to cost US\$12 billion. Its planned capacity is 2,900 mmcf/d, of which China would utilize 1,900 mmcf/d while South Korea would consume 1,000 mmcf/d. CNPC and Kogas are likely to be the offtakers of gas. The gas seller would be Russia Petroleum, whose 30% stake is owned by BP. The expected start-up date is 2010.

Two other major gas projects under planning are located offshore China. One is the Chunxiao Gas Field in the East China Sea, which is already supplying gas to Shanghai through a pipeline. A second pipeline linking the field with Shanghai is under planning. The second gas project is the Xihu Trough exploratory area also in the East China Sea, 250 miles east of Shanghai. Shell, CNOOC and Sinopec signed an agreement to jointly develop the Xihu Trough in January 2004.

A gas pipeline linking Central Asia and China is also being studied. If it is built, it will link natural gas reserves in Central Asia to China's coastal regions through the West-East Pipeline.

The Role of LNG

The electricity shortages in southern China's coastal region caused by rapid economic development prompted the government to decide on the importation of LNG as an alternative energy source. The Guangdong LNG project, which is a pilot project, is currently under construction at full speed. BP owns 30% of the LNG import terminal; CNOOC owns 31% while local firms own the remaining 49%.

A 25-year Gas Sales and Purchase Agreement was signed with Australia's North West Shelf LNG in 2002. The capacity of the terminal is 3 Million Tonnes per Annum (MTPA). The expected start-up date is late 2005. It has been reported that the CIF LNG price to Guangdong would be below US\$3.00 per MMBtu at an oil price of US\$20/bbl². The contract also contains a price ceiling which mitigates the impact of excessively high oil price on the price of LNG.

A second LNG terminal is at an early stage construction in Fujian Province, on the western side of the Taiwan Strait. It is jointly owned by CNOOC (60%) and Fujian Investment & Development Corp. (40%). A Gas Sales and Purchase Agreement was concluded with BP's Tangguh project in Indonesia in September 2002. The planned capacity of the LNG terminal is 2.6 MTPA. The expected commercial operation date is late 2007.

A third LNG terminal with a capacity of 3 MTPA is planned by CNOOC for start-up in 2009 in Zhejiang Province, but no government approval has been obtained. In addition, five more LNG receiving terminals are being studied for China's east coast provinces and municipalities including Liaoning, Tianjin, Shandong, Jiangsu, and Shanghai. However, they are all at a very early stage of planning and the likelihood of their obtaining government approval is low as the central government and everyone else are waiting for the results of the Guangdong LNG terminal before taking any further actions in the LNG trade in China.

Even though LNG is a new venture in the PRC, it will nevertheless play a key role in China's overall strategy for energy security. LNG could prove to be a good alternative in case the Russia-China/S. Korea gas pipeline fails to go through. However, the competitiveness of LNG is untested in the Chinese market. Although according to the base case forecasts by the sponsors, imported LNG is relatively competitive against other fuels in the intended markets, i.e., the booming coastal regions including Guangdong Province, Fujian Province, and the Yangtze River delta region represented by Shanghai, the competitiveness of LNG in the long term is yet to be proven. The price of LNG for the Guangdong LNG and Fujian LNG terminals is still indexed to the weighted average of crude imports to Japan³, or the Japan Crude Cocktail (JCC) in spite of a strong tendency to break away from such indexation. Based on current oil prices of around US\$40/bbl, electricity generated from imported LNG will be more expensive than that produced by coal, the dominant fuel for thermal power generation in the PRC. Thus the gas-fired power plants using imported LNG will be located in the high range of the electricity supply curve, making LNG-fueled electricity unaffordable for most parts of the PRC except the relatively rich coastal regions. Therefore, it is predicted that China's approach to imported LNG will be very cautious in the next few years. We do not expect governmental approval for more LNG receiving terminals over the next few years.

The Challenges in the Gas Industry of the PRC

Perhaps the biggest challenge in the gas industry is the formation of a workable and effective regulatory and legal framework which ensures the long-term healthy development of the industry. Currently the PRC does not have a unified regulatory system on the gas industry, and natural prices in different cities and regions are regulated by different local regulations. The key question is what type of model the PRC should adopt to develop its natural gas industry in the context of the deregulation of gas and electricity industries in advanced markets such as the U.S. and Europe. The

lack of a transparent and reliable regulatory system may be one of the barriers for foreign participation in the mid-stream and downstream distribution business of the gas industry.

The second challenge is the absence of a unified natural gas market and an effective pricing mechanism. Currently natural gas prices are still subject to local government control and are not determined by market forces. A unified market in which various participants including producers, traders, marketers, and users interact with each other to determine the equilibrium prices of natural gas has yet to be established. There are only a limited number of gas suppliers controlled by the three large oil companies of the PRC, and there is a lack of competition in the system. How competition is introduced into the gas pricing and trading system and how equal access is guaranteed to all suppliers are the key issues to be addressed by the policy makers and private sector participants for the next few years.

The third challenge is the absence of a national gas transmission and distribution infrastructure. In spite of the tremendous progress made in the building of the gas infrastructure since the mid 1990s, including the completion of approximately 2,600 miles of natural gas trunk lines since 1995 and a further length of more than 3,800 miles of pipelines under construction, a national gas transmission grid has yet to take shape. In addition, most of the population centers lack modern gas distribution systems. Establishing a national natural gas transmission and distribution system requires billions of dollars of investment. Currently most of the projects are financed by bank loans, which may increase the overall risks of the banking sector in case projected natural gas demand fails to materialize.

The fourth challenge is the gas-on-gas competition and the competition between natural gas and other energy sources. There will be competition between indigenous gas and imported gas as well as between pipeline gas and LNG. Furthermore, the competition between natural gas and other fuel sources such as LPG, oil and coal will always exist. How to use innovative technology and management systems to reduce the cost of production, transmission and distribution is a major issue to be considered by would-be investors or lenders to this industry.

Financing of the Gas Projects

Before the end of the 20th century, oil and gas projects were primarily funded by the government through the state-owned monopoly CNPC and bank loans. Since the break-up of CNPC into three oil companies in 1998, new and large oil and gas projects have been undertaken by one of the three major oil companies, namely PetroChina, Sinopec and CNOOC, all of which are listed overseas.

With China's entry in to the WTO in 2001, the oil and gas sector is now fully open to foreign participation and the central government is now calling for more investment in this sector. However, so far only the lucrative upstream exploration and development of oil and gas has successfully attracted foreign investment. Major foreign participation in the mid-stream pipeline and downstream distribution sectors except for BP's 30% stake in the Guandong LNG receiving terminal has yet to take place. The high profiled West-East Pipeline projected was originally intended to attract foreign investment but ended without foreign participation. Currently all the would-be participants, both domestic and international, are observing the outcome of the Guangdong LNG terminal for indication of the viability of LNG in the PRC market.

In addition to equity investment, large amount of third party debt is expected to be utilized for future natural gas projects. Local banks, the four large state-owned commercial banks in particular, are expected to play a leading role in the financing of these projects. This trend for local financing is driven by the huge lending capacity of the key local banks given the high savings rate of more than 40% and the availability of only a limited number of large and high quality projects. Furthermore, local banks are able to provide large amounts of RMB financing at relatively low rates in the current low interest rate environment, and USD denominated loans at very competitive margins, sometimes as low as 50 bps for large gas projects. A good example of the power of local banks is the financing of the Guangdong LNG terminal project, which borrows RMB 5.2 billion (US\$626.5 million) entirely from local banks. The Fujian LNG terminal project also intends to source the entirely debt of RMB 4.15 billion (US\$500 million) from local banks both in RMB and USD denominated loans.

Even though local banks are increasingly playing a major role in the project finance market in the PRC, international banks are still active in this market. All the large projects have retained foreign banks as financial advisors, and international banks played significant roles in the three large petrochemical projects closed in 2003, including the CSPC Nanhai project with debt financing of US\$2.7 billion, the BASF-YPC project with debt financing of US\$1.4 billion, and the BASF-Hunstman project with debt financing of US\$740 million. With the full opening of the financial sector to foreign investment after 2005 according to the requirements of China's WTO membership, international banks are expected to increase their presence in the PRC market. Possible increase in the RMB interest rates in the future to curb excessive investment may also reduce the attractiveness of RMB financing. Besides, import of gas-fired power generation equipment which China does not produce may also make ECA financing a viable alternative.

Conclusions

Although developing rapidly and forecast to grow by more than 10% per annum from 2003 to the end of 2020, China's natural gas industry is still at a very early stage of development compared with developed markets such as the U.S. and Europe in terms of the natural gas infrastructure and regulatory environment, and there are huge opportunities for foreign participation in the upstream, mid-stream and down-stream of the gas chain. Given the great potential for LNG imports into China, every player is closely eyeing at the outcome of the Guangdong LNG as a barometer for the viability of LNG in this market.

Large amount of capital is required for building the natural infrastructure including transmission lines, distribution networks, and gas-fired power plants. A huge chunk of the financing will come from debt financing. Local banks will be key sources of funding. International banks will be more focused on providing financial advisory services and will be involved in more complicated structured finance transactions.

A regulatory and legal framework conducive to private investment in this sector must be instituted. And above all, a market system that guides the production, transmission and distribution of natural gas trade must be established.

With the expected double-digit annual growth rate and the government's intention to double the share of natural gas in the total primary energy mix by 2010, the dragon has stepped on the gas. How fast it will go remains to be seen.

¹ National Development and Reform Commission.

² Petroleum News, Vol. 9, No. 18, May 2004.

³ Petroleum News, Vol. 9, No. 18, May 2004.