THE EFFECTS ON THE AISAN AND WORLD GAS MARKETS OF THE CHINESE GAS MARKET EXPANSION

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ABSTRACT

China has experienced high economic growth of almost 10% per annum since the end of the 1970s, when she has adopted the policies of reforming and open-door. Such a high economic growth has required tremendous amount of additional energy supplies. China, like most developing countries, chose natural gas as a strategic fuel for the nation's continuous growth.

She adopted a two-pronged approach to increase gas supplies. One prong is to develop domestic natural gas resources, particularly in Tarim basin in the West and Ordos basin in the North. Produced gas in these basins was supplied mostly to Beijing and Shanghai and adjacent cities through 4,000km-long West-East pipelines, which was completed by the end of 2004. The other prong is to implement various gas import projects. These projects include more than 10 LNG projects and several gas pipeline projects.

It is well known that China has signed on the two long-term LNG purchase contracts in 2002 for the Guangdong and Fujian projects with NWS and Tangguh projects. Jiangsu LNG project has recently been approved by the government. Several other LNG projects are also waiting for the government's final approval. The emergence of China as a major LNG player has already started to affect the rigid Asian LNG market in various ways.

As for the pipeline project, it is highly likely that China will receive pipeline gas from Caspian region of Kazakhstan and West and East Siberia of Russia within the next 10 to 15 years. This implies that Europe will be connected with China via gas grids. In other words, Europe might have to compete with China over the Caspian and West Siberian gas. China together with South Korea has also been implementing the Kovykta gas pipeline project, which aims at developing Kovykta gas field in East Siberia of Russia and supplying 30 bcm per annum of gas to China and South Korea through 4,800km-long pipelines. The realization of this project would create a new regional gas market, centered on Eastern Siberia of Russia, China, and Korea.

This paper attempts to analyze the overall effects on both Asian and world gas markets of the expansion of the Chinese gas market. It adopts a conceptual approach to achieve the goal. The most important implication associated with the expansion of Chinese gas market is that it will not only provide a basis of Northeast Asian gas market to be integrated, but also make the Chinese market play a role of bridge connecting gas-rich central Asia and West Siberia with one of major consuming countries of Northeast Asia, making Europe and China compete for the Central Asian and West Siberian gas. In addition, the surge of Chinese LNG market will integrate the regional LNG markets to a global LNG market, making the world LNG market more flexible and competitive.
Abstract

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1. INTRODUCTION

China, one of the most closed countries in the world, has begun to implement the policies of reforming and open-door in the late 1970s. In 1979, she started to open the door appointing Shenzhen and Zhuhai of Guangdong province as a special economic zone. Shantou of Guangdong province and Xiamen of Fujian province were also included in the special economic zone in the following year. It was further extended to 14 regions of eastern coast including Dalian, Tianjin, Qingdao, Wenzhou, Fuzhou, Guangzhou in 1984. Such a wave of door opening has spread over whole regions of eastern coast in the late 1980s and 1990s.

Great success of the policies of reforming and open-door has enabled China to enjoy unprecedented growth rate of almost 10% per annum on average over the last 20 years. However, such a high economic growth had necessitated tremendous amount of energy and it had thus made China to fall down to an oil-importing country in 1993, which had been self-sufficient in energy before with huge amount of coal (ranked 3rd in the world in reserve) and considerable amount of oil and gas reserves. In 2002, China consumed 220 $10^6$ tons of oil, in which 31.4% were imported, ranking 2nd in the world. Timely supply of energy has thus been the most crucial issue, but less-developed structure of energy supply and demand mainly consuming coal has caused additional problems of environmental pollution and reduction of efficiencies.

In 1999, China announced the 10th five-year plan for the period 2001-2005, where it is stressed that improvement of energy consumption structure and expansion of natural gas demand are inevitable due to rapid economic growth and improvement of living standard. According to the plan associated with natural gas, several goals are set to achieve. They include the increase in the demand share of natural gas from 2.5% to 4~4.5% in the energy market, discovery of additional gas reserves of $1.45 \times 10^{12}$ m$^3$ in the existing gas fields, production of $50~55 \times 10^9$ m$^3$ of gas in around 2005, construction of additional gas pipelines of $10 \times 10^3$ km and establishment of a nation-wide gas network until 2015. To achieve such goals, Chinese government plans to implement various energy policies inclusive of opening of gas market, enhancement of international energy cooperation, attraction of foreign investment in gas sector, importing of LNG and pipelined gas, etc. The characteristic of such policies is that it is focused on natural gas. Given a shortage of domestic energy together with a surge of environmental protection all over the world, it is easily figured out that China can not but choose natural gas a strategic fuel of a nation.

The gas market of China is now waking up from a long hibernation and is about to take off. As a matter of fact, it has already emerged as a gas market with huge potentiality in Northeast Asia launching several international gas projects. These changes in the Chinese gas market have a great deal of implications in both Asian and world gas markets in various ways.

This paper attempts to analyze the overall effects on both Asian and world gas markets of the
expansion of the Chinese gas market. It adopts a conceptual approach to achieve the goal. In brief, the most important implication associated with the expansion of Chinese gas market is that it will not only provide a basis of Northeast Asian gas market to be integrated, but also make the Chinese market play a role of bridge connecting gas-rich central Asia and West Siberia with one of major consuming countries of Northeast Asia, making Europe and China compete for the Central Asian and West Siberian gas. In addition, the surge of Chinese LNG market will integrate the regional LNG markets to a global LNG market, making the world LNG market more flexible and competitive.

Section two of this paper reviews natural gas reserves and gas pipeline grids in China. It also covers the trend of gas consumption, as well as outlook on future demand. Section three reviews gas projects in China, both gas pipeline and LNG projects. Section four analyzes the effects of the Chinese gas market expansion from the standpoint of both Asian and world gas markets. The final section summarizes main contents, followed by conclusions.

2. Natural Gas Supply and Demand in China

2.1 Natural Gas Reserves

China is endowed with rich natural gas resources although they are not evenly distributed across the country. The southern and eastern regions, where the economy is rapidly growing and population is concentrated have insufficient gas resources, whereas less-developed regions of northwest have abundant gas resources. China conducted the third round investigation of gas resources over the 150 gas-endowed basins in 2004. Table 1 shows the investigation results.

<table>
<thead>
<tr>
<th>Name of Basin</th>
<th>Resources (10¹⁵ m³)</th>
<th>Proved Reserves (10¹² m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onshore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ordos Basin</td>
<td>10.7</td>
<td>731.0</td>
</tr>
<tr>
<td>Sichuan Basin</td>
<td>7.3</td>
<td>494.0</td>
</tr>
<tr>
<td>Tarim Basin</td>
<td>8.4</td>
<td>452.0</td>
</tr>
<tr>
<td>Songliao Basin</td>
<td>2.0</td>
<td>173.0</td>
</tr>
<tr>
<td>Qaidam Basin</td>
<td>2.4</td>
<td>128.0</td>
</tr>
<tr>
<td>Offshore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. China Sea</td>
<td>10.0</td>
<td>130.0</td>
</tr>
<tr>
<td>E. China Sea</td>
<td>5.0</td>
<td>41.0</td>
</tr>
<tr>
<td>Others</td>
<td>7.2</td>
<td>651.0</td>
</tr>
<tr>
<td>Total</td>
<td>53.0</td>
<td>2,800.0</td>
</tr>
</tbody>
</table>

Table 1: Natural Gas Reserves in China

According to the Table, total gas resources are around \(53 \times 10^{15} \) m\(^3\) in which offshore reserves account for two thirds and the remaining one third is onshore reserves. Ordos basin in the northwest region has the largest proven gas reserves followed by Sichuan basin of southwest region, Tarim basin of far northwest region, Songliao of northeast region, South China Sea basin, Qaidam basin of far northwest region, and East China Sea basin. China has made tremendous efforts to add up the amount of gas reserves over the last 10 years and thus the reserve volumes have been increasing continuously.

### 2.2 Natural Gas Transmission Grids

Natural gas in the northwest provinces of China, where gas resources are heavily endowed, has been consumed mostly for re-injection for oil production and a feedstock for fertilizer until the beginning of 2000s due to lack of transmission infrastructures. Recently, however, natural gas in the regions has started to flow towards southeastern and northeastern provinces for residential consumers and power plants as several long distance gas trunklines have been built. Newly constructed trunklines include West-to-East pipeline (Tarim basin of Northwest - Shanghai), two pipelines from Jingbian of Shaanxi province to Beijing, a pipeline from Sebei of Qinghai province to Lanzhou of Gansu province, and Zhongwu pipeline (Chongqing - Hubei - Hunan provinces) as shown in Figure 1.

![Figure 1: Natural Gas Transmission Grids in China](Image)

2.3 Natural Gas Consumption and Demand Outlook

Natural gas has played a minor role in the energy market of China, possessing less than 2% in demand share until 1997. The demand share has since grown a bit, but is still at a level of around 2.5% by the end of 2004 (BP 2005). However, it is highly expected that the increase in demand share will speed up for the next 10 to 20 years due to improvement of price competitiveness of gas over oil, enhanced environmental protection, and strong governmental drive. The Figure 2 supports such expectation. Gas consumption in 2002 is $30.1 \times 10^{12} \text{ m}^3$, but is expected to increase rapidly. In 2020, gas demand will reach over $210 \times 10^{12} \text{ m}^3$, which is almost seven times as much as that of 2002.

As was stated previously, natural gas in China is mainly used for industrial use and a feedstock for petrochemicals. In 2002, gas consumed for industrial use and petrochemicals are 9.6 and $11.7 \times 10^{12} \text{ m}^3$, possessing 32% and 39% in share. The remaining consumption was met by city gas (residential and commercial) and power generation uses. Such a demand pattern will be reversed in the future. In 2020, city gas and power generation together will have 63.3% in demand share, whereas industrial and petrochemical sectors will have the remaining share of 36.7%.

![Figure 2: Gas Demand Outlook in China](source)

3. Natural Gas Projects in China

In preparation for the rapidly increasing gas demand, China is exploring and developing domestic gas resources first. Extracted domestic gas will then be transmitted to eastern gas-consuming regions through gas grids already in place or to be built. Shortage will be met by LNG and pipeline gas from abroad. At present, various gas projects are being carried out or under contemplation.

3.1 Gas Pipeline Projects

China has implemented several gas pipeline projects since the end of 1990s to build a nationwide gas network and at the same time to import gas from neighboring countries. Those gas pipeline projects include West-East pipeline, West Siberian, Kazakhstan, East Siberian (Kovykta), and Sakhalin pipeline projects. Among them, West-East gas pipeline is the first cross-country gas transmission pipeline, which connects gas-rich region of Tarim basin with Shanghai. The construction of the 4,000 km-long West-East pipeline started by PetroChina in July 2002 and completed in August 2004 (see Figure 3). This pipeline has transmitted around $6 \times 10^{12} \text{ m}^3$ of gas to eastern bound in 2005 and will double up the supply volume within the next several years.

As West-East pipeline is completed, China is now planning to extend the west end of the pipeline to central Asia and West Siberia, where tremendous amount of gas resources are buried. In fact, bringing the central Asian and West Siberian oil and gas into China has been considered when she has planned to construct the West-East pipeline in the middle of 1990s.

![Figure 3: Gas Pipeline Projects in China](image-url)
China and Kazakhstan have jointly constructed the 1,000 km-long oil pipeline connecting Atasu of Kazakhstan with Alasankou of China in November 2005. It is the 2nd stage of oil pipeline project running from Caspian Sea to western border of China and the remaining sections within Kazakhstan are scheduled to be completed by the end of 2007. China plans to import 1,000 tons of oil from Kazakhstan in 2006 and increase it further to 2,000 tons after 2007. In addition to oil pipelines, China and Kazakhstan plans to build probably a parallel gas pipeline. For this gas pipeline project, they signed an MOU (Memorandum of Understanding) in June 2003 and started to conduct a joint feasibility at the end of 2004. Two routes were proposed. One is Caspian Sea-Shymkent-Almaata-China and the other route is Turkmenistan-Uzbekistan-Shymkent of Kazakhstan-Almaata-China. Another gas pipeline being planned is to connect the west end of West-East pipeline with Omsk of West Siberia. PetroChina is in talks with Gazprom for this project. China wishes to bring in around 40 $10^{12}$ m$^3$ per annum of West Siberian gas.

To meet the gas demand in northeast regions, China is implementing two gas pipeline projects. One is Kovykta gas project and the other one is Sakhalin gas project. China conducted a feasibility study jointly with Russia and South Korea from November 2000 to November 2003 to develop the Kovykta gas field in East Siberia. The study results were submitted to the three governments for approval. China hopes to bring in 20 $10^{12}$ m$^3$ of gas per annum from the Kovykta field through 4,000 km-long pipelines. As for the Sakhalin-1 gas pipeline project, the project operator, ExxonMobil has investigated two routes of gas pipelines, one for Japanese buyers and the one for Chinese buyers. It became more favorable to Chinese buyers as the project completed gas pipeline from Sakhalin to Khabarovsk by the end of October, 2005. China pursues to bring in 10-12 $10^{12}$ m$^3$ of gas per annum from the project, by extending the pipelines further to Haerbin of China.

3.2 LNG Projects

In line with gas pipeline projects, China has implemented various LNG projects. In 2002, China has signed two long-term LNG contracts for the first time. One is for Guangdong project and the other one is for Fujian project. Guangdong project is aimed at importing 3.3 $10^6$ tons of LNG per annum to Guangdong province from NSW project of Australia starting in 2006, whereas Fujian project plans to import 2.6 $10^6$ tons of LNG per annum to Fujian province from Tangguh project of Indonesia starting in 2007. These two contracts are famous for their characteristics in terms of adoption of a tender, lowest prices, price caps, low indexation (30%) to oil prices, no inflation adjustor, etc.

In addition to these two LNG projects, a number of LNG projects have been proposed by the competing state oil and gas companies, CNPC, CNOOC, and Sinopec. Chinese government, however, announced to restrict the spree of LNG import terminals in June 2005. She will only develop one terminal for every province. Only 10 terminals in southeastern and northeastern coasts are likely to receive the approvals from the government and they are listed in Table 2. Expected operators and related information are also summarized in the table.
<table>
<thead>
<tr>
<th>Project Name</th>
<th>Operator</th>
<th>Expected Supplier</th>
<th>Delivery Date</th>
<th>Volume (10^6 tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guangdong</td>
<td>CNOOC</td>
<td>NWS</td>
<td>2006</td>
<td>3.3</td>
</tr>
<tr>
<td>Fujian</td>
<td>CNOOC</td>
<td>Tangguh</td>
<td>2007</td>
<td>2.6</td>
</tr>
<tr>
<td>Shanghai</td>
<td>CNOOC</td>
<td>-</td>
<td>2008</td>
<td>3</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>CNOOC</td>
<td>Gorgon</td>
<td>2009</td>
<td>3</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>CNPC</td>
<td>-</td>
<td>2010</td>
<td>3</td>
</tr>
<tr>
<td>Guangxi</td>
<td>Sinopec</td>
<td>-</td>
<td>2012</td>
<td>3</td>
</tr>
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<td>Tianjin</td>
<td>Sinopec</td>
<td>-</td>
<td>2010</td>
<td>3</td>
</tr>
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<td>Shandong</td>
<td>Sinopec</td>
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<td>3</td>
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<td>Liaoning</td>
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<td>-</td>
<td>2008</td>
<td>2</td>
</tr>
<tr>
<td>Hebei</td>
<td>CNPC</td>
<td>-</td>
<td>2012</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 2: Expected LNG Projects in China

4. The Effects of Chinese Gas Market Expansion

Expansion of gas demand in China has made the Chinese government look for neighboring countries’ gas resources, thereby implementing various gas pipeline and LNG projects. These gas projects are expected to greatly affect the Northeast Asian gas market, as well as world gas markets in several ways. Note that, if the west end of West-East gas pipelines is connected with around 500 km-away Almaata, East end of Kazakhstan gas grids, gas resources in Central Asia can flow into China.

In fact, the Chinese government signed an MOU (Memorandum of Understanding) with Kazakhstan government for the gas pipeline project connecting the two countries in June 2003, and in June of the following year signed a gas cooperation agreement with Uzbekistan for the same purpose. In addition, the west end of West-East gas pipelines can be connected with the southeastern end of West Siberian gas grids. CNPC, a state oil and gas company of China, is currently in talks with a Russian state gas company, Gazprom to materialize the connection of pipelines and gas trade. These pipeline connections between China and Central Asia and West Siberia are likely to take place not in distant future, and this will make Europe compete with China for the gas resources in those regions.

The 10 LNG projects in China mentioned in the previous section would also have similar effects. The Asian LNG importers in South Korea, Japan, Taiwan, India, West Coast of US, etc will have to compete with Chinese buyers. Europe will also be faced with more competitive LNG supply market due to China. However, there are possibilities of cooperation as well between these LNG buyers. In addition, enlarged LNG market resulted from the entrance of China might benefit both suppliers and buyers, making a pie bigger.
4.1 The effects of Gas Pipeline Projects in China

The realization of gas pipeline projects being implemented by the Chinese government would have tremendous effects on both Asian and world gas markets as shown in Figure 4. The realization of Kovyktak and Sakhalin gas pipeline projects would connect Chinese and Korean gas markets and possibly further to Japanese gas market in the future, providing a basis for the integration of Northeast Asian gas market. In other words, there might be a creation of such a regional gas market as North America and Europe in Northeast Asia.

This regional market will not only cause a gas-to-gas competition, but also improve the cooperation between gas players within the region, thereby accelerating the developments of Chinese, South Korean and Japanese gas markets. The future Northeast Asian gas market will thus have to adopt new regimes such as EU Directives in Europe to secure free trade and movements of gas flow and fair competition and pipeline operation. From the standpoint of world gas market, Europe might have to compete with Northeast Asia for the gas resources in Central Asia and West Siberia. Consequently, this will accelerate the development of remote gas resources in Central Asia and West Siberia. In brief, formation of a regional gas block of Northeast Asian gas market is highly likely within the next decade and this would provide a basis for the Europe and Northeast Asian gas markets to be integrated.

Figure 4: Effects of Gas Pipeline Projects in China

4.2 The effects of LNG Projects in China

Like gas pipeline projects, the realization of LNG projects being implemented by the Chinese government would also have tremendous effects on both Asian and world LNG markets. The Figure 5 summarizes such effects. The realization of Guangdong, Fujian, and other scheduled 10 LNG projects would change both regional and global LNG markets greatly. First of all, these LNG projects will cause more competition for LNG procurement between Asian LNG buyers. In particular, gas resources in Australia where abundant gas resources are buried, political situation is stable, and transportation distance is close would be a target of severe competition. Sakhalin LNG will also be competitively pursued for the same reasons. However, it is also expected that LNG cooperation such as swap and joint purchase of LNG could take place between Asian LNG buyers.

The emergence of huge LNG market in China will expand the world LNG market. The expansion projects of existing LNG projects as well as stand-by projects are likely to be developed in a speedy manner. In addition, gas resources that have not been developed yet for various reasons as in Iran, Central Africa, Barents Sea of Russia, etc. will also be developed. In consequence, orders of new LNG carriers together with untied speculative ship orders will increase considerably. Such changes will transform the world LNG market, still in its oligopolistic stage, to more competitive global LNG market rapidly. On-going flexibility processes of world LNG market will also speed up. In brief, the surge of Chinese LNG market will not only transform the regional LNG markets to global LNG market, but also make the world LNG market more flexible and competitive.

Figure 5: Effects of LNG Projects in China

5. Summary and Conclusions

Gas demand in China has started to increase slowly since the implementation of the reforming and door-open policies of 1979. Recently, such trend in gas demand has been accelerating due largely to rapid economic growth and expansion of such energy-intensive industries as petrochemicals, cement, steel, etc. In addition, strengthening of environmental regulations has also accelerated such trend.

China, in preparation for rapid gas demand increase, plans to develop domestic gas resources first. For this, gas resources in Tarim and Ordos basins have been developed and supplied through newly built West-East and Jingbian-Beijing transmission pipelines to developed economic regions of eastern coast and Northeast China. In addition to domestic gas development, China plans to bring in gas resources of neighboring countries through both gas pipeline and LNG projects. Chinese government is currently in talks with Kazakhstan and Russian governments to import Central Asian and West Siberian pipeline gas. She also hopes to bring in East Siberian and Sakhalin pipeline gas. 10 LNG projects in southeastern and northeastern coasts inclusive of Guangdong and Fujian LNG terminals will intensify the procurement of gas supplies.

These gas pipeline and LNG projects will have tremendous effects on both Asian and world gas markets. Expansion of Chinese gas market to be connected with Central Asian and West Siberian gas resources would not only provide a basis for separated Northeast Asian gas markets in China, Japan, and South Korea to be integrated by gas grids, but also connects European gas market with Northeast Asian gas market, thereby integrating both markets into a global pipeline gas market. In this case, Europe will have to compete with Northeast Asia over Central Asian and West Siberian gas.

Similar argument can be found in LNG market. The new 10 LNG projects in China will change dynamics of both Asian and world LNG markets. The expansion projects of existing LNG projects as well as stand-by projects will be developed in a speedy manner. Consequently, orders of new LNG carriers together with untied speculative ship orders will increase considerably. Such changes will transform the world LNG market to more competitive global LNG market. On-going flexibility processes of world LNG market will also speed up.
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