

Development of Natural Gas in China

– Concentrating Resources to Accomplish Major Undertakings, and Expediting Development through Diversified Ownerships

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The development of China's natural gas industry can be described as the story of an ancient but rising industry. In general, the route for China's natural gas development is through concentrating resources to accomplish major undertakings, and expediting development through diversified ownerships.

A brief review of the development of the natural gas industry in China

In China, natural gas is both a time-honored, traditional source of energy and newly popular mass-use energy. China's Sichuan Basin has natural gas resources and underground salt mines. As early as more than 2000 years ago, natural gas was used to cook brine to produce salt in Zigong, Sichuan, a process that was recorded in Heavenly Creations accompanied by illustrations. However, until four decades ago, when China implemented the policy of reform and opening up, natural gas was still only known by a minority of people in a few regions. At that time, natural gas made up only a trivial part of China's energy structure, which even as a whole was negligible. In 1997, the first long-distance natural gas pipeline of China, the Shaanxi-Beijing Gas Pipeline with a total length of 918 km, was built, transporting natural gas to Beijing. Offshore gas was discovered in the waters off the Beibu Gulf of Hainan Island, and a pipeline was built between Yinggehai and Hong Kong, which can supply 2 billion cubic meters of natural gas to Hong Kong annually. In the East China Sea, the geologic survey team of the Ministry of Geology and Mineral Resources, currently

Star Petroleum Company, discovered a small amount of natural gas in the Pinghu Gas Field adjacent to Shanghai, which could possibly allow for 400 million cubic meters of gas be supplied to Shanghai each year. Back then, I was serving in the National Planning Commission. I remember that 200 million meters of gas had been allocated to Tianjin and 100 million meters to Xi'an from the Shaanxi-Beijing Gas Pipeline then, but the authorities of Tianjin were worried that they couldn't use up the supply. Until 2003, the proportion of natural gas in the energy mix was merely 2.3% in China, but it had exceeded 10% in many developed countries, and was even up to 30% in some countries. Taking the U.S. and Russia for instance, natural gas had become a main kind of clean energy for them. However, in China, it was mainly for domestic use in urban areas at that time, and an additional small amount was used in producing fertilizer and generating power. After the year 2000, the Chinese government started to contrive the scheme for the West-East Gas Pipeline connecting Xinjiang and Shanghai, which was planned to have a total length about 4000 km and a designed capacity of 12 billion cubic meters per year. We had never built such a long gas pipeline with such a huge capacity. Though we also attempted to cooperate with such foreign companies as Shell, no deal was reached. Finally, we had to turn to our own means. At that time, we even couldn't produce X70 pipeline steel or make gas-fired compressor units, so we started off developing and manufacturing X70 steel in steel plants, groping around in the dark step by step. We had never built a large-scale gas storage

either. In order to satisfy the need of the West-East Gas Pipeline Project, we built the first large gas storage based in the cave of an underground salt mine in Jintan, Jiangsu. Nevertheless, despite our inexperience, through hard work, the pipeline was completed within a mere two or three years, and it is connected to the Shaanxi-Beijing Gas Pipeline in Jingbian, making available a gas supply for Beijing and Tianjin. Benefiting over 200 million people, the West-East Gas Pipeline has had an important significance in ushering in the period for extensive application of natural gas in China. In former premier Zhu Rongji's words, it was akin to adding a heavy brushstroke to the blueprint of China (to highlight its significance). Later, the second West-East Gas Pipeline was put into use, transporting natural gas from Xinjiang to Guangdong and Hong Kong.

Foreign cooperation in natural gas

In consideration of the fact that the proven natural gas reserves of China had fallen behind the rapidly increasing market demands, we started to negotiate with Russia and Central Asian countries about importing pipeline gas in 2005. Personally promoted by the heads of China as well as those of Central Asian countries, including Turkmenistan, Uzbekistan and Kazakhstan, the Central Asia-China Gas Pipeline was completed in 2009. It was our first long-distance gas pipeline inlet from abroad, establishing a record in China's natural gas import history, initiating China's entry into international natural gas cooperation, and enabling China to become a net importer of natural gas. This gas pipeline had a preliminary design capacity of 30 billion cubic meters per year, with Line A, Line B and line C all constructed along the same route, and it is connected with the West-East Gas Pipeline. Line D is under construction, and it takes a different direction than that of the above three lines. In this way, the contract volume of natural gas imports via the Central Asia-China Gas Pipeline has been expanded to 68 billion cubic meters. Up until now, China has accumulatively imported over 190 billion cubic meters of natural gas through this pipeline.

After that, we joined hands with Myanmar, jointly and simultaneously building the Myanmar-China Oil and Gas Pipelines. The gas source of the project is the offshore gas explored and developed by South Korea's Daewoo in the Bay of Bengal in Myanmar. As production there was only some 5 billion cubic meters per year, the company sold it to China. However, the design capacity of 5 billion cubic meters per year still hasn't been reached. Despite this, the pipeline makes the use of natural gas possible for the

southwestern remote mountainous areas in Yun'nan. At present, China only has these two onshore pipelines for natural gas imports. The eastern route of the China-Russia Gas Pipeline is still in progress, and is expected to be put into use next year.

At the beginning of this century, while contriving the scheme of the Central Asia-China Gas Pipeline, we started LNG operations. After intense bidding competition, we primarily chose to import LNG from Australia and Indonesia through LNG terminals in Fujian and the Daya Bay of Guangdong, and later expanded to Shanghai to import LNG from Malaysia. Up till now, we have built 13 LNG terminals and put them into operation, and this number is rapidly increasing now. The LNG exporters we use have also expanded from Australia, Indonesia and Malaysia to adding Qatar and Brunei. We also import BG's LNG made from coalbed methane (CBM) in Queensland, Australia. Likewise, although we were once unable to make LNG carriers or the steel plates for LNG tanks, we now export LNG carriers to Mitsui O.S.K. Lines (MOL). Within only the past 20 years, China has developed from being a country whose natural gas consumption only took up a negligible part in its energy mix to becoming the world's third largest natural gas consumer, after the U.S. and Russia. However, it should be noted that gas consumption in China only takes up 5.9 percent of global natural gas consumption, in contrast to the 33 percent of the U.S. and Russia. The current proportion of natural gas in the energy mix of China is up to 6.3%, and there is still a substantial gap in natural gas usage proportions compared with that in developed countries. Nevertheless, thanks to China's huge market space, natural gas has achieved faster growth in China compared with other energy resources. Even under the circumstance of relatively sluggish energy demands in recent years, natural gas has maintained its rapid growth, and usage of it increased by 15.2 percent in the first half of this year compared with the same period in 2016. The amount of imported gas reached 41 billion cubic meters, in comparison to the 74.3 billion cubic meters of domestic gas used, resulting in an import dependence ratio of 36.5%. China's has not yet begun exporting natural gas, but we have extended the West-East Pipeline to Hong Kong SAR via submarine pipeline, and we supply one billion cubic meters of natural gas to Hong Kong every year to maintain the prosperity and stability of the region. Businesses in Taiwan are also very interested in introducing natural gas from the mainland, particularly in Jinmen, which is adjacent to the mainland and where I was invited to visit before. Technically, extending the gas supply even to the Taiwan

Island is currently viable. However, the current hindrance is not related to any engineering or technological aspects; rather, it is a result of cross-strait political relations, and wholly depends on the attitudes of the Taiwan authorities influenced by Tsai Ing-wen.

Concentrating resources to accomplish major undertakings, and expediting development through diversified ownerships to enable the rapid growth of the urban gas business in China

Our natural gas business started from scratch. Currently, on the vast land of China, the West-East Gas Pipeline, the Shaanxi-Beijing Gas Pipeline, the Sichuan-to-East Gas Transmission Pipeline, the Offshore Gas Pipeline, the Central Asia-China Gas Pipeline and the Myanmar-China Gas Pipeline have all been connected, and so a national gas pipeline network has begun to take shape. Moreover, these pipelines have been integrated with the LNG terminals scattered in coastal areas. The rate of construction for these pipelines is unprecedented across the world. For example, the Nabucco Gas Pipeline, which is meant to stretch from Central Asia through the Caspian Sea to Europe, was initiated earlier than our Central Asia-China Pipeline, and yet no substantive progress has been witnessed even today. Our natural gas pipeline network is both the result of the superiority of the central government in concentrating efforts to accomplish major tasks and the mutual support of numerous enterprises all over China, which highlights the superiority of socialism. At present, the trunk pipelines are mainly constructed and operated by state-owned enterprises, which rely on their abundant funds and strong technical force, but some private enterprises and foreign enterprises have also participated in the activities. For instance, the CBM pipeline stemming from the southeastern Shanxi region to Duanshi in Henan was built by a private entrepreneur from Sichuan; the gas field from Jeminay (Xinjiang) to Zaysan (Kazakhstan) was built and run by GUANGHUI, a private energy company in Xinjiang; The Zhoushan LNG terminal project currently under construction was undertaken by ENN, which is also a private company. The branch lines in different provinces and cities are built or run by local state-owned enterprises, private enterprises or mixed-ownership enterprises. Private and foreign enterprises have also played an important role in urban gas business. China's urban gas business is mostly operated by PetroChina Kunlun Gas Limited (state-owned), Towngas (Hong Kong-funded), China Resources

Gas (Chinese-funded enterprises based in Hong Kong) as well as the private companies ENN and China Gas. These five enterprises are operating gas business in more than 100 cities. Moreover, in many cities, the gas business is run by the gas companies subordinated to the local government, which can be seen in such companies like Beijing Gas. Currently, the natural gas consumption in Beijing has exceeded 16 billion cubic meters per year, and has even surpassed that of New York, and so Beijing is now the world's second largest gas consuming city behind Moscow. This is beyond our expectations. In 2018, after the east route of the China-Russia Gas Pipeline is put into operation, China's natural gas pipeline network will stretch even further to the Northeast, which boasts a population of 100 million people, and thus connect the pipeline network inside and outside Shanhaiguan. Right now, Chinese enterprises are still actively investing in overseas natural gas exploration. One eighth of the shares in the North West Shelf of Australia are owned by Chinese enterprises, and the gas field at the right bank of the Amu Darya River and the gas field in Yamal of Russia are both supported by Chinese funds, and so China has become one of the most active countries in the field of natural gas.

Increasing the proportion of natural gas in the energy structure is necessary for air pollution control

As is well known, in China, many cities, including Beijing, are suffering from smog, and the government has made up its mind to control the pollution. Despite the many controversies over smog, as well as differing opinions from voices in the coal industry, the glut of coal in the energy structure of China is undoubtedly one of the main causes of smog. Coal still accounts for up to 65 percent of the energy mix in China, and 72 percent of power in China is generated by coal. In 2013, China's coal production reached a peak of 3.8 billion tons, accounting for almost half of global coal consumption. Therefore, for the purpose of smog control, it is an inevitable trend to replace coal-fired units with gas-fired units in large cities. In the urban areas of Beijing, there used to be four coal-fired power plants. When I was still in office, I was determined to require the use of gas to replace coal and encouraged the adoption of gas-fired combined heat and power (CHP) systems, but encountered substantial resistance. In face of increasingly serious smog, the authorities of Beijing have finally made up their decision to have all coal-fired generating units in urban areas shut down and replaced with advanced gas-fired heat and

power cogeneration units. However, a consensus hasn't been reached yet, for some scholars hold that nitrogen oxides produced by gas-fired units can still form smog. Regardless, the fact of the matter is that major cities, including London and Los Angeles, have all taken the route of replacing coal with gas for the purpose of smog control, and it is undoubtedly the truth that natural gas is a cleaner energy than coal.

Price is the foremost constraint limiting the expanded use of natural gas

As present, the price of natural gas is a big constraint impeding the replacement of coal with gas in China, as the costs of natural gas are still higher than that of coal. Many experts call for the consideration of pollution costs, carbon trading, and increasing sewage charges. However, under the constraints of various interest groups and opinions, substantial resistance has been encountered in implementation. Anyway, I believe that a switch to clean energy is an inevitable trend in history, and any interest group must eventually realize this. China is now carrying out a natural gas price reform, but determining how to make natural gas competitive still remains a challenge. There is a strong opinion that China's coal-based energy structure is inflexible and that natural gas resources are insufficient. In fact, natural gas resources are abundant worldwide, and there is great potential for natural gas in China. For instance, China's CBM has development potential, and the development scale is not so large so as to hinder its use. Moreover, taking into account the growth momentum of shale gas, it is clear that the idea that there are not enough natural gas resources should not be a constraint.

With regard to the pricing of natural gas, the S-curve Model proposed by Japan has been used in Asia for a long time. Natural gas prices in Asia have been higher than those in international markets, the resource supply has remained adequate despite variation in the international markets, and market growth is slowing, reflecting the clamor for decoupling the natural gas price from the oil price. This year, the spot market price of LNG has inclined to become lower than the long term agreement price, reflecting the abundant supply of natural gas in the international natural gas markets and indicating that the seller's market has become a buyer's market.

The international energy pattern is undergoing changes

Energy issues are closely related to the international

political and economic situation, and I used to refer to the interweaving of political and economic factors to describe the complexity of international energy cooperation. In the field of energy, the shale revolution in the U.S. has had a huge impact, and the U.S. has become a major exporter of natural gas, whereas before it was a country highly dependent on gas imports. While reducing imports from Canada, it has also begun to export gas to Mexico, and also seeks to export to Asia and Europe so that the Middle East countries have to re-consider their own export markets, etc. These changes will be bound to affect the international political pattern and the foreign policy orientation of the U.S. The pattern of world energy is being reshaped, demonstrating a main feature of slow economic growth due to weak energy demand. Global consumption of natural gas only increased by 1.5% in 2016, 0.8% lower than the 2.3% increase in 2015, thus possibly making it the lowest growth year in history. Currently, oil prices are fluctuating around USD 50/bbl, and the spot price of LNG is generally USD 7/mmbtu. Although the U.S. has withdrawn from the Paris Climate Agreement, the general trend of global attention to global warming and reductions in greenhouse gas emissions has not been changed. Unprecedented and continuously rising importance is being attached to renewable energy and clean energy, and the proportion of clean energy will rise, as its growth is irresistible. The option of replacing coal with gas remains unchanged. This is the same case with the U.S.

China is becoming the most active participant in the global natural gas markets

China has rapidly grown into a major producer and consumer of natural gas. Moreover, its market space is very large, and its potential is far from being fully exploited. In fact, the price elasticity of city gas is also very large; for example, our per capita income is far lower than the average income of Beijing, Shanghai and Yichun, but the price of natural gas for us is RMB 4.70 per cubic meter while it is only RMB 2.27 per cubic meter in Beijing. Natural gas is still mainly used domestically in China, but demands for its use in distributed energy and energy for vehicles are also increasing. China needs to learn from and cooperate with other countries. We are bidding for the rotating presidency of the International Gas Union (IGU), and actively striving to host the 2024 World Gas Conference (WGC)—China is becoming the most active participant in global natural gas market. 