

Research article

Natural gas supply-demand situation and prospect in China

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Received 31 October 2013; accepted 25 January 2014

Available online 1 November 2014

Abstract

Since the 21st century, the reserves of conventional natural gas as well as tight gas in China have been decreasing and their annual production growth rates have been generally reduced from double-digit to one-digit number of percentage. It is predicted that natural gas production will possibly reach up to 134 billion m³ in 2015; and if the marketable rate is 90%, the gas supply volume will probably be 120.6 billion m³ in 2015. Since shale gas development just has started currently, about 0.6 billion m³ of the marketable shale gas will be added to gas supply in 2015. The CBM gas production especially such gas consumption has long been lagged behind the expected targets, and what's more, flaws exist in their statistics; on this basis, it is assumed that the marketable CBM gas will be 4 billion Nm³ in 2015. With so many achievements made in the coal gas exploitation, it is forecasted that about 5.5 billion m³ coal gas will be added to gas supply in 2015. In total, the domestic fuel gas supply is roughly estimated to be 131 billion m³ in 2015; if the gas consumption in the year is presumably 231 billion m³, about 100 billion m³ gas will then be imported in 2015. From the presumable actual imports of piped gas and LNG terminals, there is still a gap of 27–30 billion m³ in 2015. Therefore, it is suggested that more LNG receiving terminals be put into production in advance and the increment of import gas be needed from Middle Asia. Also, it is proposed that the statistics be completed on the practical marketable fuel gas quantity in the fundamental study of energy planning in the National 13th Five-Year Plan. In conclusion, the economic system reform process is the key to the further development of oil and gas industry in China.

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Keywords: China; Natural gas; Reserves; Production; Growth rate; Supply-demand situation; Marketable gas; Conventional natural gas; Unconventional natural gas; Imported natural gas

On the half way of the “12th Five-Year Plan” of China's national economic development, it is urgent to investigate the status of its implementation, get an idea of whether the corresponding targets can be reached on time, and make a plan on the research of the “13th Five-Year Plan” as soon as possible. To this end, we have analyzed the recent supply and demand situation of natural gas and fuel gas in China, and made a framework prediction on the targets that can be reached by the end of the “12th Five-Year Plan”, and made suggestions on the basic research of the “13th Five-Year Plan” for reference.

When studying the quantitative indicator system of China's natural gas, the following features of the system are worth noting, which is the prerequisite for conducting in-depth discussion. (1) China's reported natural gas production includes

both conventional gas and tight (sandstone) gas (unconventional gas). Gas production in China has been gradually pushing toward tight sandstone reservoirs with poor physical properties that require fracturing and horizontal wells to reach economic development, but since there is no clear or unified definition for tight gas, and systematic statistics on its reserves and production, its reserves and production are included in the conventional gas in report. (2) Current coal bed methane (CBM) reserves and production management are not yet in place, and the statistics from multiple sources differ widely from one another. (3) For lack of serious statistics on marketable gas, many people take the wellhead production as the market supply, which often results in an artificial gap between the supply and sale. This gap is particularly significant in CBM due to its low marketability rate [1]. (4) The fuel gas supply in China does not include coal gas (including coke oven gas), bio-gas, and other synthetic gases. But these types

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Peer review under responsibility of Sichuan Petroleum Administration.

of gas supply can no longer be ignored because they will be produced on a large scale in the future. As these types of gas get into the supply list, our study objects will also expand from natural gas into fuel gas (often called gaseous fuel abroad), which is more complex in composition.

1. Changes in China's natural gas production in recent period

1.1. Natural gas reserves

China's modern natural gas industry evolved later than China's modern petroleum industry. During the last two decades of the 20th century, it was still in the adolescent stage of fast development. The annual growth rate of Original Gas In-Place (OGIP) reached a two-digit percentage, and was approximately 17.3% during the 1990's [2].

As the base increased and there were fewer new discoveries made, however, the annual growth rate dropped to single digits at the beginning of the 21st century, slowing to 9.47% from 2001 to 2005, 8.0% from 2005 to 2010, then finally to 7.99% and 9.53% in 2011 and 2012, respectively.

What is the most noteworthy is the change in recoverable reserves. Of the newly discovered and proved natural gas reserves, the share of tight sand gas has progressively increased, while the quality of reserves has decreased. Moreover, as production has increased year after year, the annual growth rate of residual recoverable gas reserves (which are the reserves referred to in international general statistics) has decreased as a whole. Therefore, the trend of decreasing residual recoverable gas reserves became evident at the beginning of the 21st century (note that the annual growth rates of residual recoverable reserves in 2011 and 2012 were 1.37% and 2.33% lower than the annual growth rates of OGIP, respectively (Table 1). On the basis of the above points, the author predicts that the annual growth rate of OGIP and the residual recoverable gas reserves in China in 2014 and 2015 will be 8% and 7%, respectively. It is further predicted that the cumulative proved OGIP and residual recoverable gas reserves in China in 2015 will reach $13.616 \times 10^{12} \text{ m}^3$ and $3.817 \times 10^{12} \text{ m}^3$, respectively (i.e. the increases during the "12th Five-Year Plan" period will be approximately $4.48 \times 10^{12} \text{ m}^3$ and $1.09 \times 10^{12} \text{ m}^3$, respectively). Regarding the amount of newly proved OGIP, it is possible that the goal ($3.5 \times 10^{12} \text{ m}^3$) set in the "12th Five-Year Plan" will be surpassed.

1.2. Conventional gas and tight gas production

The change in China's natural gas production has clearly been periodical (Fig. 1). Production exceeded $200 \times 10^8 \text{ m}^3$ in 1996 and reached $350 \times 10^8 \text{ m}^3$ in 2003, showing an annual growth rate of 7.23%–12.73% and an average annual growth rate of 8.71%. Production exceeded $400 \times 10^8 \text{ m}^3$ in 2004 and $800 \times 10^8 \text{ m}^3$ in 2008, while this period was marked by a high annual growth rate (15.97%–18.96%, at an average of 18.07%). The annual growth rate has decreased significantly

Table 1
Change of natural gas reserves in China from 2005 to 2015.

	2005	2010	2011	2012	2015
Reserves/ 10^8 m^3	62,176	91,385	98,684	108,088	136,160
OGIP	28,185	27,257	29,061	32,154	38,165
Residual recoverable gas reserves					
Annual growth rate in this period		8.00%	7.99%	9.53%	8.00%
Annual growth rate in this period		-0.67%	6.62%	7.20%	7.00%

Notes: All raw data comes from the "National Oil and Gas Mineral Reserves Bulletin". Only data for 2015 were predicted based on annual growth rates of 8% and 7%. (Tabulated and calculated by the author.)

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