

Gas Market of China

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China – Focus of Global Gas Industry

China's population totals nearly 20% of the World total. Chinese economy is the second at a global scale after the USA. Gross Domestic Product (GDP) of China will continue to grow steadily as well as the standards of living in the country. These are the facts.

On 14 March 2011 the 12th Five Year Plan of China was endorsed by the National People's Congress. This plan sets the course of Chinese nation for the period from 2011 to 2015: the social and economic measures contained in the plan will have a deep impact on the business environment and the types of industries that will be encouraged. Natural gas as well as nuclear and renewable energy will be the focus for the next 5-10 years.

According to the plan the share of natural gas in the energy mix is expected to move from 4% (88 bcm) in 2009 to about 8.3% (260 bcm) in 2015. Much of this will come from internal supplies, and unconventional reserves are expected to play an important role in that, but significant imports are also expected. China's government key 2015 targets for natural gas are very ambitious, but there are meant to serve as indicators of how serious Chinese government is in developing the industry.

Most energy research institutes and gas industry players around the world expect scarcity of gas supplies on China's gas market, and this entire situation to be a trigger for golden age of gas at a global scale, as depicted by the IEA in a recent report.

But is it so? Is Chinese gas industry ready for such a rapid growth in demand? Are the conditions of the country's market suitable for gas producers to supply? Do we see indeed the deficit of gas in China in the long-term?

Aims

Review and analyze long-term gas demand on China's market, identify supply possibilities, explore opportunities to further develop and grow gas market of the country, identify emerging issues and challenges in developing and growing this gas market, summarise China's gas balance for the long-term period.

China: Country analyses

China has the third-largest area in the world (9.6 million km²), after Russia and Canada. The state was founded in 1949 with the capital in Beijing. The population of the country is nearly 1,300 million. The national currency is the Yuan.

China has administrative control over 22 provinces, 5 autonomous regions (where national minorities reside), 4 cities under central control and 2 special administrative regions (Figure 1).



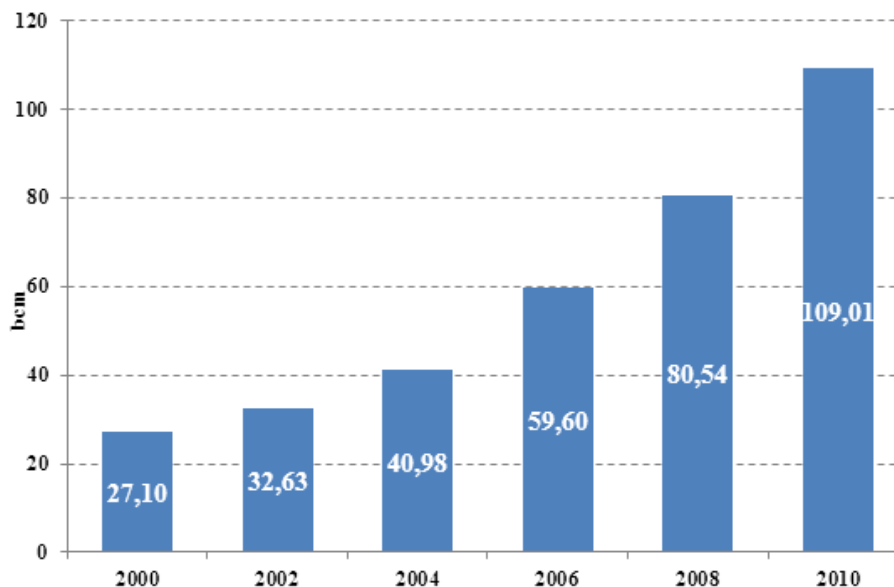
Figure 1. Administrative division in China

China's terrain is heterogeneous, with high mountains, plateaus, valleys, deserts and large plains. The climate also differs: from subtropical in the south to mild in the north.

China is rich in fuel and raw mineral resources and has deposits of nearly 150 kinds of the world-known natural resources. Deposits of coal, oil and iron ore are of high significance. Primary energy source is coal, which deposits in China account for one-third of the world's total deposits. The biggest mines in China are in the Shanxi province.

Demand: History and trends

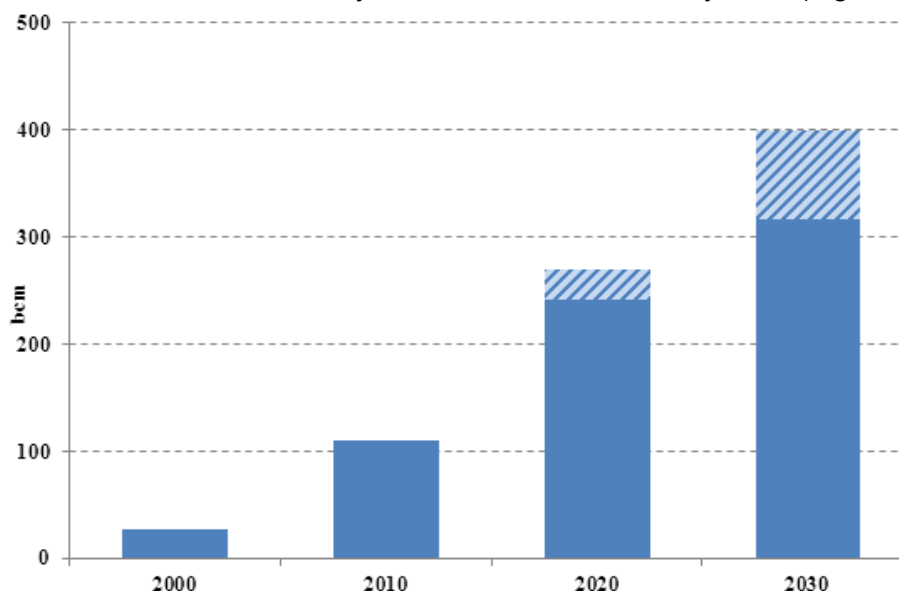
China's gas consumption in 2009 accounted for 89.6 bcm and 109.0 bcm in 2010, having grown by almost 4 times in the latest decade (Figure 2).



Source: Cedigaz

Figure 2. Evolution of gas consumption in China, 2000-2010

The highest level of consumption is in Sichuan, Shaanxi, Guangdong and Hebei provinces, the cities of Beijing and Chongqing and in the Xinjiang autonomous region. Their share of the total gas consumption in the country is nearly 50%. China's gas consumption is expected to grow over a period of decades. Our estimations show that the level of gas consumption can reach 240-270 bcm by 2020 and 315-400 bcm by 2030 (Figure 3).



Source: Cedigaz, JSC Gazprom

Figure 3. Gas demand in China, 2000-2030

Key drivers and levers for gas demand growth

Despite the growth in the previous decade, the share of natural gas in China's energy consumption mix is the smallest.

Majority of the gas consumption is dominated by industrial users, the recent growth in the past few years stems from the power, utilities, and residential sectors.

Each economic segment has its own drivers for the growth in gas consumption.

Demand for gas in China's residential sector is based on the three main drivers: urbanization, gas supply availability to populated areas and the gas consumption growth per household.

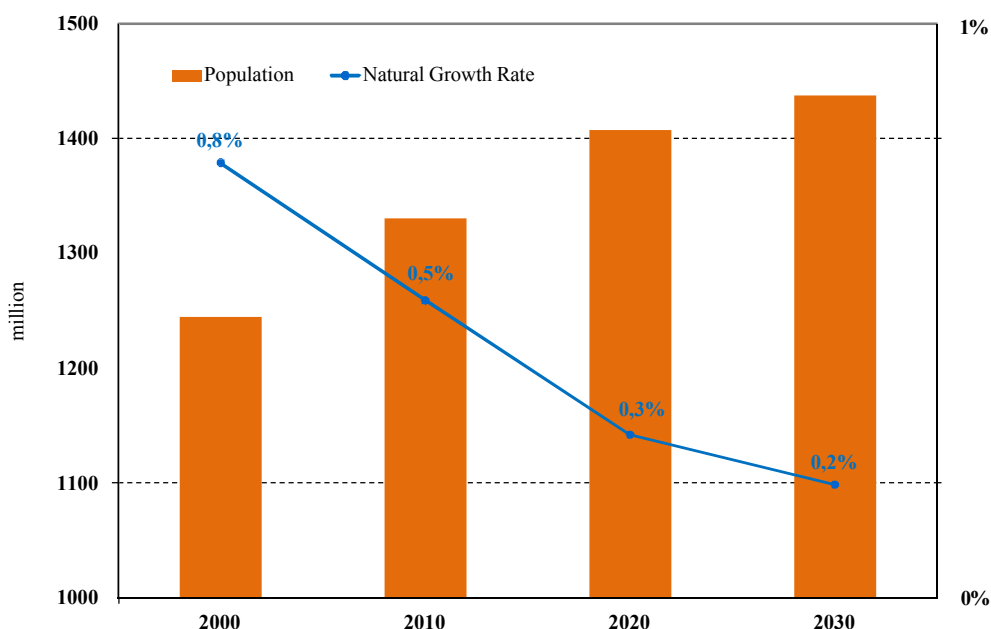
Demand for gas in industry is based upon several sectors – mainly the chemistry (including the production of fertilizers), and in some areas of the valuables production (for example, glass and porcelain production). The growth of industrial consumption will be driven by two factors: the general growth rate of Chinese economy – new demand and increasing share of gas in the total energy mix – demand from substitution.

Development of gas consumption in power generation is the main source of uncertainty and it highly depends on the government policy. As measures to alleviate high pollution from the country's heavy coal use, boosting the share of gas in the fuel mix as well as the increasing availability of this energy source (especially in large urban areas) will undoubtedly lead gas consumption growth in this sector.

Growth factors and levers

Population growth. Currently China's population totals nearly 1,300 million people or 20% of the total world population. Already in 1950 the country's population exceeded 550 million people, and by the early 1980-s reached 1,000 million. Because the government introduced a legislative limit on the number of children in a family, the so-called one-child limit, which resulted in the lower population growth rate and the decrease in the number of

children born by a woman during her lifetime – from 5.8 to 1.8. Despite the fact that the figure of 1.8 is smaller than that of 2.1 necessary to keep the population size stable, experts forecast the growth of China's population till early 2030-s resulting from migration process and the decrease in the death rate among new-born babies (Figure 4). Only after 2030 is the population size forecasted to gradually decrease.



Source: CIA World Factbook, National Bureau of Statistics of China

Figure 4. Population, 2000-2030

GDP and standards of living. China's economy was growing together with the population. Today the country's economy is the second in the world after the USA in terms of nominal Gross Domestic Product (GDP) and GDP allowed for currency parity. According to the National Bureau of Statistics of China the country's GDP totalled nearly 6 trillion USD in 2010, having grown by 10.3% compared to 2009. The key drivers for GDP growth in recent years were large capital investments, increase in household savings and labour production. Still, a number of experts believe that such rapid economic growth (10-13% per annum in 2003-2007) against the world economic crisis can point to an economic overheating in China. The GDP growth rate can show a slowdown to 7.2% by 2020 and 5.5% by 2030.

In 2009 the GDP per capita accounted for nearly 6,500 USD, and the average household disposable income – nearly 1,600 USD. Nearly half of household expenditures go to foodstuff (43% – in rural areas, 40% – in urban areas).

Life expectancy is 73 years. Life expectancy in the country may reach 74.9 years by 2020 and 76.6 years by 2030. At the same time GDP per capita may increase up to 7,500-8,500 USD by 2020 and 14,200-15,600 USD by 2030.

Improvement of the standards of living in China will be connected with the urbanization process. The urbanization of Chinese population has been steadily growing in the recent decade. The increase in urban population (with relatively stable population in the country) amounted to 200 million people. In the long-term this trend can continue but at a lower rate. For the following two decades the total urban population can also grow by 200 million people.

Energy mix

In the recent decade the structure of energy consumption has gone through certain changes (Table 1). The share of gas has almost doubled up to 3.6%. The shares of oil and coal have decreased by 3 and 1 percentage points respectively. Thus, on the whole the modern structure of consumption of primary fuel and energy resources continues to be based on coal (70%) and oil (19%). The share of natural gas is the smallest.

Table 1. Structure of primary fuel consumption and energy sources in China, %

	1998	2010	2020	2030
Gas	2.0	4.0	5.3-6.0	6.8-7.7
Oil	21.5	17.6	17.0-18.0	16.5-17.0
Coal	71.1	70.5	68.0-68.5	60.0-65.0
Other	5.4	7.9	7.3-10.0	9.5-16.4

Source: BP Statistical Review of World Energy 2011, JSC Gazprom

In the considered term China plans to gradually increase the share of gas. According approved 12th Five Year Plan the share of gas is aimed to be 8.3% in the country's primary energy mix by 2015. But taking into account extent of industry's infrastructure development and availability of gas supply (both pipeline and LNG), gas share in energy mix will most probably be 5.3-6.0% by 2020 and 6.8-7.7% by 2030, still the smallest one, accompanied with reducing the share of coal to 68.0-68.5% by 2020 and 60.0-65.0% by 2030.

Today the largest gas consumer in China is the industrial sector (over 60%). In the considered term its share will decrease to 50% with the simultaneous increase in energy sector from 9% in 2010 to 17-26% in 2030 (Table 2).

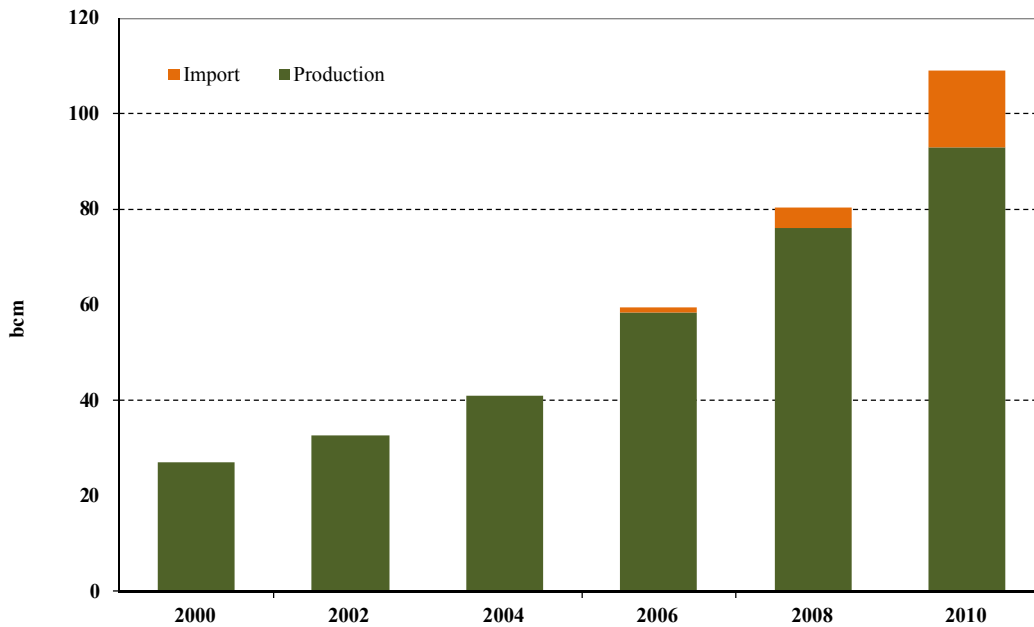
Table 2. Gas consumption by sector in China, %

	2000	2010	2020	2030
Residential sector	16	21	19-20	18-22
Industrial sector	67	61	54-58	45-51
Energy sector	2	9	12-17	17-26
Others	15	9	10-11	10-11

Source: BP Statistical Review of World Energy 2011, JSC Gazprom

Supply: History and trends

Increase in the demand for gas requires sufficient sources of supply. With the construction of the first regasification terminal in 2006 liquefied natural gas started to be imported. Prior to that time the country was self-sufficient with gas due to intensive gas exploration and natural resources exploitation (Figure 5).



Source: Cedigaz

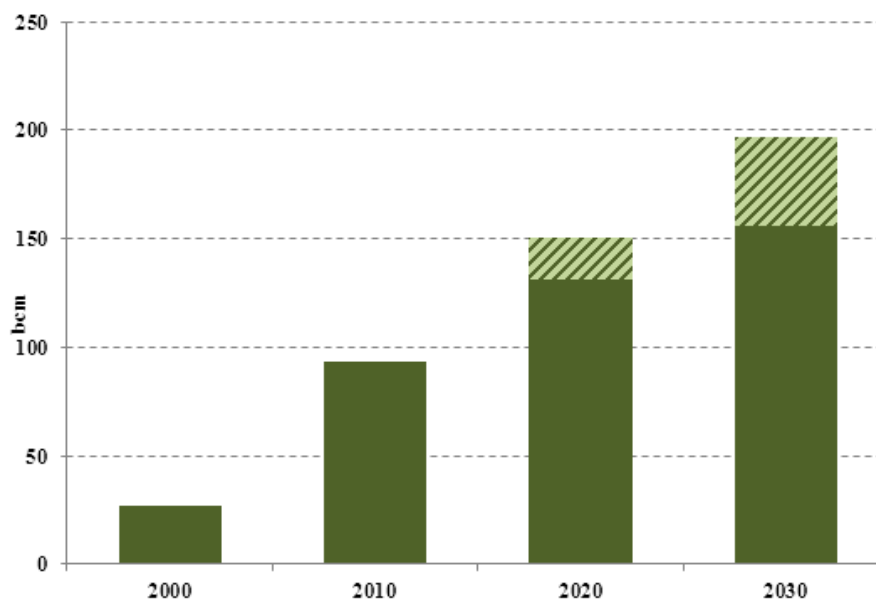
Figure 5. Gas supply to China, 2000-2010

Domestic supply

Total domestic resources of natural gas according to the Ministry of natural and land resources of China account for 35 trillion cubic meters. Much of them are explored by less than 20%, which indicates that relatively large gas deposits are still likely to be discovered. The potential of unconventional gas resources of the country is considerable, but the exact amount of unconventional gas will be determined only after extensive exploration.

Gas production in China is growing at high rate. In the latest decade it has grown significantly – from 27 bcm in 2000 to 93 bcm in 2010. Production growth resulted from the development of new fields discovered in the second part of 1990-s – early 2000-s, such as Kela 2, fields in the northern part of the Tarim Basin (the resource base of North-West pipeline), large deposits of the Ordos Basin (Sulige), the Qaidam Basin (Sebei 1, Sebei 2), the shelf of the South China Sea (Dunfan 1-1) and others.

According to our estimates, gas supply (excluding gas for technological needs, transport and shrinkage at gas refinery) may grow to 130-150 bcm by 2020 and 160-200 bcm by 2030 (Figure 6), while unconventional gas production (shale gas and CBM) may grow to 20-40 bcm by 2030.



Source: Cedigaz, JSC Gazprom

Figure 6. Domestic gas production in China, 2000-2030

External supply

China imports natural gas either in the form of pipelined gas or as LNG (Table 3).

Table 3. Gas import in China 2010-2030, bcm

	2010	2020	2030
Pipeline gas	3.6	105-125	130-145
– Central Asia	3.6	50-65	65
– Myanmar		5-10	5-10
– Russia		50	60-70
LNG	12.4	50-65	63-140
Total	16.0	155-190	193-285

Source: Cedigaz, JSC Gazprom

Pipeline supply

Central Asia. Gas pipeline from central Asia with the length of nearly 7,000 km and pass-through capacity of 30 bcm per annum goes through the area of Turkmenistan, Uzbekistan and Kazakhstan. It will include 2 pipes 1067 mm in diameter each. The first pipe was put into operation in the late 2009. According to the new agreement between China and Turkmenistan, which was signed in November 2011, Chinese gas supply from Turkmenistan will grow from current level of 17 bcm (plan for 2011) to 40 bcm in 2012 and to 65 bcm in the long-term period.

Myanmar. There is a memorandum of intent between China and Myanmar on the construction of the pipeline with the length of 2,800 km and the pass-through capacity of 6-10 bcm per annum. Gas will be supplied to the southern regions of China starting from 2012-2015.

Russia. It is considered practical to build pipelines from Russian across East and West parts of Russia-China borders. After signing the contracts the parties will be able to launch construction of the Russian and Chinese parts of the pipelines. Natural gas supply through the western corridor is expected to begin after 2015. That through the eastern corridor can be organized after 2017.

LNG

In 2006-2010 China was importing LNG both in the framework of long-term contracts with Australia, Indonesia and Malaysia and spot contracts (on less beneficial terms) with Algeria, Egypt, Equatorial Guinea, Nigeria, Oman, Russia, Qatar and Trinidad Tobago (Table 4). In the long-term China is planning to sign contracts with new exporters of LNG in order to diversify supply sources.

Table 4. LNG import in China 2006-2010, bcm

	2006	2007	2008	2009	2010	Total
Algeria		0.42	0.17			0.59
Australia	1.00	3.30	3.61	4.75	5.21	17.87
Egypt			0.25	0.08	0.08	0.41
Equatorial Guinea			0.16	0.08		0.32
Malaysia			0.01	0.88	1.57	2.57
Nigeria		0.08	0.24	0.08	0.17	0.57
Oman		0.07		0.09		0.16
Russia				0.25	0.51	0.76
Indonesia				0.72	2.27	3.17
Qatar				0.55	1.61	2.16
T&Tobago				0.08	0.07	0.15
Peru					0.08	0.08
UAE					0.08	0.08
Yemen					0.70	0.07
Reloading					0.08	0.08
Total	1.00	3.87	4.44	7.56	12.43	29.04

Source: Cedigaz, BP Statistical Review of World Energy 2011

Infrastructure: Existing infrastructure and Future plans

LNG terminals. China has 5 regasification terminals, 2 are under construction, and the construction of 9 more is planned (Figure 7).



Source: JSC Gazprom

Figure 7. Regasification terminals in China

If all proposed regasification terminals will be commissioned, their total capacity will be able to reach 76-106 bcm after 2020. The maximum production capacity by the end of the period will be concentrated in the following provinces: Guangdong (16%), Hebei (13%), Jiangsu (13%), Shandong (12%) and Zhejiang (12%).

Pipeline grids. Chinese national pipeline grid (Figure 8) is still developing. Currently it is based on the major pipelines East-West, Shaanxi (Ordos)-Beijing 1, 2, Sichuan-Wuhan, Sebei (Qaidam)-Xining-Lanzhou, and the interconnecting pipelines of Hebei-Nanjing (between the pipelines Shaanxi-Beijing 1, 2 and East-West) and Huaihe-Wuhan. In the beginning of 2009 the total length of gas pipelines in China accounted for 32 thousand kilometers. In 2009 the country completed the construction of the Puguang (Sichuan)-Shanghai (Sichuan-East) gas pipeline, ring pipelines in the Sichuan and Jungar basins, and local pipe networks in the north of China and in the delta of the Yangtze River. Then regional pipelines in the central part of the south and in the delta of Zhejiang were completed.

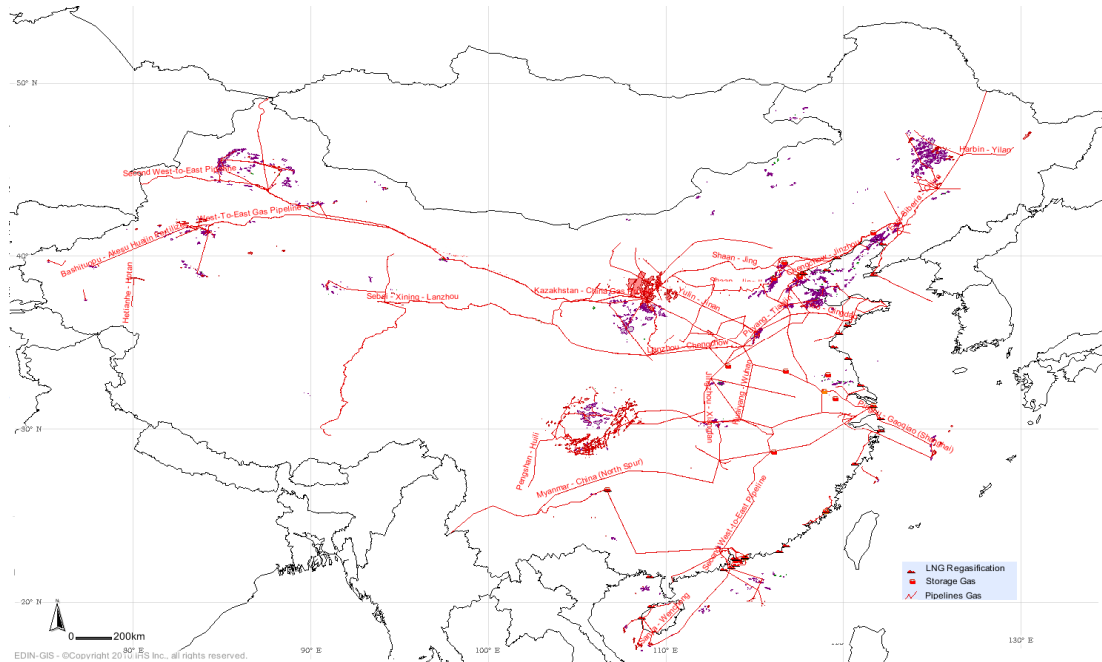


Figure 8. Chinese gas pipeline system

China is very interested in rapid expansion of gas pipeline system. The West-East 2 pipeline was a key object in 2010. Other important objects are the gas pipeline Yuling-Jinan, the pipelines of Shaanxi-Beijing 3, Qinhuangdao-Shenyang, and Taian-Qingdao. Chinese national pipeline network is planned to cover 8 large regions and to transport both domestic and imported gas. The basis of the network will be the pipelines West-East 1-3, Sichuan-East, Shaanxi-Beijing and Sichuan-Wuhan.

Regulatory framework: Government policy

In China gas is more expensive energy source compared to coal. This explains its limited usage in the energy sector and other sectors where coal is an alternative fuel. Limited use of gas is also stipulated by the legislation. The National Development and Reform Commission (NDRC) has issued a policy document concerning the use of gas in various economic sectors (Table 5).

Table 5. Priority sectors of gas consumption in China

Sector	Gas Usage	Consumers
Residential sector	Priority	<ul style="list-style-type: none"> - City residents (e.g. cooking, heating, etc.); - Public facilities (e.g. airport, schools, hotels, restaurants, offices, etc.); - Natural gas vehicles (especially hybrid); - Combined cooling, heat and power system.
	Allowed	<ul style="list-style-type: none"> - Centralized heating (for city centres); - Individualized heating; - Central air-conditioning.
Industrial sector	Allowed	<ul style="list-style-type: none"> - Substitution of oil, LPG and coal in certain industries* ; - Interruptible consumers in certain industries* .
Energy sector	Allowed	- Peak-sharing power generation in important areas with sufficient gas supply.
	Restricted	- Non-essential power generation.
	Prohibited	- Base-load generation in 13 major coal base areas** .
Chemical	Allowed	- Hydrogen production with low gas consumption and

industry		good economics; - Nitrogen fertilizers production using gas that is not suitable to be transported elsewhere or cannot be absorbed by other priority or allowed users.
	Restricted	- Gas-based ammonia production plants that have already been built or transformed from coal-based; - Carbon-1 chemical projects using methane; - New gas-based ammonia projects.
	Prohibited	- New or expansion gas-based methanol projects; - Substitution of coal feedstock for methanol projects.

* construction materials, machinery and electrical, light textiles, petrochemical, metallurgical industries, etc.; ** Shaanxi, Inner Mongolia, Shanxi, Anhui, etc.

Source: Gao Hua Securities Research

Key players

The key players of the China gas market are large national and local regional companies, state authorities (at the first place – The National Development and reform Commission) and some foreign companies.

In general China's gas sector is divided between three largest national companies – PetroChina (subsidiary of China National Petroleum Corp.), China Petroleum & Chemical Group (Sinopec) and China National Offshore Oil Corporation (CNOOC).

Among the foreign companies which do business in China: BP, Chevron, Exxon and Royal Dutch/Shell should be mentioned. They perform exploration and exploitation of gas fields and manage gas loading facilities within China's borders.

CNPC is China's largest oil and gas producer and supplier, as well as one of the world's major oilfield service providers and a globally reputed contractor in engineering construction, with businesses covering petroleum exploration & production, natural gas & pipelines, refining & marketing, oilfield services, engineering construction, petroleum equipment manufacturing and new energy development, as well as capital management, finance and insurance services.

Sinopec Corp. is a Chinese company listed in Hong Kong, New York, London and Shanghai with integrated energy and chemical operations. The principal operations of Sinopec Corp. include:

- exploring and developing, producing and trading crude oil and natural gas;
- processing crude oil into refined oil products, producing refined oil products and trading, transporting, distributing and marketing refined oil products;
- producing, distributing and trading petrochemical products.

China National Offshore Oil Corporation (CNOOC) is the largest offshore oil and gas producer in China. Established in 1982, the Company has its headquarters in Beijing. CNOOC has maintained rapid growth and a reputation for quality since its incorporation. It has evolved from an upstream company into an integrated energy company, possessing high performance core business and other related businesses along the value chain. The Company is built upon synergetic business portfolios including:

- upstream (oil and gas exploration, development, production and sales);
- mid and downstream (gas and power, chemicals, refinery, fertilizers);
- technical services (oilfield services, offshore oil and gas engineering and construction, logistics services);
- financial services;
- alternative energy.

Pricing policies and tariff structure

Prices for natural gas in China are regulated by central and regional state authorities and have the following three components:

- well-head price;
- transportation fee by main pipelines (till gas distribution system);
- transportation fee by urban pipelines.

The sum of the first two components determines the city-gate price. The retail price for end users is equal to the sum of all three components (Figure 9).

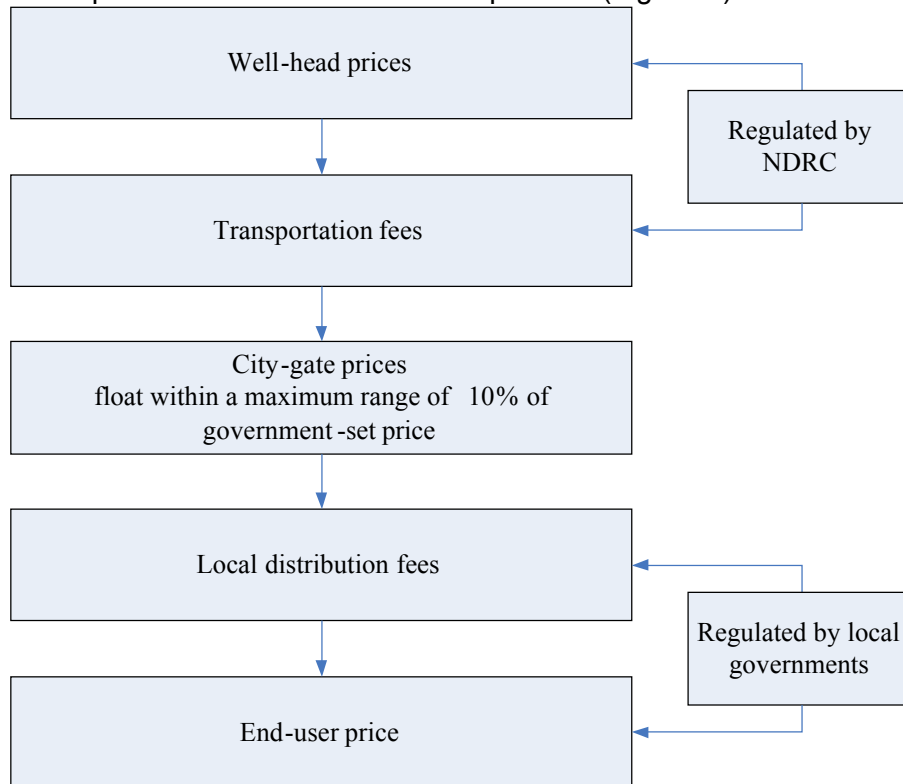


Figure 9. Gas pricing in China

Well-head price of the gas for onshore fields is regulated by NDRC. Well-head price for offshore fields (developed by CNOOC) is formed during negotiations of the company with consumers. As estimated by GaoHua Securities Co. in 2008 the prices for gas produced by CNOOC at offshore fields were 13% higher than those at onshore fields. They were 36% higher in 2004.

The set level of well-head prices depends on the certain gas basin and doesn't take into account the actual cost of hydrocarbons extraction from each field.

Transportation fee usually varies and depends on the distance of transportation.

In the late 2005 a national pricing reform took place in China – the first one in 8 years. NDRC has issued a directive, the essence is as follows:

- simplification of categorization of fields and consumers;
- transition from prices set by government to prices regulated by government;
- introduction of links between well-head prices and the cost of alternative fuel sources;
- increase of gas prices and decrease of price inequity between gas fields of different types.

The latest change in the pricing system took place in 2010 when gas prices were increased for all groups of consumers. Today there are three types of consumers in China – fertilizer producers, industrial sector and city residents (residential sector and small

companies). Prices are set up for each category of consumers for each gas basin. Domestic gas prices in China are lower compared to other countries and types of fuel. Contradiction between domestic gas prices and international prices, at which the country imports the energy resource, led to growth of basic domestic prices. By this measure the government is trying to stimulate economic consumptions of resources, regulate correlation of prices for gas and other types of fuel, and carry out the policy of reasonable gas use. The growth of prices together with establishment of transparent pricing system can create stimuli to increase in domestic production from more expensive sources to meet the growing demand.

Figure 10 provides average gas transportation fees by different pipelines, regulated by NDRC.



Figure 10. Average gas transportation fees in China

Summary/ Conclusions

China's gas market does show the high potential growth in natural gas demand. We will see in the coming years further growth in gas consumption and in demand for imported gas. All forecasts of China's market evolution are very ambitious. Such rapid growth of gas consumption makes this market very fragile, the future of this market is highly depended on the government policies and efforts from industry players.

But since natural gas pipeline network of China is still young, one of the biggest challenges is necessity of rapid and sufficient infrastructure development as well as the implementation of pricing policies to transition gas prices at a higher cost import slate, in lieu of largely regulated domestic gas prices.

Before that gas demand in China is – and will likely for some time – remain constrained by the availability of gas supply. With natural gas accounting for a small percentage of overall energy demand the potential to realise future growth will, however, be dependent on the ability to grow supply. This will mean reliance not just on increasing volumes of domestic supply, but also on importing gas – both pipeline and LNG.

In order to adequately develop the market infrastructure further liberalization of the industry is needed. And key challenge for China is the regulation of gas prices. Although a series of price reforms have been undertaken – and more are anticipated, the cost of

imported natural gas is raising the overall cost of supply. This is creating a challenge in the near term for policy makers who remain concerned about the social and inflationary impact of future price increases.

The share of imported gas in China is expected to reach almost 55% in 2030. But if all of proposed gas import projects in the country will be commissioned (both pipeline and LNG) by the end of forecasted period, this highly promising gas market will be oversupplied (Table 8).

Table 6. Gas consumption balance in China 2010-2030, bcm

	2010	2020	2030
Domestic production	93.0	130-150	160-200
External supply	16.0	155-190	193-285
- pipeline gas	3.6	105-125	130-145
- LNG	12.4	50-65	63-140
Supply	109.0	285-340	353-485
Demand	109.0	240-270	315-400
Demand-Supply Gap	0	(45)-(70)	(38)-(85)

Source: Cedigaz, JSC Gazprom

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