Russia's Dilemmas about China's Gas Market

Elena Shadrina*

Abstract

Russia has abundant gas resources located in direct proximity to China and is able to satisfy a significant share of gas demand of the world's second largest economy. For long, Russia's attempts to enter China's rapidly growing gas market were to no avail. Despite the eventual conclusion of a long-negotiated Sino-Russian gas contract in May 2014, some uncertainties about Russia-China gas cooperation persist. The article addresses the Chinese gas market principal trends, examines Russia's current position as China's supplier and scrutinises Russia's China-bound gas export potential. The article explores whether Russia's interest to further expand in China's gas market can materialise and how Russia needs to act in order to attain this goal.

Keywords: China, Russia, natural gas, Power of Siberia gas pipeline

Introduction

The Ukrainian crisis of 2013-2014 revealed the risks of Russia's overdependence on European energy demand, making clear that export diversification should be Russia's rational choice allowing it to alleviate its vulnerability vis-à-vis European markets. Under the new circumstances of the sanctions initiated by the USA and the EU and supported by Japan and some other countries, Russia turned more orientated towards China, and in May 2014 signed what was dubbed a historic gas deal.[1] While the scope of Russo-Chinese gas cooperation is not limited to this large-scale contract and while it is still too early to assess the impact of this newly-struck agreement, it seems worthwhile to examine the overall potential for the bilateral gas cooperation.

China's gas market is exceptionally attractive to any gas exporter. In 2012, it was the fastest growing gas market, accounting alone for 40 per cent of additional gas consumption among non-OECD countries. While in 2013 China's GDP grew by 7.7 per cent (in the preceding three decades it averaged 9.8 per cent), the country's gas consumption increased by 13 per cent. A result of the rather modest expansion in domestic gas output (of less than 9 per cent), China's gas imports rose by 25 per cent in 2012 (Du 2014). By 2035, China's natural gas production is predicted to grow by 232 per cent, while its demand is expected to rise by 322 per cent. Hence, China's gas imports will continue to increase causing import dependency to exceed 40 per cent by 2035 (BP 2014) from 31.6 per cent in 2013. Over the next few years China is expected to surpass the world's third largest gas user, Iran (IEA 2013) and by 2025 to overtake Russia as the world's second largest gas consumer (BP 2014). Until 2018, China's gas demand is projected to grow by 12 per cent annually and the country will absorb one-third of new LNG supplies worldwide (IEA 2013).

The imperative factors driving China's gas consumption are: rising energy use associated with economic growth, continuing urbanisation and industrialisation (Wang and Lin 2014), recovery of China's relatively energy-intensive exports from the 2008 crisis (Li et al. 2014), increasing role of gas in China's energy mix as a part of the government's pollution mitigating policies, etc. Overall, China's energy mix is dominated by coal (some 68 per cent), but the role of natural gas is increasing. It is projected to rise from the current 5.9 per cent (Du 2014) to 10 per cent by 2020 (IEA) and 12 per cent by 2030 (CNPC). Certainly, as China's economic growth decelerates and industrialisation, electrification and motorisation continue at a more moderate pace, China's gas demand growth rates will also be lower (BP 2013, 2014). Even so, owing to its present large scale and significant potential for further growth, China's gas market will remain one of the most attractive.

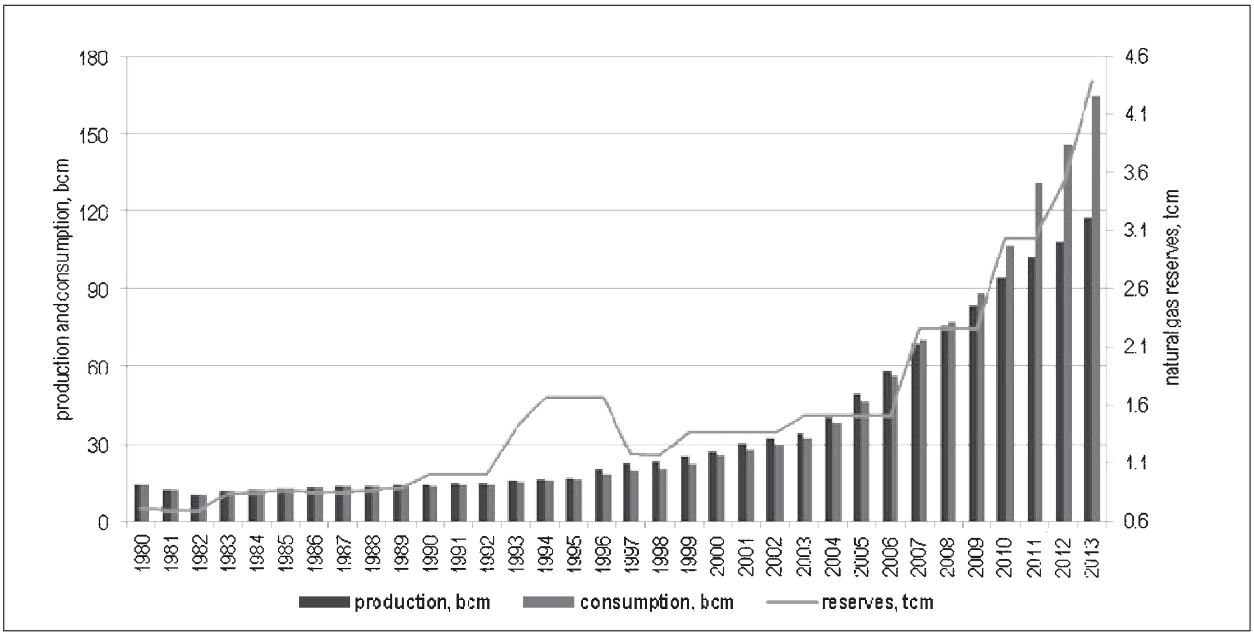
The article discusses the possibility for Russia to increase gas exports to China. The study analyses the trends in China's gas market, characterises the country's current gas supply-demand balance and its import needs. It discusses Russia's current role in the Chinese gas market and overviews Russia's China-oriented projects. While evaluating Russia's opportunities to expand into the Chinese gas market, the article gauges the match between the timing and volume of gas flows as required in China and planned by Russia. The concluding section proposes policy implications related to Russia's gas policy vis-à-vis China.

1. China's Gas Supply – Demand Balance

1.1. Reserves

Since the 1978 Reform and the Opening-Up, five major national oil and gas resource assessments have been implemented (Wang et al. 2013). China's natural gas reserves have been increasing[2] due to the advancement of innovations in geological theory and progress in exploration technology, but data on conventional gas reserves vary widely. While China's domestic assessments agree that the country's recoverable gas resources range from 7 tcm to 10 tcm (Wang et al. 2013: 691-93), the external agencies, such as BP (2013), estimate China's proved gas reserves at 3.1 tcm and EIA (2014) refers to 4.4 tcm (Figure 1). The discrepancy in reserves classifications and terminology is one of the reasons for data inconsistency.

Figure 1: China's Natural Gas Reserves, Production and Consumption, 1980-2013



Source: composed by author.

Gas resources are unevenly distributed across China. The main deposits are located in the western and central regions, whereas consumption concentrates in the eastern coastal areas. Three major basins - Ordos, Tarim and Sichuan - contain more than half of China's total proved reserves (Higashi 2009: 7). In the Ordos basin (11 tcm), the flagship field is Sulige 6 with 1.69 tcm reserves. In the Sichuan basin, Longgang (700-750 bcm) and Puguang (412 bcm) are the biggest fields. The recent discovery of the Yuanba field adds reserves of 160 bcm. The largest deposits in the Tarim basin are Kela 2 (284 bcm), Dina 2 (175 bcm) and Dabei 3 (150 bcm). Besides, China possesses the world's largest technically recoverable shale gas resources of 32.7 bcm[3], most of which are concentrated in Sichuan and Tarim (Golden Rules 2012: 115), but also in Jianghan, Junggar, Songliao, Subei and Yangtze Platform (Map 1).[4]

Map 1: Major Unconventional Natural Gas Resources in China

Source: Chrisman 2014

1.2. Production

China's domestic gas production has been increasing from 94.4 bcm in 2010 to 102.8 bcm in 2011, 108 bcm in 2012, and 117.6 bcm in 2013. However, the production growth rates (12 per cent, about 9.6 and 9 per cent respectively) were significantly lower than the growth in demand. The increase in domestic production is imperative to national gas policy.

China's primary sources of conventional supply are in Sichuan Province (Puguang in the Sichuan basin produced 10 bcm in 2012), the Xinjiang and Qinghai Provinces in the Northwest

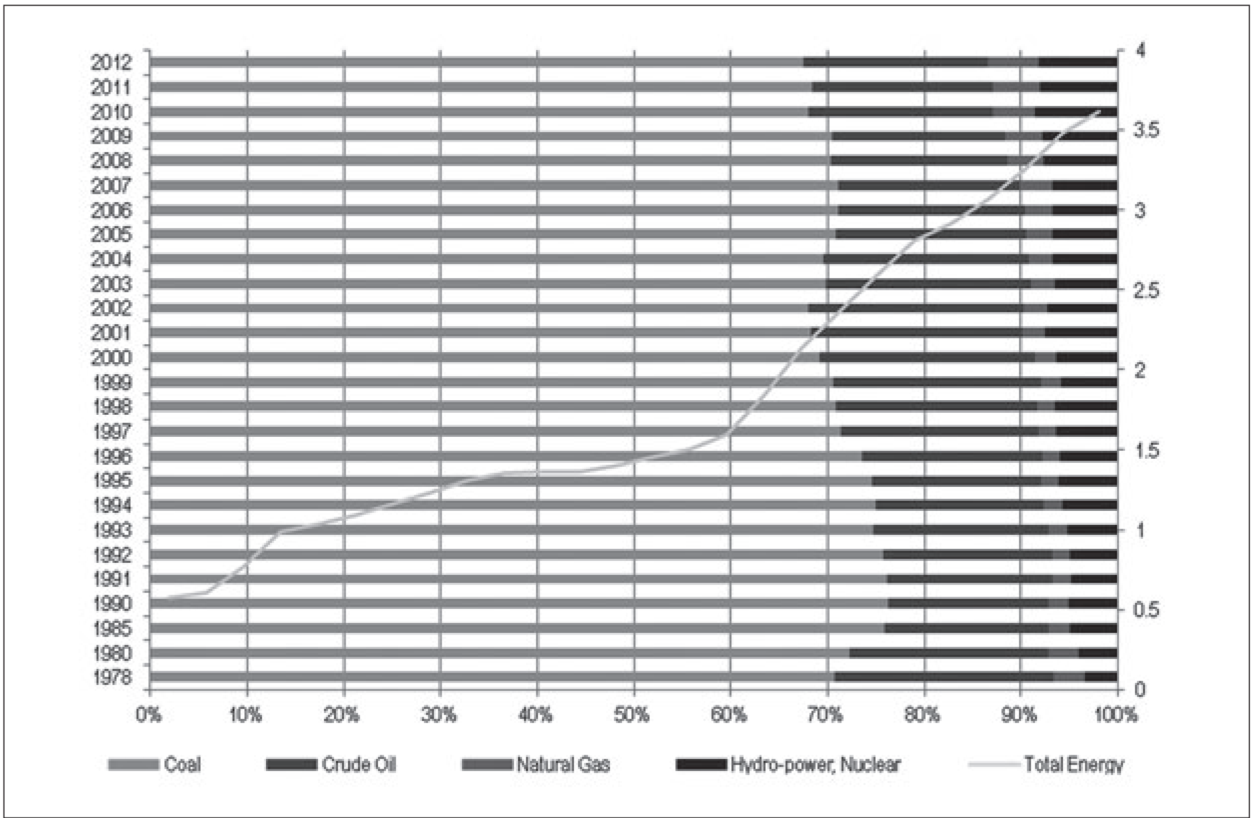
(Tarim basin produced 19.3 bcm in 2012), Junggar and Qaidam basins and Shanxi Province in the North (the Changqing field in Ordos basin produced nearly 30 bcm in 2012). There are also offshore gas producing fields in the Bohai basin and the Panyu complex of the Pearl River Mouth Basin (the South China Sea). By 2015, China plans to increase conventional gas production to 138.5 bcm. Of this, Sichuan Basin is projected to produce 41 bcm, Ordos – 39 bcm, Tarim – 32 bcm and South China Sea – 20 bcm[5]. The development of unconventional sources of gas is emphasised as a realistic way to reduce China's increasing import dependency. In 2013, China's shale gas production was 0.2 bcm (up from just 0.05 bcm in 2012),[6] while coal-bed methane (CBM) totalled to 3 bcm. China's targets for CBM production are 16 bcm (30 bcm) by 2015[7] and 50 bcm by 2020; for coal-to-gas (CTG) or synthetic natural gas (SNG) - 15-18 bcm by 2015 and 80 bcm by 2017; and for shale gas - 6.5 bcm by 2015[8] and 100 bcm by 2020. Based on China's 12th FYP, the total output from unconventional sources would add over 40 bcm by 2015 and 190-230 bcm by 2020. The recent estimates by the IEA and EIA on China's unconventional gas production are more cautious. For instance, the IEA projects China's tight gas, shale gas and CBM production at 17.2 bcm in 2015. Wood Mackenzie estimates China's 2020 shale gas output at some 11 bcm.[9] The overall assessments of the achievability of China's goals for unconventional production are predominantly sceptical (Hu and Xu 2013, Kushkina and Chow 2013, Rattanavich et al. 2013, etc.). There is certain reason to assess the Chinese government's projections for unconventional gas production as overambitious. While in China's 11th FYP (2007-2011) the 2010 target for CBM production was 8 bcm, actual output was less than 4 bcm.

Complex geological structure (faulting, high tectonic stress, etc.), location in seismically active areas, primitive drilling technologies, high production costs, etc. have been frequently cited as factors impeding the rapid commercialisation of China's shale gas. However, the more Chinese companies report on their progress,[10] the faster the earlier pessimistic assessments are being revised.[11] Platts estimates China's 2030 unconventional gas production at some 150 bcm and total domestic output at around 300 bcm.[12] Assessing two scenarios (high and low unconventional gas production), the IEA 2012 projects China's 2020 gas production at 246 bcm and 139 bcm, and the 2035 two scenario assessments are 473 bcm and 194 bcm respectively.

1.3. Demand

For about a decade China's gas consumption has been growing at a two-digit rate. In 2010, China consumed 106.7 bcm, demonstrating a 20.6 per cent y-o-y. In 2011, gas consumption increased by 22.7 per cent to 130.1 bcm. Further growth of 11.4 per cent to 146.6 bcm and almost 15 per cent or 167.7 bcm was recorded in 2012 and 2013 respectively. China remains a coal-dominated economy (Figure 2), although the role of natural gas is increasing rapidly. In 2013 share of natural gas in the primary energy mix was almost 6 per cent, while the 12th FYP target is 8.3 per cent by 2015.

Figure 2: China's Total Consumption Energy and its Composition

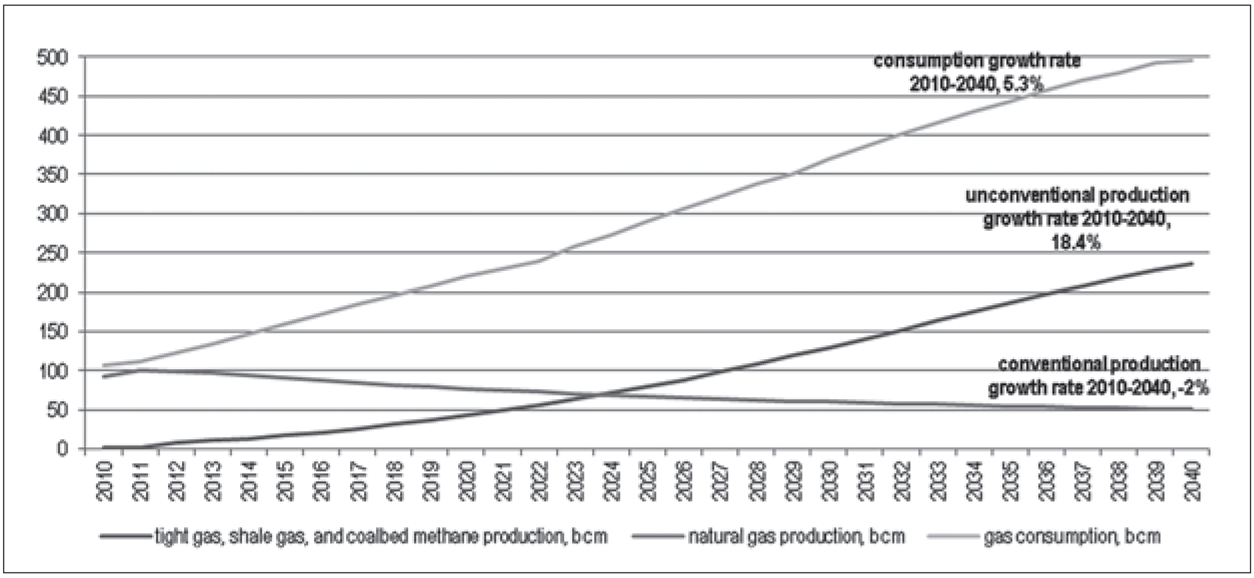


Source: composed by author based on data <http://www.stats.gov.cn/tjsj/ndsj/2012/html/G0702e.htm>

There is significant difference between the international agencies' estimates and those by the Chinese government regarding China's future natural gas demand. The Chinese experts (Lin 2012: 227, Paik et al. 2012: 3, Wang et al. 2013: 695) tend to agree that by 2030 China will consume no less than 400 bcm. While the IEA envisages China's 2015 gas demand at 159 bcm, the Chinese NDRC assesses it at 230 bcm. Estimates by the Chinese government may be more accurate, as, for instance, in 2010 the IEA predicted China's 2012 gas consumption at 123.1 bcm, while the actual 2012 demand reached 146.6 bcm. The IEA (2011) forecasts China's 2030 demand at 535 bcm and 2035 demand at 634 bcm. CNPC assesses China's 2030 gas demand based on three scenarios as 400, 500 and 550 bcm, showing that China's gas demand includes many uncertainties and is sensitive to many factors. One of the key parameters defining China's gas demand is economic growth, which has become weaker (about 7.5 per cent a year). Even so, China's continuous economic development translates into continuous growth in energy demand. Also, the Chinese government aims at a new quality of economic growth for which the decreasing carbon and energy intensity become important policy denominators. The Chinese government environmental targets[13] confirm that the deteriorating environmental situation is one of the most significant factors defining China's energy policy. Natural gas will replace the diminishing share of coal in the country's energy mix, thereby playing an increasingly important role.

In either scenario, high or low domestic unconventional gas production, China's supply-demand imbalance is widening (Figure 3).

Figure 3: IEA 2012 Forecast on China's Demand and Production, 2010-2040

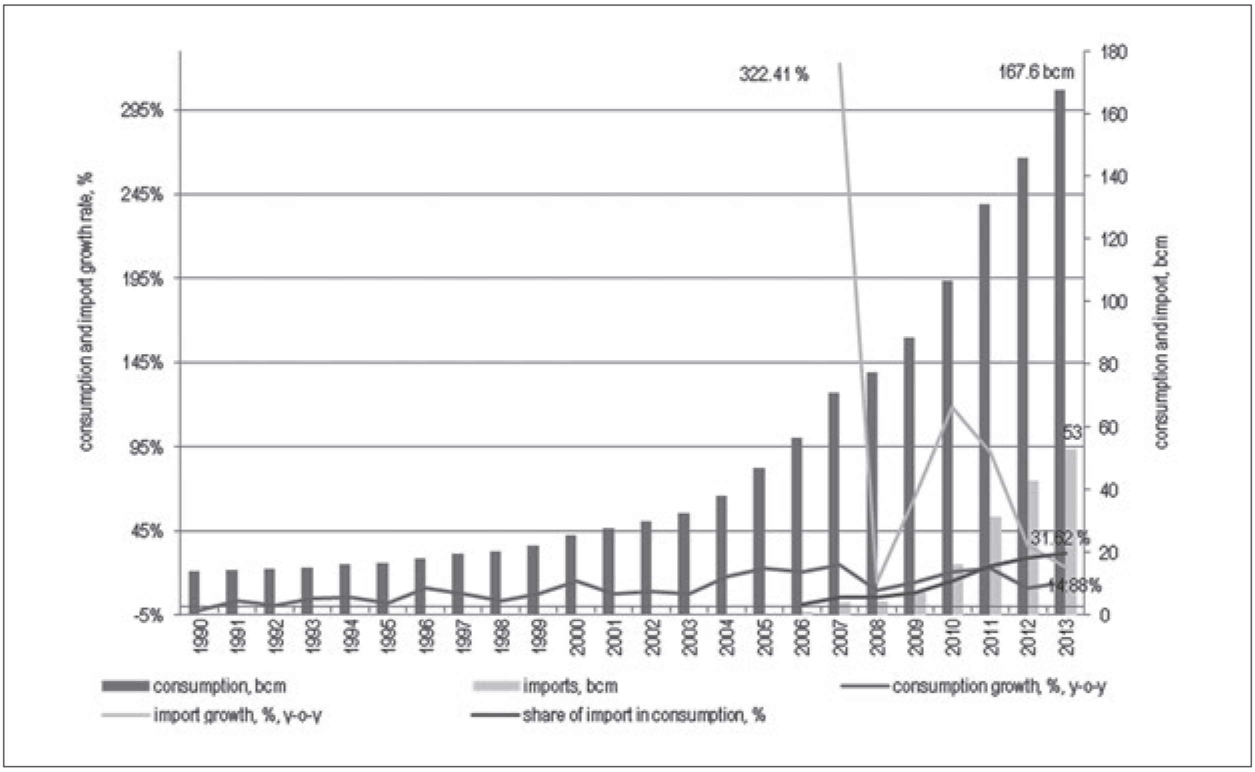


Source: composed by author based on data from<http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=3&pid=26&aid=1>

1.4. Imports

In 2007 China became a net importer of natural gas and in 2013 China's gas import dependency ratio exceeded 30 per cent (Figure 4).

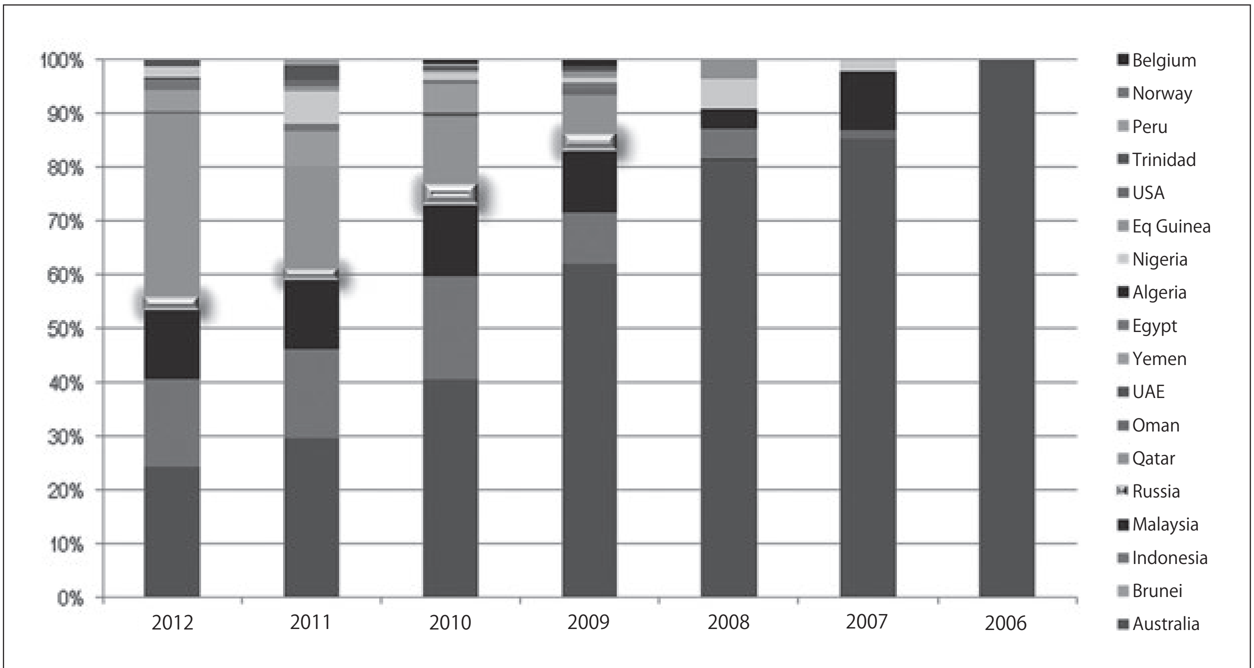
Figure 4: China's Natural Gas Consumption and Import, 1990-2013



Source: composed by author.

As China's dependency on imported gas is projected to rise further, diversification of LNG and pipeline gas imports is crucial to ensure the country's energy security. China's first LNG terminal - Guangdong - opened in 2006. Since then, China's LNG imports have grown rapidly, making the country the world's third largest importer in 2012. China imported 20.26 bcm in 2012 (21.9 per cent up from 2011) and 25 bcm in 2013 (23.4 per cent increase against 2012). LNG imports accounted for over 47 per cent of China's total gas imports in 2013. Qatar, Australia, Indonesia and Malaysia are China's major LNG suppliers (Figure 5). LNG imports will continue to rise, keeping pace with the expansion of capacity of LNG receiving terminals. CNOOC, Sinopec Group and CNPC are actively involved in new construction projects.[14]

Figure 5: Composition of China's LNG Import by Origin, %, 2006-2012



Source: composed by author.

Since 2009, the Central Asian countries have become China's main pipeline gas suppliers (Table 1). In 2012, Turkmenistan was the origin of nearly 50 per cent of China's total gas imports. In 2013, Myanmar commenced gas exports to China via the newly completed pipeline.

Table 1: China's Actual (and Agreed) Import of Pipeline Gas

Source country	2012 Imports (announced capacity/ agreed extension), bcm/ y	Developments
Turkmenistan	21.3 (40 → 65 → 90)*	2006 agreements; 2007 construction of Central Asia – China Gas Pipeline (CACGP) started; 2009 inauguration
Uzbekistan	0.2 (10 → 25)	2007 agreements; 2007 construction of CACGP started; 2009 inauguration
Kazakhstan	(5 → 10)	2003 agreements; 2007 construction of CACGP started; 2009 inauguration; 2010 new branch line from Western Kazakhstan agreed
Myanmar	→ 12	2004; 2009 construction started; July 2013 completion

Source: composed by author.
Note: * shows export volumes after the agreed extensions actualised.

1.5. Infrastructure

Gas infrastructure development is an important aspect for China’s domestic production and imports (Map 2). China has been gradually progressing with pipeline and LNG terminal construction. The recently completed gas pipelines include West-East II, the Sichuan-East China gas pipeline, the Shibuya Cullinan double pipeline, the Jiangdu-Rudong pipeline, the Shaanxi-Beijing gas pipeline III and the China-Myanmar oil and gas pipeline (domestic section). The 12th FYP envisages the construction of the Central Asia natural gas pipeline (Phase 2) and the West-East Gas Transmission Lines 3 and 4. By 2015, about 44,000 km of new pipelines will be added, bringing the total gas pipelines network to about 100,000 km.

China’s re-gasification facilities include ten currently operational terminals with five more under construction. This will bring total re-gasification capacity from about 35 Mt/y as of 2013 to 52.6 Mt/y by 2016. Some five additional terminals are in the planning and feasibility study stage. By 2020, China will have some 120 Mt/y re-gasification capacity.[15] Currently approximately one third of re-gasification facilities are located in China’s north and east. This share would expand by nearly 50 per cent by 2020.[16]

Map 2: Natural Gas Infrastructure in China

Source: Gas Pricing and Regulation 2012: 16.

2. China's Strategic Goals in Gas Policy

The key elements of China's gas policy include: expansion of natural gas reserves; accelerated domestic production from conventional and unconventional sources; construction of new gas storage facilities (to bring their total capacity to 30 bcm by 2020); accelerated construction of LNG terminals and construction of interregional gas pipelines.[17] The Chinese gas sector is undergoing significant transformation. Addressing two shifts in China's gas policy appears to be especially relevant to the purposes of this study.

Concerned about how to alleviate the environmental damage to which the continuing prevalence of coal in the country's energy mix contributes enormously, the Chinese government advocates a larger role for natural gas, a cleanest fossil energy source. As China's dependence on imported supplies rapidly increases, keeping it under control is at the forefront of the government's policy agenda. Seeking effective means to decrease China's reliance on external gas sources, the government targets the *development of reserves and expansion of indigenous gas production.* Progressing with domestic *gas market reforms* is indispensable for optimising China`s energy mix, as well as for balancing the volumes of domestically produced and imported energy resources. A closer examination of the developments on these two policy dimensions - indigenous gas production and pricing reform – aims to contribute to a better understanding of the trends determining China's demand for imported gas.

2.1. Indigenous Gas Production

China currently produces insignificant quantities of shale gas. The 2020 target is set at 60 – 100 bcm shale gas, but many estimates agree on a smaller output of under 20 bcm[18] as being more realistic (Wu 2012). Numerous geological issues make shale gas production difficult in China. That is to say, China's shale deposits are deeper, less thick, have lower porosity, lower pressure, lower gas content and contain more clay component, etc. (Kushkina and Chow 2013). For these reasons, the productivity of the wells is low. Consequently, the Chinese companies incur substantial production costs, which are higher than the average in the USA. Indeed, the costs in (China's) Sichuan are estimated at $6.6-12/ MBtu and in Tarim at even 30-80 per cent larger (Kushkina and Chow 2013) than some $3-4/ MBtu in the USA. Challenges include scarcity of water resources, underdeveloped pipeline infrastructure among others (Rattanavich et al. 2013).

Other perspectives on the sluggish development of unconventional resources include China's institutional hurdles and lack of adequate domestic technology. PetroChina, Sinopec (China Petroleum & Chemical Corp.), Shaanxi Yanchang Petroleum and CNOOC and also Henan and Zhonglian are the companies operating respectively in the shale and CBM sectors. While these state-owned companies (SOC) are reluctant to engage in innovation- and investment-intensive unconventional business, small- and mid-sized companies have no access to the sector. Producing gas is only one part of the process, transporting it may prove problematic because PetroChina controls over 80 per cent of China's pipeline infrastructure. China's interest in obtaining innovations, technologies and expertise for unconventional gas production to a degree facilitated access to domestic shale gas projects for foreign companies (Chevron, Royal Dutch Shell Plc., Total SA, ExxonMobil, etc.). To gain expertise (as well as to secure some additional gas imports), Chinese companies are actively investing in overseas unconventional gas projects (Chen 2013).

Additionally, the development of shale gas demands significant investments, and this is another challenge for China. To produce 5 bcm, China needs to develop 1,300 wells, each of which costs 80 to 100 million yuan ($13 to 16 mn), which requires 130 billion yuan ($21 bn) in upfront investment.[19] The regulated gas prices and the overall weak government incentives have often been cited as factors discouraging investment in shale gas. To boost unconventional gas production the central government has introduced a subsidy of 0.4 yuan/m^3 [20] ($1.7/MBtu) for shale gas producers for the period 2012-2015 and proposed an increase in subsidies for CBM from 0.2 yuan/m^3 ($0.8/MBtu) to 0.6 yuan/$m^3$ ($2.5/MBtu). In addition to the central government subsidies, CBM producers also receive 0.1 yuan/m^3 ($0.4/MBtu) from the local government. This scheme may be extended to shale gas producers. Another policy shift supporting domestic gas production is gas price reform, which was initially piloted in Guangdong and Guangxi from 2011, and is currently being expanded to other provinces. By 2015, the Chinese government plans to establish 19 key exploration and production zones in 13 provinces and regions including Sichuan, Chongqing, Guizhou, Hunan, Hubei, Yunnan, Anhui, Jingxi, Shaanxi, Liaoning and Xinjiang. The government started implementing a special fiscal regime for the domestic gas industry and introduced new pricing to encourage domestic gas production.

2.2. Gas Pricing Reform

The price for the residential sector is traditionally lower than for the industrial and commercial sectors (Wang and Ling 2014); the prices of all sectors are subsidised, although to different extents. Historically, China's National Development and Reform Commission (NDRC) has made few adjustments to China's natural gas prices. Significant problems with gas pricing in China include the prevalence of a supply-driven approach and a lack of market mechanisms, such as disregard of cost differences to different types of consumers or during peak and peak-off periods, volume-based rather than heat value-based pricing and domestic price insensitivity to price fluctuations in the international markets, etc. (Kushkina and Chow 2013).

Traditionally China has followed a cost-plus approach to gas price regulation. The NDRC regulated ex-plant (by field basis) and transportation fee rates and set profit margins. Thus the prices varied depending on the price of the field and distance of transportation. In 2010, the NDRC raised the onshore wellhead gas prices by 25 per cent, and some Chinese cities raised end-user prices in the industrial and power sectors. Yet, the prices for producers were set at the relatively low level of 0.7-1.4 yuan/m^3 ($3-6/MBtu). At the same time, the government did not regulate LNG prices, and as they were increasing,[21] China's LNG importers have been experiencing significant losses.[22]

In order to bolster investment in the gas sector, create more transparency in the pricing system and responsiveness to market fluctuations, and to make domestic natural gas competitive with other fuels and imported gas, the NDRC initiated the Pilot Program – a pricing experiment in China's two southern provinces of Guangdong and Guangxi in December 2011. Pipeline gas in these provinces was priced under a net-back mechanism. The city-gate price was calculated on the basis of a 15 per cent discount on the average price of liquefied petroleum gas (LPG, 40 per cent weighting) and fuel oil (60 per cent weighting) with calorific differences accounted for. The net-back calculation with Shanghai[23] prices of fuel oil and LPG as the benchmarks and transportation costs were used for these two provinces. In July 2012, China opened its first natural gas spot trading market at the Shanghai Petroleum Exchange as part of its course towards gas price liberalization.[24] In July 2013, the NDRC expanded the Pilot Program to the rest of the country and made an average upward price adjustment of 15 per cent for all consumers apart from the residential sector. Under this new program, the NDRC sets the province-specific city-gate prices (for domestic onshore and imported pipeline gas), while prices for shale gas, CBM, SNG, offshore domestic natural gas and LNG are negotiated between producer and wholesale buyer. The price reform applies to incremental natural gas demand beyond the 2012 levels. The incremental demand was approximately 9 per cent of total gas demand in 2013. The full-scale application of the new pricing scheme[25] will be in place by the end of 2015. In 2014, the NDRC announced the introduction of a multi-tier pricing mechanism for the residential sector before the end of 2015.[26] The latter signifies a more fine-tuned approach to pricing, whereby price differs depending on the volume of consumption.

The important implications of the described policy measures are such that, owing to the incentives for unconventional gas production and progression of market-based pricing, China is likely to increase domestic gas output and optimise consumption. In turn, the combined outcome of these shifts will determine China's future import needs.

3. Russia - China Gas Cooperation

In recent years, Russia-China economic relations have been especially intense. Bilateral trade reached $88 bn in 2012,[27] making China Russia's largest single trading partner. The Russian – Chinese cooperation is being promoted through various levers, including the 2011 agreement allowing for bilateral transactions to be conducted in renminbi or roubles, thereby removing the need for either convertible currency.[28] The bilateral trade is expected to expand to $100 bn by 2015 and reach $200 bn by 2020.[29] The official reciprocal investments total $12 bn, with the Russian energy sector being one of the most attractive areas for Chinese capital. In 2013, for instance, PetroChina (a branch of the CNPC) announced its intention to invest $10 bn in Rosneft and Gazprom-operated gas fields in Eastern Siberia and the Far East (ESFE).[30]

Overall, the hydrocarbon-rich countries of Central Asia and Russia are well positioned to be China's energy suppliers. During the summit of the Shanghai Cooperation Organization (SCO) in June 2012, the then President Hu Jintao emphasised that China and Russia should focus on promoting cooperation on upstream and downstream energy projects.[31] The Chinese government, as Zhang Guobao, an advisor to China's National Energy Administration (NEA), articulated, sees Russia (along with Central Asia) as best suited to meet China's long-term energy demand.[32] On his first after the inauguration state visit to Russia in March 2013, the Chinese President Xi Jinping assigned top priority to joint exploitation of oil and gas resources.[33]

3.1. Russia's Achievements and Potential

Russia is the world's largest producer of conventional gas, producing 653 bcm in 2012 and 668 bcm in 2013 (a 2.7 per cent decrease and a 2.3 per cent increase respectively). Conducting only a small volume of LNG and no pipeline gas exports so far, Russia is favourably located to become China's significant supplier.

Russia started LNG exports to China after its first (and so far only) LNG plant in Sakhalin came online in 2009, but Russia remains a minor supplier to China (Table 2). Notwithstanding all the impressive growth of China's LNG imports, the country is not among Russia's principal

LNG buyers. The reason is that Sakhalin LNG is supplied under long-term contracts, the largest holders of which are Japanese and Korean companies. Objectively, Russia has no readily available LNG for other customers.

Table 2: Russia – China LNG Trade, 2009-2012

	2009	2010	2011	2012
Russia's LNG exports to China, bcm/y	0.25	0.51	0.33	0.53
Russia's share in China's LNG imports, %	3.23	3.98	2.04	2.62
China's share in Russia's LNG exports, %	3.78	3.81	2.29	3.54
China's LNG imports growth rate, %, y-o-y	72.07	67.54	29.84	21.90

Source: based on BP data.

Although in 2013 Gazprom disclosed that it could not confirm its earlier estimated as proved gas reserves of 25 tcm in ESFE, the company insisted that proved reserves of 10 tcm would suffice to satisfy the demands of China, South Korea and Japan. Poor exploration (only 6 -7 per cent of the ESFE territory was covered by geological exploration) remains a serious problem. In the period 2013-2016 Gazprom plans to spend RUB 40 bn ($1.2bn) annually on geological exploration in the ESFE.[34] Amidst the Ukrainian crisis, which escalated tensions between Russia and the European countries, the Russian government prioritises the course toward Asia and is enhancing the implementation of the Eastern Gas Programme (EGP). In these new circumstances, the tasks for the ESFE advanced development formulated by the Russian government and actively pursued in recent years (Shadrina 2014b) are to be accorded high significance. Thus it is appropriate to expect an unprecedented development of the ESFE economy and its mineral resource sector, in particular.

Russia has a number of projects developed with a view to China being either the principal beneficiary (pipeline projects) or the one importer among others (Table 3).

Table 3: Russia's Asia-oriented Gas Projects

Commissioning	Project	Characteristics	Capacity, Mt/ bcm
2005	Sakhalin I	RN 20%; ExxonMobil 30%, Sodeco 30%, ONGC 20%; long-term sales contracts btwn Rosneft & Marubeni and Rosneft & SODECO* gas - 485 bcm	gas pumped back; (possible gas swap with GP)
2009	Sakhalin II	Gazprom Sakhalin Holdings B.V. 50%+1; Shell Sakhalin Holdings B. V. (Royal Dutch Shell plc.) 27.5% - 1; Mitsui Sakhalin Holdings B.V. (Mitsui & Co. Ltd.) 12.5%; Diamond Gas Sakhalin B.V. (Mitsubishi Co.) 10%	
2009	LNG plant in Prigorodnoe	Sakhalin Energy	10.8/ 14.6
	Sakhalin III	Gazprom, for Sakhalin-Khabarovsk-Vladivostok (SKV**) pipeline: Kirinsky, Ayashsky and Vostochno-Odoptinsky fields; deposits: Kirinskoe – gas 162.5 bcm; condensate 19.1 Mt; Yuzhno-Kirinskoe – gas 636.6 bcm; condensate 97.3 Mt; Mynginskoe – gas 19.8 bcm; condensate 2.5 Mt	(possible oil swap with RN)
	Sakhalin III	RN 74.9%; Sinopec 25.1%, Veninsky field: gas 578 bcm; oil & condensate 88 Mt	
2019 (2021, 2025)***	LNG plant in Vladivostok, plant at Perevoznaya Bay, Lomonosov Peninsula	Gazprom & Japan Far East Gas Co. (consortium of Itochu Corp., Japan Petroleum Exploration Co. (JAPEX) and Marubeni Corp.)	5 (10.3-15)/ 6.9 (14.2-20.7)
2017	Yamal LNG	Novatek 60% & Total 20% & Sinopec 20%; Yuzchno-Tambeiskoye: gas 0.9 tcm; condensate 31 Mt; Gydan deposits (LNG contracts: 3Mt/y, 15 yrs to CNPC, 2.5Mt/y, 20 yrs to Gas Natural Fenosa/ Spain. 4Mt/y to Total)	16.5/ 22.7
2018 (2025, 2030)	LNG plant at the Iljinsky Port, Sakhalin	Sakhalin III, plant construction Rosneft & ExxonMobil & General Electric; Resources of Sakhalin I (RN 20%; ExxonMobil 30%, Sodeco 30%, ONGC 20%) and Sakhalin III (RN 74.9%; Sinopec 25.1%)	5 (15)/ 6.9 (20.7)
2018	Sakhalin II LNG plant 3rd train	Gazprom	5/ 6.9
2018-2020 (2030***)	Eastern Route (Power of Siberia, Sila Sibiri)	resources of Eastern Siberia, Irkutskaya oblast (Kovyktinskoe) and Yakutiya (Chayandinskoe) with the Far East (Khabarovsk -Vladivostok); resources of Sakhalin III (Kirinsky, Vostochno-Odoptinsky and Ayashsky blocks), possibly Sakhalin I through SKV; Yuzhno-Kirinskoe - from 2019; peak - 11.4 bn cm/y by 2023-24; Kovyktinskoe – from 2021: gas 1.9 tn cm, helium 3 tn cm, gas condensate 77 mn t; gas extraction – 30-35 bn cm/y; Chayandinskoe field – start 2019: 1.2 tn cm, oil and gas condensate 79.1 mt; gas extraction – 25 bn cm/y Power of Siberia: 3,177 km (3,968, if Kovyktinskoe gas field is linked); $40 b ($80-90b) (Kovykta, later stage)-Chayanda-Lensk-Aldan-Olyokminsk-Neryungri-Skovorodino-Belogorsk-Blagovezchensk(→ China)-Birobidjan-Khabarovsk-Dal'nerechensk(→ China)-Vladivostok-(→ Korea, etc.)	27.5 (44.2)/ 38 (61) 50 years
2030	Western Route (Altai gas pipeline****)	resources of Western Siberia (main field Yurubcheno-Tokhomskoe, fields in Nadym Pur Taz region); Yurubcheno-Tokhomskoe – gas reserves 709 bcm; 2,622 km: deposits in Yamal Nenets and Khanty Mansiisk Autonomous District, Tomsk and Novosibirsk Region, Altai Krai – Republic of Altai – Xinjiang region, Western China – West-East gas pipeline (Novosibirsk-Barnaul-Biisk-Gorno-Altaiisk --- China)	21.7/ 30 30 years

Source: composed by author.
Notes:
* Sakhalin Oil and Gas Development Co. – a consortium established in 1974, unites JAPEX, JOGMEC, Itochu Corp. and Marubeni Corp.
** Sakhalin-Khabarovsk-Vladivostok gas pipeline is a domestic project, but it is an important part of export infrastructure;
*** (year) shows the beginning of the next stage, i.e. Vladivostok LNG plant's second and third trains, respectively;
**** Order # 1416.

The list of projects is impressive; some, like the Power of Siberia, are so large that international cooperation will be the only realistic way to secure the necessary financial, technological, innovation and other aspects required for their development. The Sakhalin I and Sakhalin II, operated under a production sharing agreement (PSA) scheme, can be regarded as successful experiences of cooperation between the Russian and international companies.

Russia's gas supply potentially available for China is considerable (Table 4). While only a rather small volume of new LNG supplies is contracted to China, Russia's ambitions to expand gas exports to China reside in the pipeline sector.

Table 4: Russia's Actual and Projected Gas Exports to China, bcm/y

Projects	2012	2017	By 2020	By 2030
Sakhalin II LNG plant	0.53	0.5	0.5	0.5
Yamal LNG		4.14	4.14	4.14
Vladivostok LNG			6.9 – "X"	14.2 – "X"/ 20.7 – "X"
Sakhalin II LNG plant, 3rd train			6.9 – "X"	6.9 – "X"
RN LNG plant in Sakhalin			(6.9, all contracted to Japan)	13.8 – "X"
Power of Siberia pipeline			38	61
Altai pipeline				30
Total	0.5	4.5	42.5 + (13.8 – 3 "X")	95.5 + (35 – 3 "X")/ 95.5 + (41 – 3 "X")

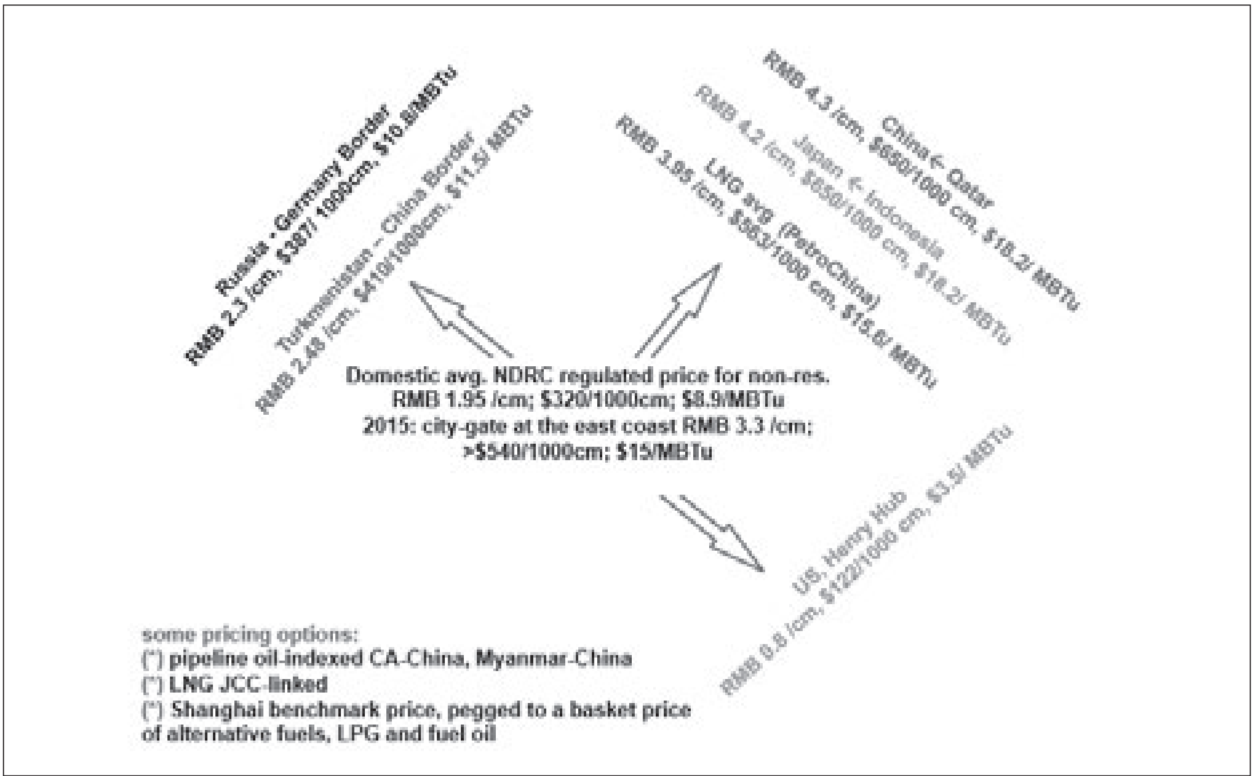
Source: composed by author based on various sources.
Note: "X" – a dummy, denotes unknown/ undecided quantities of Russia's gas supply beyond China.

All Russia's LNG projects have been lacking dynamism for their inception, with Gazprom's monopoly being one of the principal hurdles. In December 2013, the Russian government undertook a step crucial for LNG export development.[35] After the government liberalised LNG exports, the positions of two other companies besides Gazprom – namely Rosneft and Novatek – were consolidated by allowing them to begin supplying gas to the Chinese market.[36] The decision to liberalise LNG exports was intended to transform into intensified competition between Gazprom and other gas producers from the area, bringing ambitious business strategies for gas export[37] into the realm of practical implementation. The government expects to see various forms of cooperation among the national gas companies, such as gas swaps, joint projects, etc. The Russian regulators consider the latter a plausible way to improve the economics of gas projects. In practice, there has been only cautious speculation about such partnerships. In particular, Gazprom and Rosneft are hinting at a possible gas-for-oil swap[38] with regard to Yuzhno-Kirinskoe oil from Gazprom`s Sakhalin-3 and Rosneft`s gas from Sakhalin-1. This is seen as rational, but, owing to the existing competition for the new gas deals, difficult to implement undertaking. Such schemes, nevertheless, could optimise Russia's portfolio of gas export projects and significantly improve the price competitiveness of Russia`s gas (Henderson and Stern 2014). Although the pipeline segment was not affected by the December 2013 liberalisation, the expectations are high that Russia's pipeline sector will soon see similar reforms.

3.2. Russia's Obstacles and Opportunities in the Chinese Market

For over a decade, Gazprom and CNPC (Russia's and China's SOCs respectively) have been attempting to build their gas partnership. They eventually managed to eliminate the major differences with regard to prices and pricing (Figure 6) and concluded a gas agreement in May 2014.

Figure 6: Price and Pricing:
LNG vs. Pipeline Dilemma in Europe-Asia-North America Triangle



Source: developed by author.

One of the early documents signed by Gazprom and CNPC - the Agreement on Strategic Cooperation – was concluded in October 2004 (the idea of cooperation itself dates as far back as the 1990s). In March 2006, CNPC and Gazprom signed a memorandum of understanding (MoU) for pipeline gas deliveries of 60-80 bcm /y. At the time, the negotiations stalled over setting the price and determining the supply route. While Russia favoured the Western Route (not least because some gas deposits and infrastructure have already been developed there), China preferred the Eastern Route (partly because it already secured gas deliveries to its western regions through the Central Asian pipeline, but also because it did not want Russia turn into a swing supplier capable of switching gas deliveries between China and Europe depending on a particular market's attractiveness). In October 2009 Gazprom and CNPC announced the Framework Agreement on General Terms on gas supply of 68 bcm. In September 2010 Gazprom and CNPC succeeded in elaborating their intentions and signed an agreement on Extended General Terms. In 2013 the hopes of overcoming the Russia - China impasse over the terms of gas supply were particularly high. Nonetheless, despite the MoU on the Eastern Route of gas pipeline (the Power of Siberia) with an annual capacity of 38 bcm (with a possible extension to 61 bcm /y) for 30 years was concluded in March 2013, and even some of the works towards the implementation of the project have been started in the ESFE (Order 1416), the grand project was not finalised. Signed in September 2013 by Gazprom and CNPC, the General Terms of Gas Supply[39] demonstrated that the two failed again to agree on price, although China reportedly agreed to abandon its claim for the pipeline gas price to be linked to the US Henry Hub natural gas spot price.[40] At earlier stages of negotiations, China adamantly insisted that any price above \$250/1000m^3 would not be acceptable, as it would make the Chinese manufacturing sector uncompetitive. Meanwhile, the available data suggest that China has not been enjoying any outstandingly attractive prices from other gas suppliers. At the end of 2011, the Turkmen pipeline gas at the Chinese border cost \$9.1/MBtu (\$334/1000m^3), the Turkmen gas delivered to Shanghai cost \$13.3/MBtu (\$488/1000m^3)[41] (Pirani 2012) and the Qatari LNG delivered to Shanghai cost \$18.2/MBtu (\$655/1000m^3) (Kushkina and Chow 2013). In 2012, the average price of imported LNG was \$10.8/MBtu (\$388/1000m^3) and imported pipeline gas \$10.4/MBtu (\$375/1000m^3) (Lin 2013). In April 2014, China's LNG spot contracts, according to Argus, reached a level of \$17.5/ MBtu (over \$600/1000m^3).

Gazprom's approach to the negotiations was initially such that China was to pay a price close to what the European consumers pay under long-term contracts. The average price of Gazprom`s gas at the German border was \$402/ 1000m^3 (\$11.5/MBtu) in 2012 and \$387 (\$10.8/ MBtu) in 2013. Gazprom proposed using an oil-linked benchmark – the Japanese Crude Cocktail (Japan Customs-cleared Crude, JCC) in price formula. The JCC is notorious for instilling the Asian premium effect into the Asian gas markets and sending LNG prices in the region to the world's highest levels. In February 2014, for instance, the LNG price in Asia reached \$20/ MBtu (\$720/1000m^3). Certainly, using the JCC for new gas deliveries has never appeared appealing to China.

Eventually, Gazprom and CNPC settled their differences on pricing and price and signed the gas deal during the Russian President's official visit to China in May 2014. While the agreed price was said to be a "commercial secret" and remained unrevealed, Russian e-media reported extensively that the price of the deal was within a range of \$380-395/1000m^3 and pegged to a basket price of diesel, fuel oil and Brent in Singapore. If so, the deal seems to be fair to both sides, not to mention that in a new political and economic environment informed by Russia's position vis-à-vis Ukraine, securing a gas project with China becomes almost a vital undertaking for Russia.

Recently, Russia's opportunities for expanded gas exports to Asia have been estimated as rather bleak against the backdrop of North American shale gas success. A closer look at costs and prices, however, suggests that Russia's gas is competitive price-wise. More precisely, a number of US-based LNG projects coming online in 2016-2025 would produce some 75 Mt/ y (103.5 bcm/y) of exports with Henry Hub prices hovering between \$5-6/MBtu by 2020 and up to \$7/MBtu by 2025. However, other costs associated with exports, such as liquefaction and re-gasification, and especially transportation, would increase the price of North American LNG to no less than \$11/MBtu when delivered to Europe and around \$16/MBtu for Asia. According to some estimates, a floor price of \$12/MBtu could be a benchmark for LNG delivered to Asia, which is equivalent to the range of \$80-90/b JCC-based crude oil indexation.[42] Objectively, Asian importers have no grounds to anticipate inexpensive North American LNG for their markets even if oil prices fall, because the latter would arrest investment in unconventional gas production, thereby suspending the new supplies. The hub pricing will certainly play a role in new LNG contracts for Asia, but conventional oil indexation will also remain in use. The main intrigue surrounding LNG pricing is about new supplies from Australia, Canada, East Africa, but also Russia, which currently accounts for some 4 per cent in the world's LNG market, but aims to expand its share to 10 per cent in 2020 and 15 per cent by 2025.

The sluggish development of Russia – China gas cooperation has often been explained by China's lack of interest in bringing imported gas to its north-eastern regions. However, it becomes palpable that Russian supplies match the growing gas demand in China's rapidly developing north-eastern provinces (Map 3).

Map 3: The Power of Siberia Gas Pipeline

Source: http://www.gazprom.com/f/posts/74/805991/2013-12-18-map-sila-sib-en.jpg

Juxtaposing the data on China's projected demand and supply and its contracted imports with Russia's export project capacity and its contracted exports (Tables 3 and 4), makes it possible to generate a set of approximate estimates of Russia's potential to expand gas export to China (Table 5).

Table 5: Russia's Opportunities for Gas Export Expansion to China

Year	China's Projected Import, bcm	China's Contracted Import, bcm	(2-3), Discrepancy, bcm	Russia's Projected Export, bcm	Russia's Contracted Export / incl. to China, bcm	(5-6), Discrepancy, bcm	(4-7), Discrepancy, bcm
1	2	3	4	5	6	7	8
2015	60-80	-	-	-	-	-	-
2020	150 -200, incl. 100 LNG	130, incl. 70 LNG	"-" 40 PL "-" 30 LNG	~ 80, incl. LNG ~ 40	38 + 26 LNG/ 38 + 4 LNG	0 "+" 14 LNG	"0" PL "+" 20 LNG
2030	250-300, incl. 150 LNG	230, incl. 130 LNG	"-" 40 PL "-" 20 LNG	~ 160, incl. LNG ~ 70	91 + 40 bcm/ 91 + 4 bcm LNG	0 "+" 30 LNG	"-" 50 PG "-" 10 LNG

Source: developed by author based on data from IEA 2011, 2012, 2013; EIA 2014; Wu 2012; Hu and Xu 2013; Wang et al. 2013; etc.

The principal conclusions which can be drawn from the Table are: 1) Russia has no chance to enter the Chinese gas market by 2015 because it has no viable supplies to offer; 2) Russia's pipeline supplies projected by 2020 seem to be needed in China (and therefore the Table contain "zero" discrepancy), but Russia can additionally pursue a larger volume of LNG exports to the Chinese market. The very rough estimates show that some extra 20 bcm may find its demand in China. Here it is important to note that by 2030 Russia's potential share in LNG supplies to the Chinese market is likely to shrink (the discrepancy between China's uncontracted imports and Russia's uncontracted exports is negative). Russia needs to expedite bringing its LNG projects online. Because a large share of LNG in Asia is traditionally supplied under long-term contracts, by delaying on making any concrete offers of significant volumes (through the acceleration of the 2nd and 3rd trains of the RN Sakhalin and Vladivostok projects) Russia may lose a niche in China's LNG segment (negative assessment for 2030 in column "8" for LNG); 3) the significant increase in Russia's pipeline gas export projected by 2030 appears not to be matched by China's forecast for pipeline imports. This may suggest that Russia cannot retain its hopes once abandoned, but re-emerging in August 2013 (Order #1416), for the Altai gas pipeline project to materialise, at least not before 2030.

Conclusions and Policy Recommendations

China's gas market is evolving on various dimensions: the demand is growing apace with continuing economic and structural transformations, domestic production is increasing, not least owing to rather revolutionary shifts involving offshore and unconventional technologies, the domestic gas market reforms are unfolding, and so on. These simultaneous shifts contribute to uncertainty about China's future domestic reserves, production and consumption. China's gas import is predicted to continue to grow rapidly, but the available numerical assessments by China's policy-making agencies and domestic experts and also those by international organisations and professionals outside China vary greatly and often contradict each other. Thus it is important to apply the existing assessments with caution.

As environmental stewardship becomes an indispensable component of sustainable economic growth strategy, it increasingly defines China's gas policies. In particular, growing air pollution forces the Chinese government to introduce stricter targets for a wider application of environment friendly energy sources. Gradual liberalisation of China's domestic gas market is a novel denominator affecting the future of China's gas.

Given the scale and the dynamism of the Chinese gas market, Russia's current role here is insignificant. This is a consequence of Russia's protracted excessive reliance on the European gas markets and its short-sightedness in ignoring Asia's plentiful opportunities.

New China-oriented gas projects can reinforce Russia's export potential, which is especially important given the EU's course in reducing Russia's deliveries. Geographically, Russia is favourably located to become China's gas supplier. There are prerequisites for Russia to expand its LNG supplies and commence pipeline gas exports to China. While both scenarios are viable, the volume of Russia's exports depends largely on China's success in increasing domestic production of unconventional gas and competition from other regional and non-regional producers of LNG and pipeline gas suppliers. As discussed, Russia's positions in price competition are strong in both the LNG and pipeline segments. To succeed, Russia most importantly needs to focus on the timing of new deliveries.

Interestingly, Russia's LNG supplies are not limited by the capacities of its east-located projects. Navigation through the Northeast Passage in the Arctic Sea is an additional factor favouring Russia's LNG exports to China. Even if the price of Russian LNG shipped through this lane is comparable to that of Russia's competitors, it still appears to be attractive to China due to a shorter shipping time. In the pipeline sector, Russian supplies are intended for China's north-eastern territories, which is important as these latecomers gradually start catching up with China's more developed coastal provinces.

Overall, Russia has opportunities to expand its gas exports to China. However, for this to materialise Russia needs to analyse its experience of gas relationship with China and formulate a long-term policy vis-à-vis China. The eventual conclusion of the 30-year 38 bcm /y gas deal proved that bilateral gas cooperation is indeed viable under mutually fair terms and satisfactory conditions. One of the areas where China's expectations were so far not matched by Russia's attitude was the option for the Chinese companies to participate in the gas value chain and have gas equity in the Russian projects (something that China commonly practises in Central Asia and elsewhere).

Russia needs the Asian gas markets and among these, Russia especially needs China, not only to sell additional gas volumes, thereby offsetting the negative impact occasioned by the spread of anti-Russian sentiment among the traditional European consumers of Russian gas, but also for China's substantial financial potential. Russian energy (in particular, oil) companies have been tapping into this source and plan to do so again while developing the large-scale gas pipeline project in the ESFE. Also, cooperation with China is increasingly attractive to Russia because the former shows certain progress in the challenging technology- and innovation-intensive energy sectors and quickly turns into a partner from closer cooperation with whom Russia stands to benefit. The latter is particularly important in light of the sanctions imposed on Russia by the USA, the EU, Japan and others. On the whole, China is a valuable partner for Russia due to its unique ability to fulfil simultaneously three important roles: as a buyer-consumer, as a banker-lender and as a partner-innovator.

* Associate Professor, Graduate School of Governance Studies, Meiji University

1 Russia and China seal historic $400bn gas deal. *The RT,* 21 May 2014. http://rt.com/business/160068-china-russia-gas-deal/ (retrieved 21 May 2014)

2 "Proven oil, gas reserves increase steadily in China". *The People Daily*, 28 February 2014. http://english.peopledaily.com.cn/98649/8550592.html (retrieved 5 March 2014)

3 *EIA/ARI world shale gas and shale oil resource assessment, 2013*. Advanced Resources International, Inc. June 2013. http://www.adv-res.com/pdf/A_EIA_ARI_2013%20World%20Shale%20Gas%20and%20Shale%20Oil%20Resource%20Assessment.pdf (retrieved 6 August 2013)

4 Of these, the closest to the route of proposed by Russia the Power of Siberia gas pipeline (and therefore potentially competing with Russian supplies) is Songliao; Ordos, which is relatively close to Beijing, can, to a degree, also be regarded as competing supplying area.

5 *The 12th Five-Year Plan for National Economic and Social Development of the People's Republic of China for 2011-2015* (English language version) http://www.cbichina.org.cn/cbichina/upload/fckeditor/Full%20Translation%20of%20the%2012th%20Five-Year%20Plan.pdf (retrieved 23 August 2013); *The Development Plan for Shale Gas (2011-2015)*, NDRC and the National Energy Administration. 2012; *The Natural Gas Development Plan during the 12th Five-Year Plan Period,* NDRC. October 2012

6 China's 2013 shale gas output rises to 200 million cubic meters. *Bloomberg News,* 8 January 2014. http://www.bloomberg.com/news/2014-01-08/china-s-2013-shale-gas-output-rises-to-200-million-cubic-meters.html (retrieved 4 March 2014).

7 *The 12th Five-Year Plan for National Economic and Social Development of the People's Republic of China for 2011-2015* op.cit

[8] Retrieved from The Second State Council Meeting on Implementation of China's 12th FYP on Energy Development. January 1, 2013 http://www.gov.cn/zwgk/2013-01/23/content_2318554.htm (retrieved 4 August 2013)

[9] Ma, W. 2014. Sinopec says shale-gas output ahead of schedule. *The Wall Street Journal.* 24 March. http://online.wsj.com/news/articles/SB10001424052702303949704579458900508770462?mg=reno64-wsj&url=http%3A%2F%2Fonline.wsj.com%2Farticle%2FSB10001424052702303949704579458900508770462.html (retrieved 26 March 2014)

[10] Sinopec aims to produce 1.8 bcm of shale gas in 2014 from Fuling field. http://www.naturalgasasia.com/sinopec-aims-to-produce-1.8-bcm-of-shale-gas-in-2014-from-fuling-field-12095 (retrieved 26 March 2014)

[11] Global Data, 1 April 2014. http://energy.globaldata.com/media-center/press-releases/oil-and-gas/china-on-track-to-meet-its-2015-shale-gas-production-goal-but-2020-target-and-industry-reform-remain-challenging-says-globaldata-analyst (retrieved 4 April 2014)

[12] China could double oil, gas production by 2030 to 700 mil mtoe. http://www.platts.com/latest-news/oil/singapore/china-could-double-oil-gas-production-by-2030-27807594 (retrieved 26 March 2014)

[13] *Reuters*. 12 September 2013. http://www.reuters.com/article/2013/09/12/china-coal-pollution-idUSL3N0H80HB20130912 (retrieved 17 September 2013)

[14] China approves first floating terminal for LNG imports. *Reuters.* 14 August 2013. http://www.reuters.com/article/2013/08/14/china-cnooc-lng-idUSL4N0GF24C20130814 (retrieved 7 September 2013)

[15] Estimated based on EIA 2014 data on China's LNG terminals operating and planned.

[16] Author's estimates based on EIA 2014. The location is emphasised to point at Russia's opportunities for new LNG exports.

[17] *The Natural Gas Development Plan during the 12th Five-Year Plan Period,* NDRC. October 2012;

[18] "Why China will miss its shale gas production targets". *Bloomberg News.* 20 February 20 2013. http://business.financialpost.com/2013/02/20/why-china-will-miss-its-shale-gas-production-targets/?__lsa=c6a5-afb3

[19] Jun, Pu and Huang Kaiqian (2013): "China's lofty goals for shale gas development just pipe dreams, experts say". *Caixin Online.* 26 August. http://english.caixin.com/2013-08-26/100574015.html (retrieved 2 March 2014)

[20] About 7.5 per cent of the 2.28 yuan/m^3 price that Beijing residents pay for gas, while 1.5 yuan (24 US cents)/m^3 subsidy is said to be necessary in order to spur shale gas investment.

[21] From the average price for the early concluded long-term contracts with Australia and Indonesia for the deliveries to commence in 2006 and 2009 at $3.2/MBtu and $4/MBtu, respectively, to $18.2/MBtu for Qatari gas delivered to Shanghai in 2011 (Kushkina and Chow 2013: 3).

[22] As the practice continues, PetroChina alone reported a $6.5 b loss in 2013.

[23] Where a hub of future unified gas transportation system is planned.

[24] China. U.S. Energy Information Administration. http://www.eia.gov/countries/cab.cfm?fips=CH (retrieved 11 March 2014)

[25] Price depends on the volume of consumption, 3 tiers are arranged so that smaller consumption will be charged at lower price.

[26] With subsidies, China's household natural gas price averages about 2.5 yuan ($0.41)/ m^3, while the industrial natural gas price averages about 3.5 yuan ($0.57)/ m^3, as of 2014. http://english.cntv.cn/20140321/103190.shtml (retrieved 26 March 2014)

[27] China–Russia trade up 11% to $88 bln in 2012, *RIA Novosti,* 10 January 10 2013. http://en.rian.ru/business/20130110/178687770.html (retrieved 3 February 2013)

[28] China and Russia signed new bilateral local currency settlement agreement, The People's Bank of China, 23 June 23 2011. http://www.pbc.gov.cn/publish/english/955/2011/20110630151646500985220/20110630151646500985220_.html (retrieved 13 September 2013)

[29] Jiao, Wu and Xiaokun Li (2013): "China, Russia a step closer on gas supply". *China Daily*. 6 September. http://www.chinadaily.com.cn/business/2013-09/06/content_16948450.htm (retrieved 23 September 2013)

[30] Chernichkin, Konstantin (2013): "PetroChina considering $10 billion Russian gas investment". *Reuters*, 10 September. <http://rt.com/business/china-russia-gas-investment-647/ (retrieved 3 December 2013)

[31] "China and Russia sign 11 agreements, emphasizing joint energy development", *Beijing News*, 6 June 2012. http://money.163.com/12/0606/02/839IJKU800253B0H_all.html (retrieved 4 August 2013)

[32] Hoong, Ng Weng (2013): "China: Significant energy challenges ahead". http://www.energyglobal.com/news/special-reports/articles/The_oil_and_gas_pipeline_and_energy_challenges_in_China.aspx (retrieved 5 September 2013)

[33] Herszenhorn, David and Chris Buckley (2013): "China's leader argues for cooperation with Russia". *The New York Times*, 23 March 2013. http://www.nytimes.com/2013/03/24/world/europe/chinas-leader-argues-

for-cooperation-with-russia.html (retrieved 17 September 2013)

34 Topalov, Alexey (2013): "Gazprom "sduvaet" Sibirj [Gazprom "downsizes" Siberia]". *GazetaRu*, 4 April. http://www.gazeta.ru/business/2013/04/04/5243689.shtml (retrieved 5 April 2014)

35 As of now, only four companies Rosneft, Novatek, SOCs Zarubezhneft and Gazprom have met government-set criteria and are eligible for LNG exports. According to the law, only those companies which have more than 50 per cent of state ownership and secured their plans for LNG plants' construction before January 1, 2013 will be granted such rights. The liberalisation can be called partial not only because of a very limited number of eligible exporters, but also because the government set up a coordination mechanism (to prevent competition among Russian LNG exporters in external markets), which requires exporters to submit their export plans to the Ministry of Energy. The newly endorsed law on LNG export liberalisation requires the amendments to Article 3 of the Federal Law "On Gas Export" and Articles 13 and 24 of the Federal Law "On the Principles of State Regulation of Foreign Trade."

36 Shiryaevskaya, Anna, Jake Rudnitsky, and Stephen Bierman (2013): "Russia hastens China energy pivot with oil, LNG supply deals", *Bloomberg*, 21 June. http://www.bloomberg.com/news/2013-06-21/russia-hastens-china-energy-pivot-with-crude-lng-supply-deals.htm (retrieved 25 June 2013)

37 Rosneft made such a claim targeting to become Russia`s largest oil and gas company in the Asian markets.

38 Serov,Mikhail, Elena Khodyakova and Galina Starinskaya (2014): Gazprom i Rosneft' obsujdayut obmen resursami na Sakhaline [Gazprom and Rosneft discuss resource swap for Sakhalin] *Vedomosti*. 3 March. http://www.vedomosti.ru/companies/news/23476061/rodstvennyj-obmen (retrieved 8 March 2014)

39 *Reuters*, 5 September 2013. http://www.reuters.com/article/2013/09/05/us-gazprom-cnpc-export-idUSBRE9840TH20130905 (retrieved 9 October 2013)

40 Data available from http://www.eia.gov/dnav/ng/hist/rngwhhdm.htm

41 In the end of 2011, Shanghai city gate price of domestically produced gas was \$9.8/MBtu (\$360/ 1000m^3).

42 Caruzo, Guy (2014): The US LNG export and policy. Seminar at JOGMEC. 17 February. http://oilgas-info.jogmec.go.jp/report_pdf.pl?pdf=1402_JOGMEC_seminar02_caruso%2epdf&id=5174 (retrieved 13 March 2014)

References

Advanced Resources International, Inc. (2013): *EIA/ARI world shale gas and shale oil resource assessment*, http://www.adv-res.com/pdf/A_EIA_ARI_2013%20World%20Shale%20Gas%20and%20Shale%20Oil%20Resource%20Assessment.pdf (retrieved 6 August 2013)

Agreement between the Russian Federation's Central Bank and the People's Bank of China on Interbank Cross-Border Trade Payments and Settlements, 2007.

BP Statistical Review of World Energy (2013): BP. London. 2013.

BP Energy Outlook 2035 (2014): January 14. Available from: <http://www.bp.com/content/dam/bp/pdf/Energy-economics/Energy-Outlook/Energy_Outlook_2035_booklet.pdf> (retrieved 2 February 2014)

Chen, Yi (2013): "Development strategies of the Chinese natural gas market". *Clingendael International Energy Programme.* July. Available from: < http://www.clingendaelenergy.com/inc/upload/files/Ciep_Paper_2013-07.pdf> (retrieved 6 August 2013)

China Natural Gas Map Project. http://www.chinagasmap.com/theprojects/projectoverview.htm (3 August 2013)

Chrisman, Kate Rosow (2014): "Shale gas blooms in China? Not so fast." *Breaking Energy*. April 9. http://breakingenergy.com/2014/04/09/shale-gas-blooms-in-china-not-so-fast/ (retrieved 9 April 2014)

The Development Plan for Shale Gas (2011-2015), NDRC and the National Energy Administration. 2012

Du, Juan (2014): "Gas imports to rise by 19 %". *China Daily Asia*. January 16. http://www.chinadailyasia.com/business/2014-01/16/content_15112682.html (retrieved 7 March 2014)

EGP 2007 – "The Program of Creation of Unified System of Gas Production, Transportation and Supplies in East Siberia and the Far East with Possibility of Exporting Gas to China and other Asia-Pacific Countries". The Ministry of Energy of the Russian Federation Order No. 340. 3 September 2007. Available from: <http://bestpravo.ru/rossijskoje/rx-normy/r9n.htm>

EIA 2014 – *U.S. Energy Information Administration. China*. 2014.

EIA historical data and projections through 2040 retrieved from http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=3&pid=26&aid=1

Energy Efficiency and Development of Energy, State Program of the Russian Federation, Ministry of Energy, adopted by the Government of the Russian Federation Order 03.03.2013 No. 512-p. Subprogram 4 "Development of Gas Industry".

Evers, Marco (2013): Northeast passage: Russia moves to boost the Arctic shipping. Spiegel Online

International, September 22. http://www.spiegel.de/international/world/russia-moves-to-promote-northeast-passage-through-arctic-ocean-a-917824.html (retrieved 25 September 2013)

Gas Pricing and Regulation, 2012 – *Gas pricing and regulation. China's challenges and IEA experience.* OECD/ IEA. http://www.iea.org/publications/freepublications/publication/ChinaGasReport_Final_WEB.pdf (retrieved 7 July 2013)

Gazprom's press conference 2013 - Presentation "Gazprom" in Russia's East: Market entry to Asia Pacific. Moscow, June 13. http://www.gazprom.com/press/conference/2013/asia-pacific/ (retrieved 3 February 2014)

Golden Age 2011 – *Golden age: Are we entering a golden age of gas*. World Energy Outlook Special Report, IEA.

Golden Rules 2012 - *Golden Rules for a Golden Age of Gas.* World Energy Outlook Special Report on Unconventional Gas. IEA.

GreenTech 2013 - *The China GreenTech report 2013.* China at a crossroads, 2013. China GreenTech Initiative. http://284582c4ec799f36cf68-3958fb6e2144223e03d1fa1c325551a2.r86.cf1.rackcdn.com/The%20China%20Greentech%20Report%202013%20(English%20version).pdf (retrieved 30 January 2014).

Henderson, James, and Jonathan Stern (2014): "The potential impact on Asian gas markets of Russia's Eastern Gas Strategy". The Oxford Institute for Energy Studies. February.

Higashi, Nobuyuki (2009): "Natural gas in China. Market evolution and strategy". IEA Working Paper Series. IEA/OECD, June. http://www.iea.org/publications/freepublications/publication/nat_gas_china.pdf (retrieved 3 August 2013)

Hu, Desheng, and Shengqing Xu (2013): "Opportunity, challenges and policy choices for China on the development of shale gas". *Energy Policy,* 60: pp.21-26.

IEA 2013 – World Energy Outlook 2013 <http://www.worldenergyoutlook.org/publications/weo-2013/> (retrieved 1 April 2014)

Kate, Warner ten, Laszlo Varro, and Anne-Sophie Corbeau (2013): *Developing a natural gas trading hub in Asia. Obstacles and opportunities*. IEA. http://www.iea.org/media/freepublications/AsianGasHub_WEB.pdf (retrieved 3 February 2014)

Kezik, Irina (2013): Minprirody raskrylo zapasy nefti i gaza Rossii [Ministry of Nature disclosed Russia's oil and gas reserves]. Kommersant, July 15. http://www.vedomosti.ru/companies/news/14167541/minprirody-pereschitaet-zapasy (retrieved 3 February 2014) [in Russian]

Korzhubaev, Alexey (2011): Perspektivy Razvitiya Neftegazovogo Kompleksa Vostochnoi Sibiri i Daljnego Vostoka [Oil and gas development in Eastern Siberia and Far East]. *Region: Ekonomika i Sotsiologiya,* 2: pp.193-210. [in Russian]

Korzhubaev, Alexey, and Oleg Zalevskiy (2010): Problemy i perspektivy eksporta nefti i gaza iz Rossii v Kitai [Export of Russian oil and gas to China: Problems and possibilities]. *Sovremennye Issledovaniya Sotsialjnykh Problem*, No. 4.1 (04). pp.438-445.

Kushkina, Ksenia, and Edward, Chow (2013): "*Golden Age" of gas in China. Is there still a window of opportunity for more gas exports to China?* Yegor Gaidar Fellowship Program in Economics. USRF. IREX.

Li, Fangyi, Zhouying Song and Weidong Liu (2014): China's energy consumption under the global economic crisis: Decomposition and sectoral analysis. *Energy Policy*: 64: pp.193-202.

Li, Zhidong (2013): "Natural gas use policy trends in China". IEEJ: May.

Lin, Boqiang and Ting Wang (2012): "Forecasting Natural Gas Supply in China: Production Peak and Import Trends", *Energy Policy* 49: pp.225-233.

Ling, Song Yen (2013): "China Gas Prices: Deregulating the Market", Insight. October. http://www.platts.com/IM.Platts.Content%5Caboutplatts%5Cmediacenter%5Cpdf%5Cinsight-oct13-chinalng.pdf (retrieved 10 March 2014)

Medium-Term Gas Market Report. Market Trends and Projections to 2018. IEA. 21 June 2013.

National Bureau of Statistics of China, Statistical Yearbook 2012. http://www.stats.gov.cn/tjsj/ndsj/2012/html/G0702e.htm (retrieved 3 August 2013)

The Natural Gas Development Plan during the 12th Five-Year Plan Period, NDRC. October 2012

Nikitin, Boris, Anatoly Dzyublo, Anna Storojeva and Konstantin Khalimov (20130: Shelf Sakhalina. Resursnaya baza i perspektivy osvoeniya gazokondensatnyh mestorozhdenii Kirinskogo Bloka [Resources and development of gas condensate Kirinksky field]. *Neftegaz.Ru*. No. 6, pp. 12-16. [in Russian]

Notice 2012 - *The Notice on Issuing the Subsidy Policies of Exploring and Utilizing Shale Gas.* The Ministry of Finance and the National Energy Administration, 2012.

"Oil and gas regulation in China", *Practical Law*. http://uk.practicallaw.com/3-525-3038 (retrieved 13 March 2014)

Oil and gas security. Emergency Response of IEA Countries. People's Republic of China. IEA. 2012.

Order # 1416 - Schema territorialjnogo planirovaniya Rossiiskoi Federatsii v oblasti federaljnogo transporta (v chasti truboprovodnogo transporta) [Russian Government Order on The Roadmap of Territorial Planning in the Russian Federation in the Area of Federal Transport (in the Part of Pipeline Transport)] The Russian Government Order #1416-p, 13 August 2013. [in Russian]

Program of Cooperation between the Regions of the Far East and Eastern Siberia and the Northeast of the People's Republic of China in 2009-2018. 23 September 2009.

Rattanavich, Raj, Stephen Thompson and Ming Cai (2013) *Unconventional gas and LNG: the ying and yang of Chinese natural gas planning*. Poten & Partners Pty Ltd.

Rosow, Kate (2014): Going big at home and abroad: China's nuclear ambitions. *Breaking Energy*. http://breakingenergy.com/2014/03/11/going-big-at-home-and-abroad-chinas-nuclear-ambitions/?utm_source=Breaking+Energy&utm_campaign=a49f4faeeb-RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_f852427a4b-a49f4faeeb-407963981 (retrieved 11 March 2014)

Shadrina, Elena (2010): Russia's foreign energy policy: Paradigm shifts within the geographical context of Europe, Central Eurasia and Northeast Asia. Oslo: Norwegian Institute for Defence Studies. *IFS Insights*. http://www. ifspublications.com/pdf_downloads/Shadrina_nov_2010.pdf (retrieved 10 January 2014)

Shadrina, Elena (2013): "State capitalism and Russia's energy policy in Northeast Asia". *Near East University Journal of Social Sciences*, 6 (2), pp.65-123.

Shadrina, Elena (2014): "Russia's hydrocarbons for Northeast Asia: Dynamics and dilemmas". *Journal of Governance Studies*. 10, pp.139 -178.

Shadrina, Elena, and Michael Bradshaw (2013): "Russia's energy governance transitions and implications for enhanced cooperation with China, Japan, and South Korea". *Post Soviet Affairs*. 29 (6), 461–469

The Second State Council meeting on implementation of China's 12th FYP on energy development. 1 January 2013. http://www.gov.cn/zwgk/2013-01/23/content_2318554.htm (retrieved 6 July 2013)

The 12th Five-Year Plan for National Economic and Social Development of the People's Republic of China for 2011-2015 (English language version) http://www.cbichina.org.cn/cbichina/upload/fckeditor/Full%20Translation%20of%20the%2012th%20Five-Year%20Plan.pdf (retrieved 23 August 2013)

Vygon, Grigory, and Maria, Belova (2013): Razvitie mirovogo rynka SPG: Vyzovy i vozmozhnosti Rossii [World's LNG market: Russia's opportunities and challenges]. Energeticheskii Tsentr Moskovskoi Shkoly Upravleniya Skolkovo. May. p. 53. [in Russian]

Wang, Jianliang, Lianyong Feng, Lin Zhao and Simon Snowden (2013): "China's natural gas: Resources, production and its impacts". *Energy Policy* 55: pp.690-698.

Wang, Ting, and Boqiang, Lin (2014): "China's natural gas consumption and subsidies – From a sector perspective". *Energy Policy* 65 (2014) pp.541-551.

Wood Mackinzie (2012): "China: Shale gas will not satisfy demand, requiring coal-to-gas and additional imports by 2030". Press Release. 6 June 2012. http://www.woodmacresearch.com/cgi-bin/wmprod/portal/corp/corpPressDetail.jsp?oid=10598941 (retrieved 6 August 2013)

Wu, Kang (2012): *Energy economy in China: Policy imperative, market dynamics, and regional developments.* World Scientific.

Yamaguchi, Kaoru, and Keii Cho (2003): "*Natural gas in Chin*"*a*. Institute of Energy Economics, Japan (IEEJ). August. http://eneken.ieej.or.jp/en/data/pdf/221.pdf (retrieved 16 August 2013)

Yujno-Kirinskoe GKM stalo konkurentom Shtokmana [Yuzhno-Kirinskoe field rivals Shtokman]. *Neftegaz.Ru*. No. 6, 2013. p.8 [in Russian]

Zhou, Nan, David Fridley, Michael McNeil, Nina Zheng, Jing Ke and Mark Levine (2011): *China's energy and carbon emissions outlook to 2050*. China Energy Group. Energy Analysis Department. Environmental Energy Technologies Division. Ernest Orlando Lawrence Berkeley National Laboratory. April.