SUPPLYING LNG TO CHINA: DOES CANADA HAVE WHAT IT TAKES?

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ACRONYMS AND ABBREVIATIONS

bcm	Billion Cubic Meters
CNOOC	China National Offshore Oil Corporation
CNPC	China National Petroleum Corporation
CPG	Compressed Petroleum Gas
DRC	Provincial Development and Reform Commission
FYP	Five Year Plan
GW	Gigawatt
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MMBtu	Million metric British thermal units
NDRC	National Development and Reform Commission
NEA	National Energy Administration
NOCs	National Oil Companies
PM	Particulate Matter
RMB	Renminbi
SOEs	State-Owned Enterprises

EXECUTIVE SUMMARY

Over the past decade, China has experienced rapid growth in demand for natural gas. In 2013, China became the world's third-largest consumer of natural gas, after the United States and Russia.[1] However, as domestic gas production has not kept pace with demand, China has increased imports through cross-border pipelines and coastal liquefied natural gas (LNG) terminals. LNG now accounts for roughly half of China's gas imports. By the end of 2013, China had nine LNG import terminals in operation, with an overall capacity of 28 million tonnes per year.[2] China's imports of LNG are primarily sourced through long-term contracts with Qatar, Australia, Indonesia, and Malaysia.

Natural gas use is driven by industry (43% of China's total natural gas demand in 2012), especially chemical and fertilizer industries, and by heating and residential use (25% of total demand).[3] Demand is also driven by environmental regulations that aim to reduce pollution in major cities like Beijing and Shanghai by decreasing coal use in industry and power generation. Furthermore, the government aims to increase the use of natural gas in transportation.

Gas consumption in China is highly regionalized. For example, 24% of China's total gas use occurs in central China while only 8% of total use takes place in the northeast.[4] There are a number of reasons for these differences, including the distribution of domestic pipeline capacity, regional levels of economic development, and proximity to natural gas and coal production bases within China.

Future demand for LNG in China will be contingent on a number of factors. The first is reform of the domestic pricing mechanism for natural gas. Currently, the price of gas delivered through national pipelines is regulated by the National Development and Reform Commission (NDRC). Generally, LNG that is not delivered through national pipelines is at a price disadvantage. Liberalization of pipeline gas prices would likely lead to some price convergence, thereby increasing the competitiveness of LNG in the marketplace.

Second, reform of oil-linked pricing for LNG sourced from long-term contracts would make LNG more price competitive relative to other sources of energy. Third, the level of domestic production of natural gas will impact demand for LNG. To date, extraction of China's unconventional gas resources, and shale gas in particular, has been limited for a number of reasons, including constraints on water resources,[5] a lack of necessary technology, and geological challenges that make the gas difficult to extract.[6] Finally, the degree of success of ongoing oil and gas sector reform will impact pipeline gas pricing reform and the level of domestic natural gas production.

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[1] CNPC Research Institute of Economics and Technology, *Domestic and International Oil and Gas Industrial Development Report 2013* (CNPC Research Institute of Economics and Technology, 2014), p. 149.
[2] CBI China, *Overview of LNG import data of China* (CBI, May 2014).
[3] GE, *China's Age of Gas: Innovation and Change for Energy Development* (GE, 2013), p. 7, http://www.ge.com/cn/sites/default/files/GE-Gas-China-1015final.pdf.
[4] GE, *China's Age of Gas: Innovation and Change for Energy Development* (GE, 2013), p. 7, http://www.ge.com/cn/sites/default/files/GE-Gas-China-1015final.pdf.
[5] P. Reig, et al., *Global Shale Gas Development: Water Availability and Business Risks* (World Resource Institute, 2014).
[6] Energy Information Administration, *Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries outside the United States* (U.S. Energy Information Administration, 2013), http://www. eia. gov/analysis/studies/worldshalegas.

According to International Energy Agency estimates, China will consume over 500 bcm of natural gas in 2035, making it one of the world's largest natural gas consumers.[7] China is also expected to be one of the world's largest LNG importers in 2035. Given the long term prospect of rising LNG demand in China, market space exists for Canadian LNG. If Canada can get its gas to tidewater, Canada would have the following advantages relative to many competitors as an LNG exporter to China: 1) comprehensive and transparent laws and regulations, rule of law, and a stable political environment; 2) large reserves of natural gas; 3) the potential of offering LNG without the oil-indexed pricing mechanism; and 4) close relationships with China and Chinese national oil companies.

However, Canadian LNG projects face the following challenges in exporting LNG to China and elsewhere: 1) complicated approval procedures; 2) some domestic opposition to building the infrastructure necessary to export gas; and 3) the large transportation distance to China (it takes about 11 days to transport LNG from the west coast of Canada to China). Most importantly, Canada will need to compete with other LNG exporters, notably Australia, Indonesia, Malaysia, Qatar, Russia, and the United States, some of which have the advantages of pre-established contracts with Chinese LNG terminals and shorter transportation distances.

Given this strong competition, Canada must strive to make its projects as competitive as possible. Canadian LNG project proponents will need to be very familiar with the characteristics of the Chinese gas market in order to find niche opportunities and to understand the competitive landscape. Canadian LNG proponents may also want to consider collaborating with Chinese NOCs on LNG terminal construction in China in order to secure buyers.

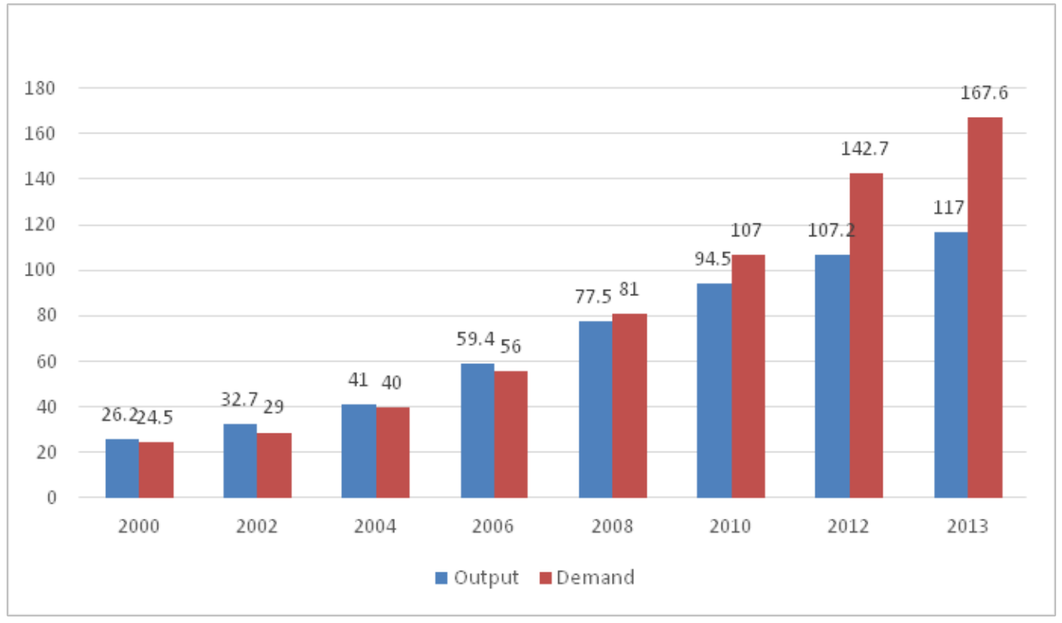
[7] International Energy Agency, *World Energy Outlook 2011* (International Energy Agency, 2011), p.8.

DEMAND FOR NATURAL GAS/LNG IN CHINA

Over the past decade, China has witnessed rapid growth in demand for natural gas. In 2013, China became the world's third-largest natural gas consumer, with total usage of 167.6 billion cubic meters (bcm).[8] In the same year, natural gas accounted for 5.1% of total primary energy consumption, up from 4.7% in the previous year.[9]

Although China was the sixth-largest natural gas producer in the world in 2013, domestic production has not kept pace with demand.[10] Therefore, China is increasingly dependent on imports either through cross-border pipelines from Central Asia or coastal LNG terminals. While China only started to import natural gas in 2006, import dependency has increased rapidly to over 30% by end of 2013 (Figure 1).

Figure 1. Output and demand of natural gas in China, 2000 to 2013 (bcm)



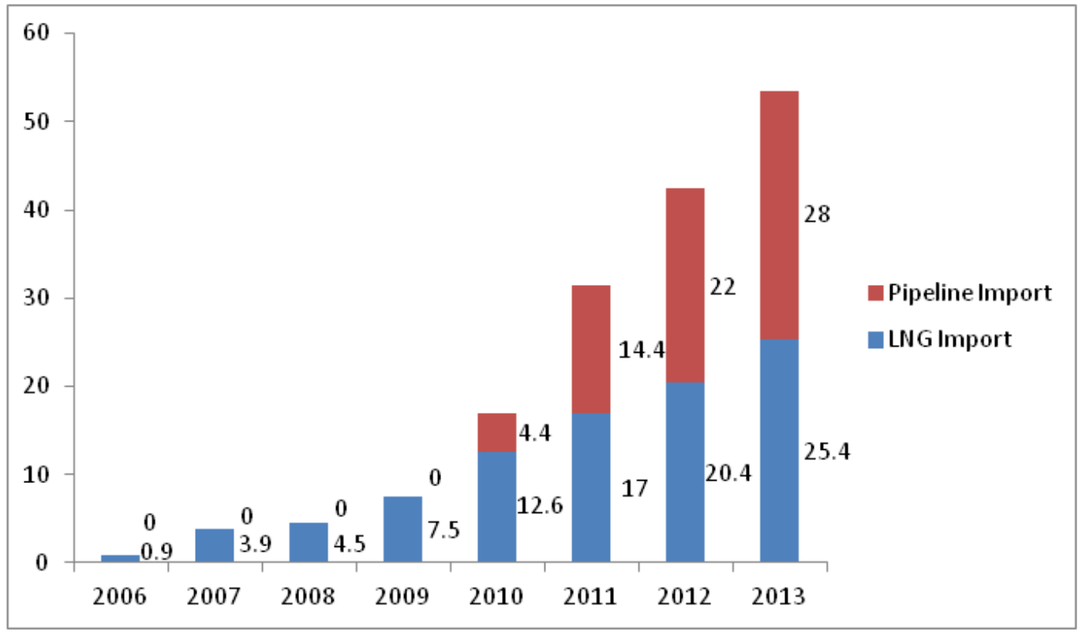
Source: National Bureau of Statistics, 2013

LNG supplies roughly half of China's gas imports (Figure 2). Large Chinese state-owned enterprises (SOEs) and several private-owned enterprises have already established large presences in the global LNG market. For example, China National Offshore Oil Corporation (CNOOC), one of China's top three

[8] CNPC Research Institute of Economics and Technology, *Domestic and International Oil and Gas Industrial Development Report 2013* (CNPC Research Institute of Economics and Technology, 2014), p. 149.
[9] BP, *BP Statistical Review of World Energy 2014* (BP, 2014), p. 41, http://www.bp.com/content/dam/bp/pdf/Energy-economics/statistical-review-2014/BP-statistical-review-of-world-energy-2014-full-report.pdf.
[10] Ibid, p. 22.

energy companies, imported 13 million tonnes of LNG into China in 2013, with a cumulative volume of 50 million tonnes over the past seven years.[11] As of March 2014, CNOOC had signed six long-term contracts overseas, and is now the world's third-largest LNG buyer.[12]

Figure 2. China's natural gas imports, 2006 to 2013 (bcm)



Source: General Administration of Customs, 2013

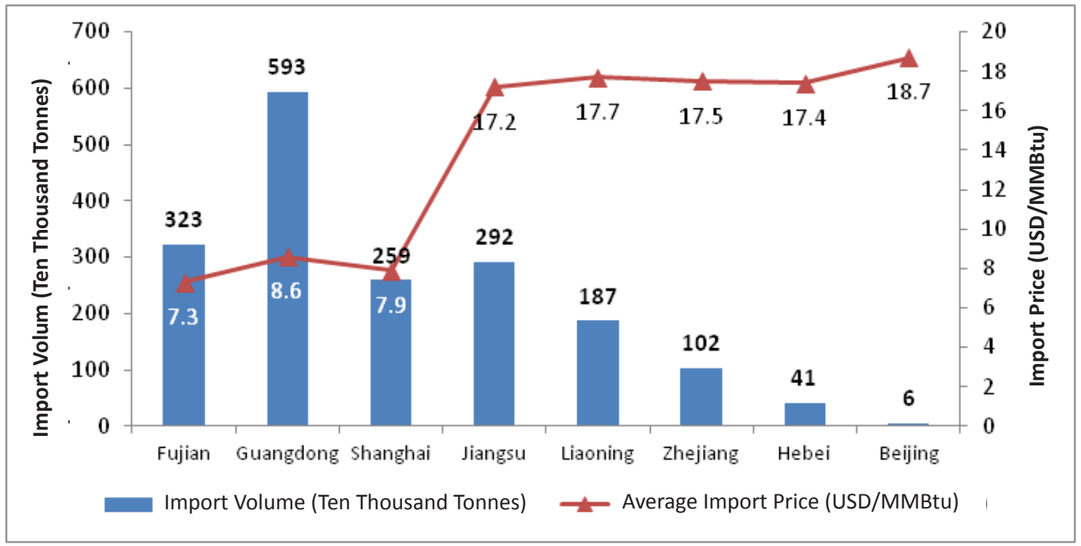
Currently, China's imports of LNG are primarily sourced through long-term contracts with Qatar, Australia, Indonesia, and Malaysia. By the end of 2013, China had nine LNG import terminals in operation, with an overall capacity of 28 million tonnes per year.[13]According to the 12th Five Year Plan (FYP) and discussions for the 13th FYP, the total capacity of China's LNG terminals will reach 50 million tonnes per annum in 2015 and 80 million tonnes per annum by 2020.[14]

As shown in Figure 3, the price of LNG imported to China's southeast coast is less than half the price of LNG imported to the northeast. This discrepancy is due to differences in the terms of the LNG contracts

[11] BP, *BP and CNOOC sign 20-year LNG deal* (June 17, 2014), http://www.bp.com/en/global/corporate/press/press-releases/bp-and-cnooc-sign-20-year-lng-deal.html.
[12] M. Kavanagh, *BP Signs $20bn Deal with China* (The Financial Post, June 18, 2014), http://www.ftchinese.com/story/001056795/en.
[13] CBI China, *Overview of LNG import data of China* (CBI, May 2014).
[14] National Energy Administration, 天然气发展"十二五"规划, (National Energy Administration, 2012).

with each of the terminals. The operators of the three oldest LNG terminals (in Guangdong, Fujian, and Shanghai) signed contracts with suppliers in Australia, Malaysia, and Indonesia in the mid-2000s on favourable terms. However, many of the LNG terminals built in the last five years have had to import high-priced LNG, mainly from Qatar. In recent years, even China's earliest suppliers have been seeking to renegotiate the LNG prices in existing contracts.

Figure 3. LNG import volumes and prices by province or city, 2013



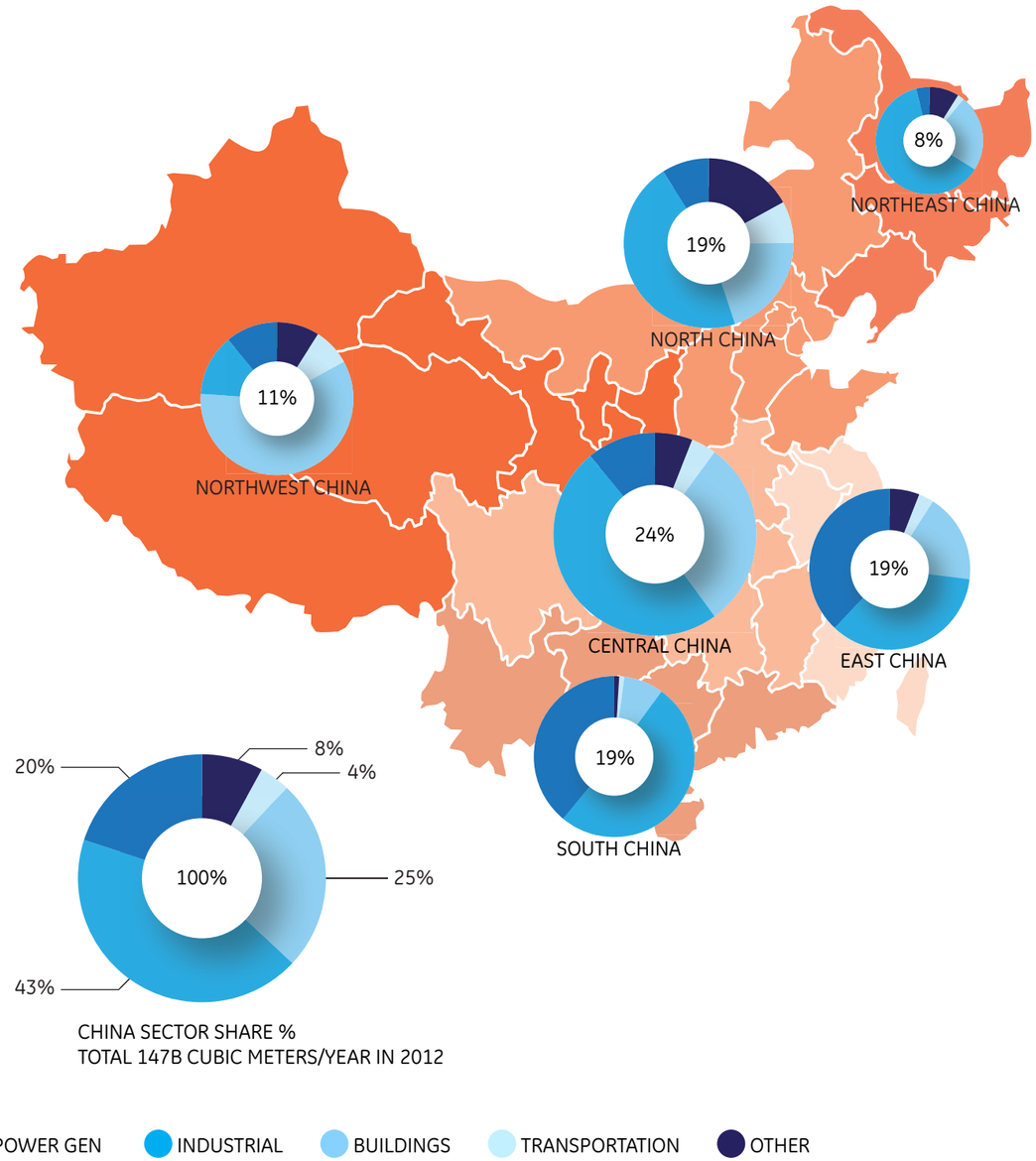
Source: CBI, 2014[15]

Gas consumption in China is highly regionalized (Figure 4). For example, 24% of China's total gas use occurs in central China while only 8% takes place in the northeast.[16] There are a number of reasons for these differences, including the distribution of domestic pipeline capacity, regional levels of economic development, and proximity to natural gas and coal production bases within China.

The case of gas demand in East and South China illustrates these factors well. Both of these regions are far from coal production in the north and from gas-producing areas, such as the Sichuan Basin. As a result, coal use in the east and south is low compared to many other regions and pipeline gas is expensive due to long transport distances. Nevertheless, due to relatively high levels of economic development, these regions are able to afford substantial consumption of pipeline gas and LNG. For example, Guangdong alone accounts for 11 GW of China's 40 GW of gas-fired power generation capacity.[17]

[15] CBI China, *Overview of LNG import data of China* (CBI, May 2014).
[16] GE, *China's Age of Gas: Innovation and Change for Energy Development* (GE, 2013), p. 7, http://www.ge.com/cn/sites/default/files/GE-Gas-China-1015final.pdf.
[17] CNPC Research Institute of Economics and Technology, *Domestic and International Oil and Gas Industrial Development Report 2013* (CNPC Research Institute of Economics and Technology, 2014), p. 162.

Figure 4. China's regional natural gas demand, 2012



[18] GE, *China's Age of Gas: Innovation and Change for Energy Development* (GE, 2013), p. 7, http://www.ge.com/cn/sites/default/files/GE-Gas-China-1015final.pdf.

DRIVERS OF NATURAL GAS DEMAND IN CHINA

Natural gas is utilized across a range of sectors in China, including industry, heating and residential use, power generation, and transportation. Furthermore, the recent surge in China's natural gas demand has been driven, at least in part, by environmental policy. These drivers of gas demand in China are discussed below.

INDUSTRIAL USE

Industry is the largest consumer of natural gas in China, accounting for 43% of total demand in 2012 (Figure 4). Within this category, major consumers are the chemical and fertilizer industries, both of which use natural gas as feedstock. This gas is predominantly supplied by pipelines at prices regulated by NDRC. Heavy industries, such as glass and ceramics manufacturers, are increasingly switching energy sources from coal and oil to natural gas due to government pressure to reduce pollution.

However, as the Chinese economy slows down, low value-added chemical and heavy industries may need to switch from natural gas to cheaper sources of fuel and feedstock. As a result, natural gas consumption growth from these industries may be limited in the future. In the long term, gas suppliers may need to cultivate the emerging high value-added markets, such as transportation and high-tech chemical industries, that are able to afford higher priced and cleaner energy.

HEATING AND RESIDENTIAL USE

The second largest use of natural gas in China is for heating and residential purposes.[19] The consumption of natural gas in urban areas has increased nearly ten-fold since 2000, due to the completion of more local and regional gas pipelines.[20] However, in 2012, only 210 million citizens, or less than 30% of the urban population, had access to city gas supply, leaving huge potential for future growth.[21]

POWER GENERATION

Power generation is the third largest use for natural gas. Due to severe air pollution, many provinces and cities in northern China are now switching their coal-fired heat and power plants to natural gas. For example, the Beijing municipal government already phased out all four of the coal-fired heat plants in the city and replaced them with gas-fired plants.

Natural gas is used for peak-load power generation for industry in rich regions that are far from coal production bases in China. Local governments are sometimes willing to subsidize gas-fired power plants to provide industry with a steady supply of power. However, these governments may find it difficult to continue the subsidy, especially since the economy has slowed and coal prices have dropped nearly half from their peak.

[19] Ibid.
[20] ETRI, *Domestic and International Oil and Gas Industrial Development Report 2013* (Economics & Technology Research Institute, 2014), p.158.
[21] CNPC Research Institute of Economics and Technology, *Domestic and International Oil and Gas Industrial Development Report 2013* (CNPC Research Institute of Economics and Technology, 2014), p. 158.

TRANSPORTATION

LNG usage in transportation is nascent in China. While LNG-powered vehicles currently hold a low market share, the number of these vehicles has grown rapidly, quadrupling between 2010 and 2013.[22] The government aims for LNG to account for 10% of energy demand in inland navigation[23] by 2020.[24]

LNG in transportation illustrates the important role of government policy in driving gas demand in China. The government is promoting natural gas usage in transportation to mitigate air pollution. Both central and local governments offer purchase subsidies and tax rebates to promote clean energy vehicles, including those using LNG and compressed petroleum gas (CPG). Governments are also building infrastructure to improve the gas supply for vehicles. As a result, the number of natural gas stations increased more than 50% in the first three quarters of 2013.[25]

LNG currently has the benefit of being a cheaper fuel than diesel or petrol. This trend could intensify depending on government policy regarding oil prices. As China's car ownership increases, oil companies are facing deficits as consumer prices are not keeping pace with the costs of importing needed foreign oil, which is more expensive than domestic oil. Oil companies are pressuring the Chinese government to liberalize domestic oil prices to reduce the price gap between international and domestic markets. If international, and therefore domestic, oil product prices increase and prices of natural gas remain low, this would create a large price gap between LNG and oil products with the same thermal value.

ENVIRONMENTAL REGULATION: REPLACING COAL WITH GAS TO COMBAT POLLUTION

As illustrated above, rising natural gas and LNG demand may be partially attributed to environmental policy aimed at reducing smog and other pollutants in many major cities such as Beijing and Shanghai. Under unprecedented public pressure to reduce air pollution, the Chinese government declared a "war on pollution" during the 2014 National People's Congress.[26]

Furthermore, in September 2013, the State Council issued the Air Pollution Prevention and Control Action Plan (the plan) to reduce PM2.5[27] pollution and improve air quality. The Plan mandates that the share of coal in primary energy consumption in China as a whole should fall to 65% by 2017 from over 70% in 2013. Furthermore, the plan aims to reduce the concentration of PM2.5 in Beijing, Tianjin, and Hebei province (the "Jing-Jin-Ji economic zone") by 25%, 20%, and 15%, respectively.[28] As a result, these jurisdictions must reduce their annual coal consumption by over 60 million tonnes by 2017 through economic structural

[22] Ibid, p. 150.
[23] "Inland navigation" refers to transportation by ship through inland waterways.
[24] Ministry of Transportation, *The Opinion about Promoting LNG Utilization in Navigation Sector* (Ministry of Transportation, October 23, 2013), http://www.gov.cn/gongbao/content/2013/content_2547150.htm.
[25] Ibid, p. 159.
[26] The National People's Congress of the People's Republic of China, *China declares war against pollution* (The National People's Congress of the People's Republic of China, March 5, 2014), http://www.npc.gov.cn/englishnpc/Special_12_2/2014-03/05/content_1838415.htm.
[27] PM2.5 refers to airborne fine particulate matter with a diameter of 2.5 microns or less.
[28] Ministry of Environmental Protection, *The State Council Issues Action Plan on Prevention and Control of Air Pollution Introducing Ten Measures to Improve Air* (Ministry of Environmental Protection ,September 12, 2013), http://english.mep.gov.cn/News_service/infocus/201309/t20130924_260707.htm.

change, closure of inefficient and dirty industries and switching to alternative fuels such as natural gas. The central government has urged the Jing-Jin-Ji economic zone governments to sign natural gas contracts with the China National Petroleum Corporation (CNPC) and Sinopec.

The decision to "dash to gas" has mostly been made by local governments without national coordination. After heavy smog in January 2013, the shift accelerated so quickly that gas shortages occurred. The NDRC had to step in to ask local governments to secure gas supply before phasing out coal in their cities.

LNG PROJECTS AND LICENSING PROCESSES

LNG TERMINALS IN CHINA

As of the end of 2013, China had nine LNG terminals in operation with a total capacity of 28 million tonnes per year. Another four terminals will become operational by end of 2014 (Table 1).[29] Most existing LNG terminals are either owned exclusively by one of the three major national oil companies (predominantly CNOOC) or by a joint venture between one of the national oil companies and a local investor, most of which are also state-owned entities.

Foreign investors have been involved in some projects. For example, BP is an investor in the Shenzhen LNG terminal. Recently, there have been new proposals for LNG terminals by Chinese private energy companies, either alone or jointly with international companies. For example, ENN Energy, a Chinese private energy distributor, has proposed an LNG terminal in Zhejiang Province;[30] Xinjiang Guanghui Energy Company, together with Shell, has proposed a facility in Jiangsu Province;[31] and Hanas New Energy Group, together with Korea's SK Group, has proposed new facilities in Fujian and Guangdong provinces. These projects have not yet received official approval.

Table 1. China's existing LNG terminals as of the end of 2013

Region	LNG Project	National Oil Company Owner	Major Source Country
Bohai Rim	Dalian, Liaoning	CNPC	Australia
	Tangshan, Hebei	CNPC	Qatar, Australia
	Tianjin FLNG	CNOOC	Unknown
East Coast	Shanghai	CNOOC	Malaysia
	Ningbo, Zhejiang	CNOOC	Qatar
	Rudong, Jiangsu	CNPC	Qatar
Southeast Coast	Shenzhen, Guangdong	CNOOC	Australia
	Zhuhai, Guangdong	CNOOC	Qatar
	Putian, Fujian	CNOOC	Indonesia

Source: Compiled by author

[29] CBI China, *Overview of LNG import data of China* (CBI, May 2014).
[30] Xinhua News Agency, *Private firms looking to snatch a share in natural gas importing business* (Xinhua News, July 3, 2013), http://app.xinhua08.com/print.php?contentid=1205411.
[31] Ibid.

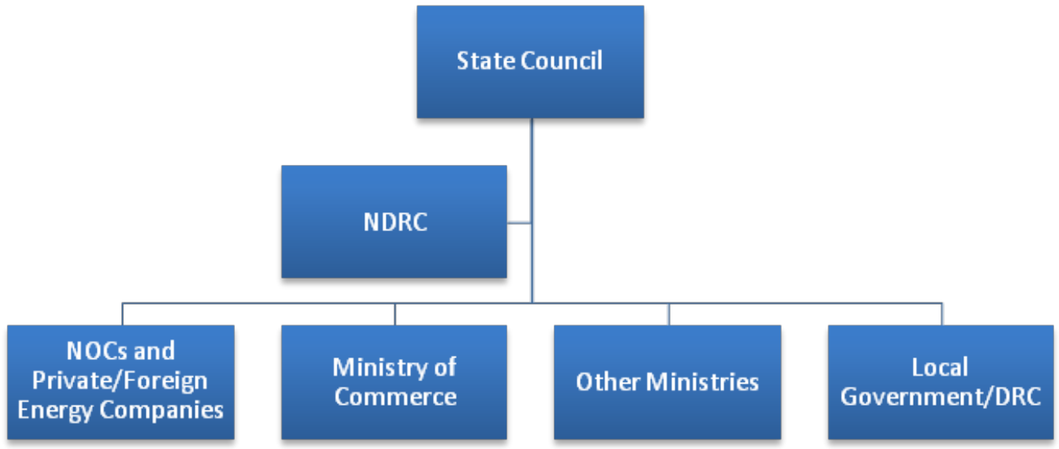
LICENSING AND OPERATING LNG PROJECTS

The central government oversees energy infrastructure such as LNG terminals. NDRC has an overall blueprint for the locations and number of LNG facilities to coordinate with gas pipeline construction. In addition, NDRC holds the ultimate right of approval for LNG terminal applications.

Under the current regulatory scheme, local governments can propose LNG import terminals. These proposals have to be approved by the provincial Development and Reform Commission (DRC) before being submitted to NDRC for final approval. Many coastal provincial governments play very proactive roles in attracting and persuading energy SOEs (the three NOCs in particular) and foreign energy corporations to build LNG terminals. In most cases, local governments hold a 30-50% share in local LNG projects through investment or local utility companies. Powerful local governments and the national oil companies are the most influential lobbyists to China's overall LNG plan.

Once the LNG terminal application is submitted by the provincial DRC to NDRC, approvals from other central government ministries have to be obtained before NDRC can issue a final decision. The Ministry of Commerce is mainly in charge of China's gas trade with foreign countries. LNG operators must be approved by this ministry in order to source LNG from abroad (See Figure 5).

Figure 5. Institutional structure of LNG approval



The trading company that will operate the LNG terminal has to prove that it has secured sufficient long-term LNG supply agreements for the terminal before the proposal goes to NDRC. In practice, NDRC approves a bundle deal for the LNG terminal and the foreign gas sources and contracted volume. The terminal operator is then the seller for any gas it imports, and can supply the gas either directly to the consumer or sell it to another domestic trader, such as a municipal gas utility company. In China, regulation permits

only local state-owned utility companies, which often have a monopoly in the local market, to supply gas to the residential market. Large industrial users, such as fertilizer manufacturers and power plants, may sign deals directly with gas suppliers, including LNG importers. An increasing number of small LNG dealers specialize in reselling LNG to inland areas that are not serviced by pipelines and to smaller gas consumers, such as LNG bus and boat operators.

FACTORS INFLUENCING THE GROWTH OF CHINA'S LNG MARKET

As China's economy continues to grow, natural gas use is expected to increase. According to International Energy Agency estimates, China will consume over 500 bcm of natural gas in 2035, making it one of the world's largest natural gas consumers.[32] China is also expected to be one of the world's largest LNG importers in 2035. Despite the optimism about increased natural gas use in China,[33] a number of factors could affect the growth of China's LNG market, including:

1. Domestic gas pricing reform
2. Establishment of an Asian hub price for gas
3. Competition from alternative energy sources
4. Oil and gas sector reform

DOMESTIC GAS PRICING REFORM

The price of natural gas that is delivered through China's main national pipelines is regulated by NDRC. As Table 2 illustrates, the price varies by province and end-user. However, the prices of LNG and other gas sources that are delivered to consumers through local pipelines or other methods of transportation are negotiated between users and importers. As a result, imported LNG prices largely exceed the pipeline gas prices regulated by NDRC, making LNG only attractive to those without pipeline access.

Table 2. Natural gas prices in different regions and sectors, 2013 (RMB/cubic meter)

Region	Residence	Industry	Transportation
Beijing	2.28	3.23	5.12
Tianjin	2.40	3.25	4.20
Shijiazhuang, Heibei	2.40	3.45	3.75
Hohhot City, Inner Mongolia	1.82	1.92	3.56
Shenyang, Liaoning	3.30	3.90	4.70
Changchun, Jilin	2.80	3.20	4.42
Harbin, Heilongjiang	2.80	4.30	4.50
Shanghai	2.50	3.99	4.70
Nanjing, Jiangsu	2.20	3.39	4.60
Hangzhou, Zhejiang	2.40	4.84	4.00
Ningbo, Zhejiang	2.80	4.45	4.45
Hefei, Anhui	2.33	3.60	3.98

[32] International Energy Agency, *World Energy Outlook 2011* (International Energy Agency, 2011), p.8.

[33] Energy Information Administration, *China's Low Carbon Development Roadmap to 2050* (Energy Research Institute, NDRC, 2009); T. Wang, and J. Watson, *China's Energy Transition* (Tyndall Center for Climate Change Research, UK, 2009); Chinese Academy of Science, *China 2050: Roadmap of Energy Technology Development* (Chinese Academy of Science, 2009).

Jinan, Shandong	2.70	4.14	4.71
Qingdao, Shandong	2.40	3.60	4.40
Zhengzhou, Henan	2.25	2.86	3.60
Wuhan, Hubei	2.53	3.41	4.50
Changsha, Hunan	2.45	3.48	4.60
Nanning, Guangxi	3.86	4.20	4.95
Haikou, Hainan	3.15	3.98	5.68
Chongqing	1.72	2.24	4.60
Chengdu, Sichuan	1.89	3.25	4.00
Xi'an, Shaanxi	1.98	2.30	3.55
Lanzhou, Ganshu	1.70	1.99	3.10
Xining, Qinghai	1.48	1.70	3.14
Urumqi, Xijiang	1.37	2.11	4.07

Source: Provincial DRC and Price Administrations

The Chinese government has undertaken reform of gas pricing since 2011. Prior to 2011, the mechanism for determining city-gate prices was "cost-adding," meaning that the price of gas was determined by adding a certain percentage of profit to the cost of production and transportation. This pricing system aimed to protect gas supply and to ensure profits for the gas industry, while also controlling the price to the end-user. However, the need to import natural gas to meet demand has resulted in large deficits for gas importers, as expensive pipelines had to be built and imported gas is more expensive than domestically produced gas. The pricing mechanism, however, did not reflect this higher cost structure.

At the end of 2011, the provinces of Guangdong and Guangxi initiated a pilot gas pricing reform, in which pipeline natural gas prices were linked to the prices of fuel oil and liquefied petroleum gas (LPG). In July 2013, this approach was extended nationwide to the industrial and commercial sectors, but only to gas volumes over 2012 demand. In September 2014, NDRC raised the price on volumes below 2012 demand levels, and will continue to raise the prices on this volume in subsequent adjustments. So far, the price reform has excluded residential gas demand.

Pipeline gas prices will likely be liberalized in the long term, and the price difference between gas provided by national pipelines and gas from other sources will diminish, improving the competitiveness of LNG. Gas pricing that is based on the market for natural gas in China would assist the development of the LNG market in the country. LNG can offer consumers greater supply flexibility and thermal value than pipeline gas, characteristics that make LNG attractive when it is not subject to a systematic price disadvantage. Uniform prices will also create a more even playing field between imported LNG and LNG that is manufactured within China from cheap pipeline gas.

ESTABLISHMENT OF AN ASIAN HUB PRICE FOR GAS

The size of the LNG market in China will be influenced by the price of LNG relative to other available energy sources. For example, weak demand for coal has reduced coal prices, making natural gas less desirable from a cost perspective.

In recent years, the price of LNG in Asia has been substantially higher than the price in the Atlantic market, a phenomenon referred to as the Asian Premium. This premium occurs, in part, because gas prices in Asia

are linked to the price of oil (which has been high), while the United States, and to some extent Europe, have gas trading hubs that allow gas prices to be determined by gas supply and demand.

A number of Asian countries are eager to secure cheaper LNG prices by seeking pricing mechanisms that are not linked to oil. As a result, some of these countries intend, and are competing, to establish an Asian gas hub. Shanghai has a number of characteristics that make it well suited to this role, including access to substantial quantities of both pipeline gas and LNG and to a growing domestic market. But there are challenges associated with the choice of Shanghai. An effective Asian gas hub will require a market-driven natural gas price as a basis for international trading, and also strong mutual trust among countries in the region. Gas prices are still government-regulated in China and the diplomatic relationship between China and Japan is complex. Nevertheless, Shanghai still has a high potential to become a regional gas hub as these challenges will likely be mitigated in the future.

COMPETITION FROM ALTERNATIVE ENERGY SOURCES

Shale and Other Unconventional Gas Developments

The growth of the LNG market in China could be negatively impacted by substantial increases in domestic natural gas production, especially if domestic gas continues to have a price advantage to LNG. While China intends to increase the production of conventional gas, the government is also turning its attention to the development of shale gas, coal-bed methane, and to some extent, coal-to-gas projects.

With respect to shale gas, the United States Energy Information Administration estimates that China has the largest technically-recoverable reserves in the world (1, 115 trillion cubic feet).[34] To date, China has had two rounds of auction for shale gas fields, resulting in the sale of a dozen fields. The first round was open exclusively to state-owned energy enterprises, while the second was opened to private companies and investors.

However, the extraction of China's unconventional gas resources, and shale gas in particular, has been limited for a number of reasons, including constraints on water resources,[35] a lack of necessary technology, and geological challenges that make the gas difficult to extract.[36] While the Chinese government still has a high ambition for shale gas production, the National Energy Administration (NEA) has halved the production target for 2020 to 30 bcm.[37]

Only one shale gas site, the Fulin shale gas field operated by Sinopec, has reached industrial operation levels. Sinopec drilled 62 shale gas wells, of which 23 are in operation, with a total output of over 1 millon cubic meters per day in April 2014. [38] Sinopec declared that it has independently developed all the technologies required along the value chain of shale gas exploration and production.[39] Furthermore, analysts from Bloomberg New Energy Finance believe shale gas from Fulin will have a price advantage

[34] Energy Information Administration, *Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries outside the United States* (U.S. Energy Information Administration, 2013), http://www. eia.gov/analysis/studies/worldshalegas.
[35] P. Reig, et al., *Global Shale Gas Development: Water Availability and Business Risks* (World Resources Institute, 2014).
[36] Energy Information Administration, *Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries outside the United States* (U.S. Energy Information Administration, 2013), http://www. eia. gov/analysis/studies/worldshalegas.
[37] *China cuts 2020 shale gas output target as challenges persist* (Platts, 18 Sept 2014), http://www.platts.com/latest-news/natural-gas/singapore/china-cuts-2020-shale-gas-output-target-as-challenges-27641138
[38] X. Cao, *China makes progress developing shale* (Bloomberg New Energy Finance, 2014), p.1.
[39] Ibid, p.1.

over LNG imports.[40]

Coal-to-Gas Projects

As of the end of 2013, four plants for converting coal into natural gas had received approval by NDRC and more than 60 projects were pending. These projects, both approved and pending, have a total capacity of over 26 bcm, equivalent to the volume of pipeline imports. Some pending projects have started construction without approval.[41] However, coal-to-gas projects are proving to be neither cost effective nor environmentally- friendly. After a fatal accident in a coal-to-gas project in Inner Mongolia that supplies gas to Beijing,[42] NDRC applied the brakes to the Chinese version of "dash to gas using coal," stating that it would be more stringent in approving future projects.[43]

In summary, unconventional gas production in China amounted to under two bcm, less than 1.5% of total natural gas production, in 2012.[44] Therefore, pipeline and LNG imports will continue to play vital roles in China's natural gas supply in the coming decade, and LNG will have great potential in areas that are far from major gas pipelines.

OIL AND GAS SECTOR REFORM

The upstream and downstream oil and gas industry in China is dominated by three NOCs: CNOOC, CNPC, and Sinopec. Recently, there has been escalation in reforms aimed at reducing the control of China's major NOCs in the areas of gas production, pipeline infrastructure, and LNG facilities, as well as removing the monopoly enjoyed by some regional gas distributors. These reforms could create opportunities for the LNG industry by increasing demand for natural gas and expanding LNG import infrastructure. However, the reforms could also create greater competition for LNG within China by stimulating domestic natural gas production and creating favourable conditions for pipeline gas imports.

The reform of the oil and gas sector has been an ongoing project since the 1980s, when the Ministry of Petroleum was broken up into the three national oil companies. However, the Chinese government only recently opened up the strategically important oil and gas sector to private investment. At the Third Plenum of the Eighteenth Party Congress in November 2013, the Chinese government decided to expedite the mixed ownership reform and let the market play a more decisive role in allocating resources, including energy resources.

In order to encourage private sector involvement in shale gas production, the Chinese government has identified shale gas as a separate mine category to natural gas. This is intended to avoid existing legal constraints preventing non-NOC investors in the oil and gas sectors. Investment in shale gas is open to all investors and the price of shale gas is fully market driven. This approach is expected to extend to other unconventional gas production, including coal-to-gas, but so far environmental concerns and high costs

[40] Ibid, p.8.
[41] CNPC Research Institute of Economics and Technology, *Domestic and International Oil and Gas Industrial Development Report 2013* (China National Petroleum Corporation, Research Institute of Economics and Technology, 2014), p. 431.
[42] Climate Policy Institute,中国低碳发展报告 *(2014)* (Climate Policy Institute, Tsinghua University, 2014).
[43] National Energy Administration,关于规范煤制油、煤制天然气产业科学有序发展的通知》, (National Energy Administration of National Development and Reform Commission, July 22, 2014).
[44] ETRI, *Domestic and International Oil and Gas Industrial Development Report 2013* (Economics & Technology Research Institute, 2014), p.158.

have created barriers to attracting private investors.[45]

Control of pipeline infrastructure by the big three NOCs, is also being relaxed. CNPC, which operates about 80% of China's oil and gas pipelines, is preparing to refinance the West-East Gas Pipelines I and II, or about 20% of its total pipeline assets. CNPC also opened up investment in the construction of West-East Gas Pipeline III to other state-owned and social finance institutions, including the National Pension Fund. Meanwhile, Xinjiang Guanghui Energy Company, a private energy company in China, has constructed a China-Kazakhstan gas pipeline, the first cross-border natural gas pipeline built by private investor, to connect with its LNG plant[46] in Xinjiang Province.

In October 2012, Sinopec designated one of its pipelines as available for use by others. In this case, other gas companies can deliver their gas through the pipeline by paying Sinopec a delivery rate set by NDRC. In August 2014, CNPC applied a similar approach to one of its LNG terminals, allowing a third-party trader to import a cargo of LNG through its facility. This is the first time that an NOC has allowed third-party use of one of its LNG terminals. This practice may become more common as some terminals experience problems securing affordable and reliable gas sources.

Reform of municipal gas distribution is also currently under consideration. Under current regulations, only certain large city gas companies are allowed to distribute gas to urban consumers. These companies also own their own local pipelines. This effectively gives them a monopoly position in the market. There is discussion in government about connecting municipal pipelines and opening the sector to more competition. This competition, along with gas price reform, should improve gas prices and choice of suppliers, thereby unleashing significant growth in natural gas demand in the residential sector.

As barriers are removed, new players are expected to enter the gas value chain. Small inland LNG suppliers, most of which are not state-owned companies, are already competing fiercely over market share. Some private Chinese companies are also planning to begin LNG terminal construction and compete with the NOCs. Private companies are also reported to be investing in small natural gas and oil fields overseas, both in Asia and North America. These investors will be pushing for a more open market so that they are not limited to a few large and powerful NOC buyers when exporting oil and gas back to China, either through pipeline or LNG terminals.

The potential impacts of opening up the oil and gas sector to wider investment are profound. First, the demand for gas will certainly increase as more players enter the market and offer localized solutions to meeting demand. Second, breaking down the vested interests of the major oil companies is essential to furthering market opening measures and gas pricing reform. Third, reform will facilitate investment into LNG infrastructure. On the other hand, reform may cause more competition against LNG, not only from increased domestic natural gas production, but also from alternative energy supplies, such as fuel oil and LPG.

[45] T. Li, et al., "Environmental Impacts of Shale Gas Development in China and Recommendations on Management of their Environmental Impact Assessment", Proceedings of IAIA13, the 33rd Annual Meeting of the International Association for Impact Assessment, Calgary, May 13-16, 2013.
[46] This plant produces LNG from pipeline gas.

CANADA'S OPPORTUNITIES AND COMPETITION IN CHINA'S LNG MARKET

Given China's rising natural gas demand, there is enough market space for Canada to become a high-value LNG exporter to China, provided Canada can get gas to tidewater. While Canada has some unique advantages compared to other LNG exporters, including the United States, there are also specific challenges that Canadian LNG exporters must overcome.

The top LNG exporters to China are Qatar, Australia, Indonesia, and Malaysia. China has also purchased relatively large amounts of LNG from the Republic of Trinidad and Tobago on the spot market, but the amount purchased varies by year. The three earliest LNG terminals to be constructed in China (Guangdong Dapeng, Fujian Putian, and Shanghai) each imports almost exclusively from one of the major source countries. Guangdong imports predominantly from Australia, Shanghai from Malaysia, and Fujian from Indonesia. Qatar is the main source country for all new LNG terminals that opened after the first three.

With so many other LNG suppliers available, Canadian LNG exporters will need to ensure that they can supply stable volumes of gas at competitive prices. China's average LNG price was US$11.30/MMBtu in 2013. LNG from Qatar was priced the highest of the main sources, averaging US$17.70/MMBtu, and Indonesian and Malaysian prices were significantly lower at US$3.90/MMBtu and US$8.10/MMBtu, respectively. The contract price with Australia was the lowest at US$3.40/MMBtu, about one-fifth the price of imports from Qatar. China also imports some LNG from Yemen, Egypt, Nigeria, and other Middle Eastern suppliers at an average price of US$15.12/MMBtu.[47]

It is important to note that the Chinese gas market is still very sensitive to price. After the Chinese government introduced the new gas pricing scheme nationwide in July 2013, there was an immediate decrease in demand across almost all consumer classes, including the emerging LNG transportation sector as the price gap between LNG and diesel narrowed.

CANADA'S ADVANTAGES AS AN LNG EXPORTER

If Canada can get natural gas to tidewater, it would share similar advantages with Australia as an LNG exporter. Both countries are developed economies with comprehensive but transparent laws and regulations, rule of law, and stable political environments. While the United States also has these qualities, geopolitical tensions between China and the United States will likely continue as China grows economically. Energy, and natural gas in particular, could be a sensitive political subject between the two countries. Having a stable political environment is a particular advantage for any energy seller to China, since Chinese NOCs have experienced political turmoil at operations in Iraq, Libya, and elsewhere.

Like the United States, Canada has the advantage of potentially offering LNG without an oil-indexed pricing mechanism. Since Canadian producers have been extracting large amounts of natural gas for many years, the marginal production cost of gas is much lower than that of emerging exporters. Relatively low production cost, abundant natural gas reserves, and the potential for a gas price delinked from oil are all Canadian advantages over China's traditional LNG suppliers.

[47] CBI China, *Overview of LNG import data of China* (CBI, May 2014).

Canada can also benefit from its close relationships with China and Chinese NOCs. Between 2008 and 2013, Chinese oil companies invested US$30 billion in Canada's oil and natural gas sector,[48] including the C$15 billion acquisition of Nexen by CNOOC in 2013.[49] Nexen recently received export approval from the National Energy Board for its Aurora LNG project in British Columbia.[50] PetroChina owns a 20% stake in the LNG Canada project, which is 50% owned by Shell Canada. These business connections give Canada an opportunity to extend into further collaborations with Chinese NOCs, and the advanced technology Canada could offer through joint ventures and investment is also attractive to China.

CANADA'S CHALLENGES AS AN LNG EXPORTER

However, Canadian LNG export projects face some challenges. First and foremost, Canada lacks the necessary pipelines and liquefaction facilities to export LNG and is experiencing some obstacles to building this infrastructure. Canadian LNG projects also face complicated government approval processes compared to competing projects in locations such as Qatar. China is building LNG terminals quickly and will need to secure natural gas for these projects in the near term.

Furthermore, Canada faces challenges securing the social license necessary to move forward with expansion of natural gas extraction and LNG export projects. Some members of the public are concerned about the potential environmental damage that could result from LNG projects. Some First Nations in British Columbia (B.C.) are also concerned about environmental damage and stress that they have the right to be consulted regarding activities that take place in their traditional territories. Obtaining social license is vital to successfully increasing LNG exports from Canada, but gaining this license is not assured.

Canada is disadvantaged in its long transportation distance to China, especially when compared to exporters in the Asia-Pacific region. It takes about 11 days to transport LNG from the west coast of Canada to China,[51] resulting in higher transportation costs. To what extent the distance factor will offset the price advantage of North American gas remains to be seen.

The shortest route for shipping LNG from Canada to China is to the Shanghai terminal and nearby regions. Transported to the Shanghai terminal, Canadian LNG may be price competitive against expensive gas from Qatar, but less competitive against Malaysian LNG. As Shanghai enjoys depressed and regulated pipeline gas prices, sellers of LNG will need to find an initial niche market, for example, in transportation or peak-load power plants.

[48] D. Gordon, et al., *China's Oil Future* (Carnegie Endowment for International Peace, 2014), http://carnegieendowment.org/2014/05/06/china-s-oil-future/h93y.
[49] T. Wang, *China's Energy Future at a Crossroads* (Carnegie-Tsinghua Center for Global Policy, Q&A, 2014).
[50] National Energy Board, *NEB Approves Aurora LNG and Oregon LNG Export Licenses* (NEB, 1 May 2014), http://www.neb-one.gc.ca/clf-nsi/rthnb/nws/nwsrls/2014/nwsrls17-eng.html.
[51] G. Morrison (Canada Association of Petroleum Producers), "Opportunities and Challenges for Natural Gas in British Columbia", Proceedings of the UBCM Convention, Victoria, Canada, 2012.

CANADA'S COMPETITORS: CHINA'S CURRENT LNG SOURCE COUNTRIES

Australia

Australia is a major LNG exporter, and is expected to be the next nation to enter the shale gas revolution,[52] in spite of significant regulatory barriers.[53] It is estimated that Australia's overall LNG yields could reach 110 million tonnes per year after new LNG projects are completed, and that Australia will overtake Qatar as the world's largest LNG exporter in the long run. It is also the only developed economy in the Asia Pacific region that exports LNG to China. Geographical proximity and political stability make it one of the most reliable sources of LNG for China. Australian LNG is the cheapest among all LNG imports to China (US$3.40/MMBtu).[54]

However, Australia faces domestic challenges to further developing its LNG industry, such as complicated approval processes for LNG export facility development and resistance from communities and environmental groups. One unexpected difficulty for Australia's LNG industry is the high input costs caused by the natural resource boom over the last decade. This boom was driven predominantly by demand from emerging economies such as China. As demand from China weakened, the Australian economy slowed down, but the cost of doing business has remained high. As a result, the price of Australian LNG is likely to be much higher in the future than in China's first Australian LNG contract (see Table 3). Furthermore, high input costs are preventing Australia from investing in the natural gas infrastructure needed to facilitate future export. In fact, for the last three years, while LNG imports from other countries to China have increased, LNG imports from Australia have been slowly declining, partly due to high spot prices and other domestic constraints in Australia.

However, two major long-term LNG export projects in Australia are due to start delivery to China from 2014: 3.6 million tonnes per annum for CNOOC[55] and 2.25 million tonnes per annum for CNPC.[56] These are the first two major deals signed after the economic crisis in 2008 when LNG was a "buyer's market," so prices are expected to be significantly lower than the Qatar deals signed just before the crisis.

Indonesia and Malaysia

Indonesia was among the first countries to export LNG to China. CNOOC signed its existing deal with Indonesia in 2006 to supply to the Fujian Putian Terminal at prices comparable to those in the first Australian deal. In the same year, CNOOC signed a deal with Malaysia for a similar volume of LNG for the Shanghai terminal, but at almost double the price paid for Indonesian gas. The contracts with Australian, Indonesian and Malaysian suppliers were the earliest contracts that CNOOC signed, all at much lower prices compared to current prices. All of these suppliers are within close proximity to China, so transportation costs are low.

[52] M. Chambers, *Australia tipped to overtake China in shale boom*, (The Australian, January 20, 2014), http://www.theaustralian.com.au/business/mining-energy/australia-tipped-to-overtake-china-in-shale-boom/story-e6frg9df-1226805382078?nk=e9ab6841f550602ab779fe1c905c514f.
[53] P. Stevens, et al., *Shale gas in Australia: The Policy Options* (UCL International Energy Policy Institute Green Paper, Adelaide, Australia, 1989), p. 4.
[54] CBI China, *Overview of LNG import data of China* (CBI, May 2014).
[55] CNOOC, *BG Group Sign Australian LNG Deal* (Oil and Gas Eurasia, May 13, 2009), https://www.oilandgaseurasia.com/en/news/cnooc-bg-group-sign-australian-lng-deal.
[56] Reuters, *Australia, China sign massive LNG deal* (The Globe and Mail, August 19 2009), http://www.theglobeandmail.com/report-on-business/australia-china-sign-massive-lng-deal/article4282608/.

The relationship between Indonesian LNG suppliers and Chinese buyers has been somewhat rocky in recent years. As LNG prices increased, the Indonesian government started to push for increased contract prices. In 2010, a government official from Indonesia stated that if the price of exported Indonesian LNG was below the domestic market price for gas, Indonesia would prohibit domestic LNG companies from exporting. In 2013, the Indonesian government asked CNOOC to raise the contract price by 70% to 100% from around US$4.00/MMBtu to US$7.00 – $8.00/MMBtu.[57] CNOOC finally accepted the price, which was cheaper than the price of LNG from Qatar. So far, there have been no reports of similar contract adjustment demands from Malaysia, in part because the original contract price was already at a higher level than the initial deal with Indonesia.

Qatar

Qatar is currently the world's largest LNG exporter. Since 2010, its LNG exports to China have increased more than five times, and it is now the largest LNG exporter to China.[58] The growth of Qatar's LNG export to China is primarily due to two large deals signed by CNPC in 2008 with the Qatargas Project IV to supply two terminals in Jiangsu Qidong and Liaoning Dalian. These import terminals became operational in 2011 with a combined capacity of 5 million tonnes per annum. There was also a deal between CNOOC and Qatargas Project II in 2008 for 2 million tonnes per annum for CNOOC's other terminals, including a large supplement to the Guangdong Dapeng terminal. All these 2008 deals were signed at high prices.

Qatar's proven gas reserve is over 25 trillion cubic meters, which is projected to last for 160 years at the current exaction rate.[59] Apart from its reliable and abundant supply, Qatar is also a relatively stable nation in the Middle East and is closer to China than a number of other suppliers. It takes around two weeks to transfer LNG from Qatar to China, but with the completion of Myanmar-China gas pipeline, some of the imported LNG from Qatar will be downloaded in Kyaukpyu, Myanmar and transferred through this pipeline into China, connecting to the West-East Natural Gas Transmission Pipeline II to Guangzhou. This is a strategic route designated to avoid the Strait of Malacca, through which 80% of China's oil and gas imports pass. However, the pipeline may increase the economic costs of importing gas while still incurring substantial security risk.[60]

It is unclear which countries will be the main sources of LNG for future import terminals in China. But by the end of 2013, the new LNG terminals that designated Qatar as the main source of import had a total capacity of 16.5 million tonnes per annum in operation, yet the actual import from Qatar in 2013 was only 6.8 million tonnes.[61] How this gap will be filled in the future remains to be seen.

East Africa

New discoveries of natural gas in East Africa may offer another source of LNG for China. This is a particularly important option as East Africa is included in the extension of President Xi's new diplomatic strategy of the Maritime Silk Road, and Tanzania is among the few countries that the President visited during his first

[57] R. Cahyafitri, *Tangguh LNG price raised after deal* (Jakarta Post, July 1 2014), http://www.thejakartapost.com/news/2014/07/01/tangguh-lng-price-raised-after-deal.html.
[58] CBI China, *Overview of LNG import data of China* (CBI, May 2014).
[59] BP, *BP Statistical Review of World Energy 2014* (BP, 2014), http://www.bp.com/content/dam/bp/pdf/Energy-economics/statistical-review-2014/BP-statistical-review-of-world-energy-2014-full-report.pdf.
[60] T. Wang, 马六甲并非中国能源安全重要威胁 (*Caixin News*, July 14, 2014); T. Wang, 面向未来的能源安全战略, (China Investment, June 5, 2014).
[61] CBI China, *Overview of LNG import data of China* (CBI, May 2014).

state visit immediately following his inauguration as the leader of China.[62] Similar to Qatar, East Africa is relatively close to the Asia Pacific market.

However, the offshore gas fields in East Africa may not produce gas as cheaply as expected as they are all deep sea fields which require more advanced extraction technology. Furthermore, a lack of skilled labour and poor infrastructure will negatively affect the potential for large volumes of LNG imports from East Africa to China. Even if the costs of production fall in the future, political instability in the region will remain a concern for Chinese gas importers. Dealing with local corruption and cultural differences has been a challenge for some Chinese companies engaged in oil and gas extraction projects in the region. The political space for NOC leaders to repeat mistakes in foreign markets may have disappeared as the Chinese government initiates oil and gas sector reforms in China.

Nevertheless, the opportunity to learn state of the art technology and management from international oil companies operating in the region will continue to encourage Chinese NOCs to invest in East African projects. As private companies are expected to be allowed to import oil back to China, there will be more private Chinese companies seeking to benefit from gas discoveries in East Africa.

CANADA'S COMPETITORS: CHINA'S PROSPECTIVE LNG SUPPLIERS

Russia

Natural gas from Russia will be an important energy source for China. However, the long-term implications of the recent deal for Russia to provide China with 38 bcm per year of pipeline gas are unclear. The pipeline gas will not begin delivery until 2018 at the earliest, and the 38 bcm included in the agreement will likely supply about 25% of China's 2018 gas imports.[63] Because China's domestic pipeline systems are not well interconnected, the Russian gas will only supply Northeast China and the regions around Beijing and, at best, impact the regional price of gas. Therefore, until an interconnected national pipeline is built in China, Russian gas will only have a limited impact on the natural gas markets in East and South China, where most LNG is imported.

However, the deeper implication of this pipeline gas deal is that the gas is to be supplied from East Siberia, instead of from existing gas fields in West Siberia. The deal might be the lever to encourage the Russian government to promote gas development in East Siberia and the Far East area, which are so far untapped and account for 27% of total gas reserves, to supply the Asia-Pacific market.

Russia has opened up its LNG export market, which was previously monopolized by Gazprom. To date, there is only one LNG project, Sakhalin 2 in the Far East area, but three more projects are planned, including Yamal-LNG, in which CNPC recently purchased a 20% stake from Novatek (the second-largest gas producer in Russia) and signed a deal for 3 million tonnes of LNG per annum for import to China.[64] The price is unknown. With the terminals and large reserves in East Siberia and the Far East area, Russia could become a very influential player in the natural gas market in Asia. However, current sanctions from the European Union and the United States may prevent Russian from accessing the necessary technology for natural gas exploitation and development of LNG terminals.

[62] T. Wang, *Shared Energy Interests: An Opportunity for Sino-Indian Cooperation* (Diplomat, May 23, 2014).
[63] Author's own calculations based on projections.
[64] F. Gao, et al., *LNG*国际贸易新格局及中国的挑战 (China University of Geology (Beijing), Oil Observer.com, May 27, 2014), http://oilobserver.com.cn/html/0148594128.html.

United States

The Asian market is anxiously awaiting American LNG exports, since US gas prices are significantly lower than in other international markets. This is due in part to expanded production of shale gas in the United States and the fact that American gas prices are determined through trade at Henry Hub without linkage to oil prices. This makes gas imports from the United States and North America particularly attractive to Asian importers, because it is possible to avoid the Asian Premium. This provides Asian importers with valuable bargaining power against other suppliers.

KOGAS has already signed an import deal for 3.5 million tonnes per annum through the Sabine Pass terminal in Louisiana at an estimated price of under US$10.00/MMBtu, which is significantly lower than the LNG price Asian importers generally pay.[65] No deal has been signed by a Chinese NOC with a US LNG project directly. However, in some deals, such as the 2009 agreement that CNOOC signed with BG Group for 5 million tonnes of LNG per annum, some of the gas supplied was indexed to Henry Hub price.[66]

There is no doubt that American shale gas production will continue to grow, but whether the price will remain at the current low level is uncertain. Also, there is no guarantee that American LNG will be exported based on the Henry Hub price. More importantly, after Russia demonstrated in its relationship with Ukraine that natural gas can be used as a weapon, some in the United States feel strongly that it is possible to do the same with its shale gas and oil surpluses. China may not be willing to be caught in between.[67] Even in a best case scenario, China will not be among the first destinations for America's LNG exports, as the US prioritizes exports to its allies and free-trade partners.

Table 3 Comparison of China's existing and potential LNG source countries

Country/Criteria	Stability	Price	Distance	Route Access[68]
Australia	A	A*	B	B
Indonesia/Malaysia	C	B	A	A
Qatar/Yemen	B	C	B	C
Russia	B	**unknown**	A	A
United States	B	B	C	A
East Africa	C	**unknown**	B	B
Canada	A	B	C	A

A=highest grade, B=second highest grade, C=lowest grade

*The prices of new deals with Australia are unknown.

[65] *Cheniere and KOGAS Sign 20-Year LNG Sale and Purchase Agreement* (PRnewswire.com, Jan 30 2012), http://www.prnewswire.com/news-releases/cheniere-and-kogas-sign-20-year-lng-sale-and-purchase-agreement-138317064.html.
[66] CNOOC, *What We Do*, http://en.cnooc.com.cn/data/html/english/channel_140.html.
[67] Luft, G. *Can America Stop Russia's Energy "Pivot" to Asia?* (National Interest Magazine, May 13, 2014)
[68] An LNG supplier's grade for route access is determined based on the difficulty and congestion of the maritime route taken by the LNG supplier to China. If a shipment needs to pass through a choke point (for example, the Strait of Malacca or the Strait of Hormuz) transport may take longer and be more vulnerable to interruption.

CONCLUSION

Natural gas demand in China is increasing due to the country's robust economic growth and government policies to encourage a shift away from coal use. As natural gas demand has outpaced domestic production, China is seeking to secure LNG imports. China currently acquires half of its gas imports as LNG and is projected to remain one of the world's largest LNG importers in the near future.

In order to succeed in the Chinese market, Canadian LNG exporters will need to understand the drivers of natural gas/LNG consumption in China. Given the low share of natural gas in total energy consumption, there is large potential for increased gas use in all regions of the country. Future growth will be driven by industries, such as transportation and residential, that prioritize gas use and are not highly constrained in their fuel choice by price. Government environmental and energy security policies will also be instrumental in shaping the natural gas market. As competition to supply China with LNG is growing, Canadian exporters will need to be very familiar with the local market in order to find niche opportunities and to understand the competitive landscape.

Canadian LNG exporters should also be aware that price is not the only factor driving buying decisions in the Chinese LNG market. This is clear from the fact that Chinese companies continue to purchase large volumes of high-priced gas from Qatar. In some circumstances, such as during high summer power demand in East China, the need for immediate and reliable sources of gas is as or more important than price considerations.

Despite growing LNG export capacity globally, there is room for Canada to gain access to the Chinese market in the near to medium term. The receiving capacity of Chinese LNG terminals is far greater than the sources of LNG that have already been secured at reasonable prices. China currently has over 28 million tonnes of operational receiving capacity while imports in 2013 amounted to only 18 million tonnes.[69] With more LNG terminals coming online, there will be a surplus capacity available for exporters who do not ship to designated LNG terminals.

One way that exporters can secure dedicated access to LNG terminals is to collaborate with Chinese NOCs on terminal construction. Currently, when an NOC (or other company) applies to build an LNG terminal in China, it must show that it has secured sufficient gas supply for the facility. Chinese companies can secure this volume by partnering with LNG export terminal proponents. CNOOC currently dominates China's LNG import scene and this will continue in the near term, since CNPC is now focusing on pipelines and Sinopec on downstream sales. Therefore, CNOOC could be an ideal partner for proponents of Canadian gas projects. Shell is an example of a multinational company that is invested in a Canadian LNG project and is seeking to build an LNG terminal in China. However, LNG suppliers will need to ensure that their market security strategies extend beyond terminal construction.

[69] CBI China, *Overview of LNG import data of China* (CBI, May 2014).