

China's Natural Gas Imports and Prospects

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Executive Summary

The project provides an overview of China's current natural gas imports and key factors impacting its future imports. As part of its strategy to pursue cleaner energy sources, the Chinese government has pledged to consume more natural gas, which has historically been underrepresented in the country's energy mix. To achieve its natural gas consumption goal, China's demand for imported natural gas is expected to reach 124 billion cubic meters in 2020, more than tripling its imports in 2012 of 38 billion cubic meters.

Cheap and abundant gas in the U.S., as a result of the shale gas revolution, has generated enormous interest in China about the possibility of importing LNG from the U.S. However, uncertainties surrounding U.S. natural gas export policies reinforced China's impression that importing gas from the U.S. may be a difficult and prolonged process. Several studies predict that the future influx of gas from the U.S. into the international market will lead to a decline in natural gas prices worldwide. As a result, even if China does not import LNG from the U.S., it is likely to benefit from the decrease in LNG prices in the global market.

The mere possibility of importing gas from the U.S. has given China more leverage in its negotiations with Russia over the China-Russia gas pipeline. Given the recent progress the two countries have made in their negotiations, it is expected that Russia and China will finalize the gas pipeline agreement by the end of 2014. By 2020, the pipeline is expected to deliver 68 billion cubic meters of gas annually from Russia to China, meeting more than half of China's total demand for imported gas. A secured supply of pipeline gas from Russia may depress China's appetite for LNG imports from additional sources including the U.S.

In addition, China's domestic factors – including the gas tariff mechanism and regulations on import rights and infrastructure – will impact its future LNG imports. The current state-mandated gas tariff mechanism in China has led to losses of gas importing companies, since the mandated gas prices are not sufficient to cover the costs of imported gas. High barriers for any non-state capital to enter the gas-importing sector have further hindered efficient investments made along the LNG import value chain. Favorable regulatory reforms will incentivize Chinese companies, in particular non-state enterprises, to pursue cheaper natural gas supplies overseas, thereby increasing China's competitiveness as a gas importer in the international market.

1. Introduction

1.1 Client of the Project

The Beijing-based client for my master's project is Dr. Yufeng Yang, a senior researcher for the Energy Research Institute (ERI) of China's National Development and Reform Commission (NDRC), the national-level state-planning agency in China. The client would like to better understand China's current natural gas import policies and the outlook for future gas imports.

1.2 Motivation for the Project

Accompanied by its rapid economic development in the past decades, China, a predominantly coal-consuming nation, has been suffering from severe pollution due to its environmentally costly development strategy. In 2013, only three out of its 74 major cities were able to meet China's official minimum standards for air quality, according to the country's Ministry of Environmental Protection.¹ Beijing has recorded dangerous levels of PM 2.5 particles at over 500 micrograms per cubic meter, 20 times higher than the safe level of 25 recommended by the World Health Organization.² Urged by the alarming environmental situation, Chinese premier Li Keqiang declared a national "war on pollution" in March 2014, announcing a number of policies to curb pollution, including shutting down 50,000 small coal-fired furnaces across the country³.

As part of its strategy to pursue cleaner energy sources, the Chinese government has pledged to increase the consumption of natural gas, which has historically been underrepresented in the country's energy mix. As its domestic production of natural gas hasn't been able to keep up with its consumption, China has forayed into the international market to look for diversified gas import sources. China has already built two cross-country land pipelines, importing gas from central Asia and Myanmar. It also imports liquefied natural gas (LNG) from various countries including Qatar, Australia, Indonesia, Malaysia, etc. China is keen on increasing gas imports, demonstrated by a new agreement signed by China and France during the March 2014 visit of Chinese president Xi Jinping to France, under which the French energy company Total will supply an extra 1 million tons (about 1.35 billion cubic meters) of LNG to China each year⁴.

Thanks to the shale gas revolution, the U.S. has experienced an unprecedented level of increase in its natural gas production in the past decade, which has led to the decline of its domestic gas prices. While the U.S. has

¹ (Wong 2014)

² (Kaiman 2014)

³ (Blanchard and Stanway 2014)

⁴ (CNOOC 2014)

become an attractive natural gas exporting country due to its abundant gas resources and low gas prices, its natural gas exports to most countries⁵ including China are restricted by its current regulations on natural gas export permits. Within the U.S., there have been voices either for or against increasing gas exports, and a number of studies have been carried out to analyze the potential impacts of increasing exports. Different parties, ranging from natural gas project developers to manufacturing companies relying on large amounts of gas for operation, have been in heated debate on whether the U.S. government should lift the restrictions on natural gas exports.

From China's perspective, seeking alternative gas imports from North America including the U.S. is in line with its strategy to diversify energy sources from overseas. The prospect of importing LNG from the U.S. may also give China some leverage in its negotiation with Russia over the long-awaited pipeline to transport gas from Siberia to China, which has been delayed mainly due to two parties' disagreement on the gas price. Potential advancement in the negotiation with Russia may cause China to recalculate its willingness to import natural gas from the U.S.

Even if China doesn't import natural gas directly from the U.S., as a net gas importer, it is still likely to benefit from the lowered prices in the international gas market as a result of the influx of cheap gas from the U.S. In addition, China's domestic factors such as gas pricing mechanism and regulations on LNG import permits may impact its actual speed in expanding LNG imports. This paper aims to provide an overview of China's current natural gas imports, and examine the key factors that may impact the future prospects of its imports from additional sources including the U.S.

2. China's Demand for Natural Gas and Current Imports

2.1 China's Demand for Natural Gas Imports

After recording a rapid increase in natural gas consumption at 16%⁶ during 2003–2012, China has become the world's fourth largest gas consumer, trailing after the U.S., Russia, and Iran. China consumed 144 billion cubic meters of natural gas in 2012, accounting for 4.3% of global consumption⁷. In 2012 alone, China was responsible for 40% of the total increase in gas consumption among non-OECD countries⁸.

⁵ Except for the 18 countries that have free trade agreements with the U.S., requiring national treatment for trade.

⁶ (IEA 2013)

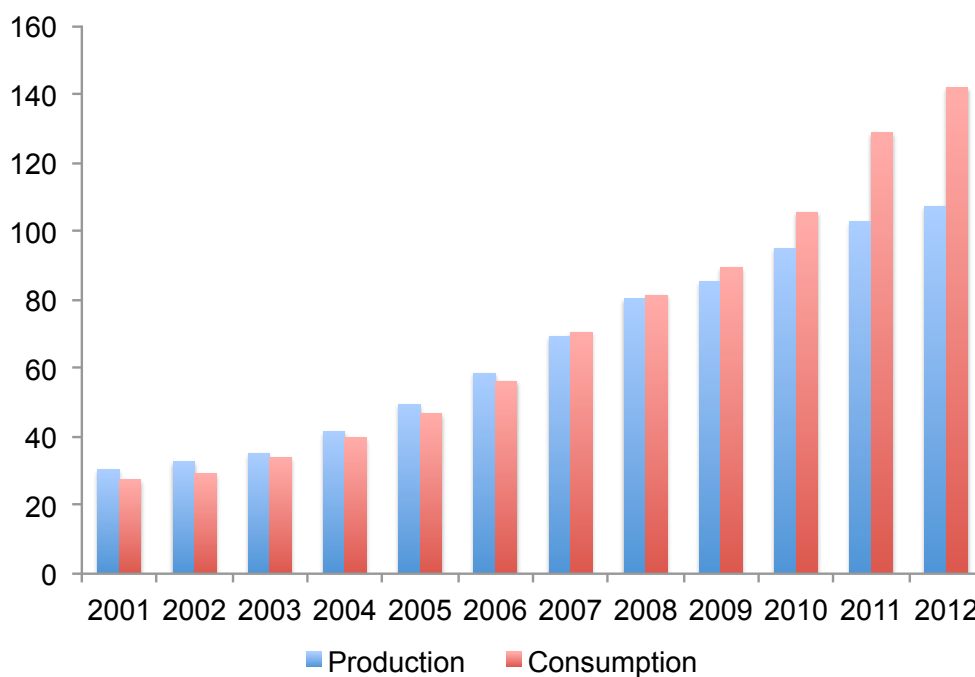
⁷ (BP 2013)

⁸ (IEA, Natural Gas Information 2013 2013)

Despite rapid increase in consumption, natural gas is still underrepresented in China's energy mix, constituting only 5.3%⁹ of the country's total energy consumption, as compared against the global average of 24%¹⁰. The Chinese government has pledged to consume more gas in the future, driven by its quest for a cleaner energy mix. China has set a goal to increase the share of gas in its total primary energy consumption mix to 7.5% by 2015¹¹, 10% by 2020, and 12% by 2030¹².

Much of the addition in China's gas consumption in recent years has been buttressed by imports from foreign countries, because its natural gas production has not been able to keep up with its domestic consumption. In 2012, China imported 38 billion cubic meters of gas, and its dependency on imports as a percentage of total gas consumption reached 27%¹³. As a result of the widening gap between supply and demand, gas shortages during winters have become a serious problem in many parts of the country. The gas shortages in winter 2013 were estimated at 10 billion cubic meters, surging from 4 billion cubic meters in 2012¹⁴.

Figure 2.1 China Gas Production and Consumption (billion cubic meters), 2001-2012



Source: International Energy Agency

⁹ (Xinhua News 2013)

¹⁰ (NDRC 2012)

¹¹ (NDRC 2012)

¹² (EnergyAsia 2012)

¹³ Calculated based on IEA data.

¹⁴ (China.com.cn, Meigaiqi mianlin baiyi tianranqi quekou, daqi zhili zaoyu qiduan 2013)

The Chinese government is set to increase natural gas production from both conventional and unconventional resources to satiate the country's ballooning appetite. The growth rate of its conventional gas production, however, may slow down due to declining production from mature fields¹⁵. In response, China has stepped up its efforts to tap into the country's vast shale gas reserves, estimated by the EIA as the largest technically recoverable shale gas resources¹⁶ in the world, almost doubling that of the U.S. In China's 12th Five-Year (2011-2015) Plan for Shale Gas, released by the National Energy Administration (NEA), China aims to produce 6.5 billion cubic meters of shale gas annually by 2015 (about 2% of its total gas production), and 60-100 billion cubic meters by 2020¹⁷.

Industry experts deem China's shale gas development plan as overly optimistic, given that there are a number of obstacles facing such a development, including severe shortage of water and lack of fracking technology¹⁸. Zhang Dongxiao, Director of Peking University's Clean Energy Research Institute, commented that it would be impossible for the country to increase its shale gas production by 130-fold to 6.5 billion cubic meters by 2015 from its current level of an annual production at 50 million cubic meters (2012)¹⁹. During 2011-2013, China drilled 100 shale gas wells, with 5 million cubic meters of gas production per each. If it were to achieve the goal of 6.5 billion cubic meters of shale gas production in 2015, China has to drill another 1,200 shale gas wells in two years, which seems to be almost impossible to achieve²⁰. Damien Ma from the Paulson Institute predicted that China wouldn't be able to produce 6.5 billion cubic meters of shale gas until 2020 by the earliest²¹.

The combined gas production of Chinese state-owned energy companies, including China National Petroleum Corporation (CNPC), China Petroleum & Chemical Corporation (Sinopec), and China National Offshore Oil Corporation (CNOOC), is expected to reach 226 billion cubic meters by 2020²². Although this is more than double its production in 2012, it still falls 124 billion cubic meters short of its predicted gas consumption in 2020, which is expected to reach 350 billion cubic meters²³. Given the huge disparity between expected gas consumption and production, China will need to continue to drive up its gas imports.

¹⁵ (Chou 2013)

¹⁶ EIA estimated that China has 1,115 trillion cubic feet of shale gas reserves, accounting for 15% of technically recoverable shale gas reserves (7,299 trillion cubic feet).

¹⁷ (China National Energy Administration 2012)

¹⁸ (Perkowski 2013)

¹⁹ (He 2013)

²⁰ (China.com.cn, Zhongguo yaobuyao yeyanqi? 2013)

²¹ (Haas 2014)

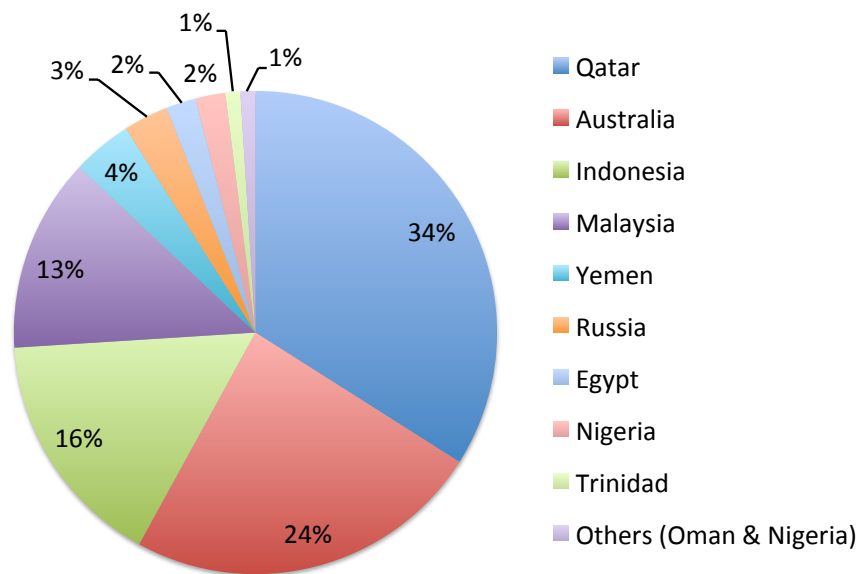
²² (Chou 2013)

²³ (EnergyAsia 2012)

2.2 Overview of China's Current Natural Gas Imports

In 2006, China started importing natural gas and received its first LNG shipment from Australia. Since then, China has been pursuing a natural gas import strategy that allows it to diversify the sources, and it imports gas through both land pipelines and LNG vessels. Currently, pipeline gas is imported through the Central Asia-China pipeline from Turkmenistan, Uzbekistan, and Kazakhstan, and through the China-Myanmar pipeline from Myanmar. LNG mainly comes from four countries – Qatar, Australia, Malaysia, and Indonesia – which provided 87% of the country's LNG imports in 2012²⁴. According to China Customs, in January 2014, 60% of the imported natural gas was LNG, while the other 40% was pipeline gas. Turkmenistan was China's largest gas supplier, providing 84% of the imported pipeline gas in January 2014, and Qatar supplied the largest amount of LNG to China, accounting for 48% of total imported LNG in January 2014.²⁵

Figure 2.2 China LNG Import Sources, 2012



Source: U.S. Energy Information Administration

State-owned companies dominate gas imports in China. The three major oil and gas companies – CNPC, Sinopec, and CNOOC (the Big Three)– own and operate almost all of the natural gas importing infrastructure. CNPC, the largest integrated energy company in China, dominates land pipelines, operating both the Central Asia-China gas pipeline and the China-Myanmar gas pipeline. In

²⁴ (EIA 2014)

²⁵ Currently, China imports LNG from nine countries: Qatar (48%), Malaysia (16%), Australia (12%), Indonesia (9%), Yemen (5%), Equatorial Guinea (3%), Russia (2%), Trinidad and Tobago (2%), and Nigeria (2%). Calculated based on the natural gas import data (January 2014) from China Customs. (Reuters 2014)

addition, it has been in negotiations with Russia's Gazprom since the 1990s to develop the China-Russia gas pipeline. All Big Three have a share in the LNG imports market, although CNOOC, which developed China's first LNG receiving terminal – Dapeng terminal, is the largest player, accounting for a 74% share in 2012.²⁶ Despite the current dominance of LNG receiving terminals by the Big Three, there are speculations that the restrictions on non-state capital to develop LNG importing infrastructure may be relaxed in the near future.

2.2.1 Gas Imports through Land Pipelines

Central Asia-China Gas Pipeline

China's CNPC, accounting for more than 70% of the country's natural gas production²⁷, along with the national gas companies of Turkmenistan, Uzbekistan, and Kazakhstan, operates the Central Asia-China Gas Pipeline. The pipeline starts from Gedaim on the border of Turkmenistan and Uzbekistan, running through central Uzbekistan and southern Kazakhstan before ending at Khorgas in the Xinjiang Uygur Autonomous Region in western China. It's connected to the Second West-East Gas Pipeline, which runs from Xinjiang to China's east coast. The Central Asia-China Gas Pipeline currently consists of three lines – Line A, B, and C. Line A and B became operational in 2009 and 2010 respectively, with a combined annual capacity of 30 billion cubic meters. Line C will be launched in October 2014²⁸, adding another 25 billion cubic meters of capacity to the existing two lines. By the end of 2013, the accumulative amount of imported gas through the Central Asia–China pipeline reached 68 billion cubic meters²⁹.

Turkmenistan, the world's fourth largest gas exporter, supplies the most imported gas to China, providing 21.3 billion cubic meters, i.e. 51% of China's total natural gas imports in 2012³⁰. In 2007 and 2013, China signed two long-term gas sales and purchase agreements with Turkmenistan. CNPC has also entered into agreements with Turkmenistan to jointly develop Turkmenistan's significant gas reserves, including the right bank of the Amu Darya River³¹ and the Galkynysh (Renaissance) gas field³², which is the world's second largest and Asia's largest gas field. Since 2009, gas extracted from the right bank of the Amu Darya River has been transported through the pipeline to China. The Chinese government has loaned \$8 billion to Turkmenistan for developing the Galkynysh gas field³³, which is set to supply 5 billion cubic meters of gas to China in 2016 through a new line – Line D. Gas supply from Galkynysh to China is expected to

²⁶ (Sina News 2013)

²⁷ (EIA 2014)

²⁸ (Platts, Kazakhstan plans to launch Line C of gas pipeline to China in Oct 2014)

²⁹ (Xinhua News , Zhongya tianranqi guandao leiji xiang zhongguo neidi shuqi 681 yi lifangmi 2014)

³⁰ (BP 2013)

³¹ (CNPC n.d.)

³² (CNPC, CNPC completes first-phase construction of Galkynysh gas field 2013)

³³ (RIA Novosti 2013)

reach 25 billion cubic meters by 2020.³⁴ It is expected that by 2020, the annual imported gas from Turkmenistan will reach 65 billion cubic meters³⁵.

In addition, China has entered into agreements with Uzbekistan and Kazakhstan to import natural gas, albeit at a much less amount, as compared to Turkmenistan. In June 2010, Uzbekistan and China signed a framework agreement, under which state-owned oil and gas producer Uzbekneftegaz was to supply 10 billion cubic meters of pipeline gas annually to China's CNPC.³⁶ Based on the agreement, China started importing gas from Uzbekistan in August 2012. In 2007, China and Kazakhstan signed an agreement, which would allow the latter to export 10 billion cubic meters of pipeline gas per year to China.³⁷

Figure 2.3 Map of Central Asia–China Gas Pipeline



Source: Eurasian Energy Analysis³⁸

China-Myanmar Gas Pipeline

The construction of the China-Myanmar Gas Pipeline, undertaken by CNPC, commenced in 2010 as part of the China-Myanmar Oil and Gas Pipeline

³⁴ (Gurt 2013)

³⁵ (Xinhua News, Zhongtu jiangjian zhongya tianranqi guandao D xian 2013)

³⁶ (Platts, China imports Uzbekistan gas via pipeline for first time in August 2012)

³⁷ (Platts, China, Kazakhstan complete first stage of new gas pipeline 2013)

³⁸ (Coyle 2010)

project. The pipeline starts from Kyaukpyu on Myanmar's west coast, entering China at Ruili in Yunnan province and ending at Guigang in Guangxi Zhuang Autonomous Region. The pipeline is expected to help boost the economic development in China's less-developed southwestern provinces including Yunnan, Guizhou, and Guangxi. In July 2013, the China-Myanmar gas pipeline became operational, and Myanmar would supply 10 billion cubic meters of gas to China each year. By November 2013, the pipeline has transmitted a total of 230 million cubic meters³⁹ of gas from Myanmar to China. China is expected to become the largest stable gas buyer of Myanmar, the gas production of which will reach 24 billion cubic meters by 2019⁴⁰.

Figure 2.4 Map of China-Myanmar Gas (& Oil) Pipeline



Source: Reuters

³⁹ (People's Daily, Zhongmian tianranqi guandao tuidong jingji fazhan, yi shuru 2.3 yi lifang 2013)

⁴⁰ (Zhao 2011)

Figure 2.5 China’s Cross-country Pipelines

Pipeline Name	Designed Capacity	Operating Company	Receiving End
Central Asia-China Pipeline	30 bcm (Line A and Line B) 25 bcm (Line C) 25 bcm (Line D)	CNPC	Khorgos, Xinjiang; connected to China’s second west-east gas pipeline
China-Myanmar Pipeline	12 bcm	CNPC	Ruilin, Yunnan

Source: CNPC and news reports from Xinhua News Agency

2.2.2 Gas Imports through LNG Vessels

China received the first shipment of imported LNG from Australia in 2006 at its first LNG receiving terminal – Dapeng Terminal – in Shenzhen, Guangdong province. In October 2002, CNOOC and Australia LNG, a company to market Australia’s North West Shelf gas overseas, signed a 25-year sales and purchase agreement, under which Australia would supply 3.3 million tonnes (about 4.5 billion cubic meters) of LNG to China each year⁴¹. In 2008 and 2009, China signed additional supply agreements with Australia to import LNG from the Gorgon gas project. Australia accounted for 24% of China’s LNG imports in 2012.

China has also entered into a long-term supply agreement with Qatar, the world’s largest LNG exporter. In 2009, China started importing LNG from Qatar under a 5 million tonnes (about 7.5 billion cubic meters) per annum supply agreement, albeit at a high price – 16.2% over the Japanese Crude Cocktail, a commonly used index in long-term LNG contracts in east Asia, which was one of the highest priced long-term deals ever struck.⁴² In 2012, China imported 6.8 billion cubic meters of LNG from Qatar, or one third of its total LNG imports.

Indonesia and Malaysia are the other two major suppliers of China’s LNG, accounting for 17% and 13%, respectively, of its LNG imports in 2012. In 2002, China signed a 25-year contract to purchase 2.5 million tonnes per annum (or about 3.4 billion cubic meters) from Indonesia at a price of \$2.4 per million British thermal unit (mmBtu), which was later revised to \$3.4 per mmBtu in 2005.⁴³ In 2006, China and Malaysia signed a 25-year purchase agreement, under which

⁴¹ (Priestley 2010)

⁴² (Vukmanovic 2013)

⁴³ (The Jakarta Post 2012)

Malaysia would supply 3 million tonnes per annum (or about 4.1 billion cubic meters) of LNG to China⁴⁴.

In addition to Qatar, Australia, Indonesia and Malaysia, in 2012, China imported LNG from seven other countries, including Yemen, Russia, Egypt, Nigeria, Trinidad & Tobago, Oman, and Algeria, demonstrating its pursuit of diversified LNG sources⁴⁵. Based on the latest China Customs' LNG import statistics in January 2014, China has added Equatorial Guinea to its latest LNG importing country list.

3. U.S. LNG Export Policies and Uncertainties

3.1 Current U.S. LNG Export Policies

Over the past decade, the U.S. has dramatically increased its domestic natural gas production from shale reserves, largely due to technological breakthroughs such as horizontal drilling and hydraulic fracturing. Shale gas, accounting for only 1% of total gas production in 2000⁴⁶, is projected to rise to 50% of total gas production in 2040.⁴⁷ The increase in natural gas supply has driven down domestic prices. In 2012, the annual average Henry Hub gas spot price was \$2.75 per million Btu (MMBtu); a 69% decrease from \$8.86 per MMBtu in 2008 and representing approximately one fifth of the LNG landed prices (around \$16 per MMBtu) in major natural gas consuming countries in Asia like Japan, South Korea, and China.⁴⁸ Strong production and low domestic gas prices are turning the U.S. into an attractive natural gas exporter.

Current U.S. laws require all prospective exporters to submit applications to the Department of Energy (DOE) for the license to export natural gas. For exports to the 18 countries⁴⁹ that currently have a free trade agreement (FTA) with the U.S. requiring national treatment for trade in natural gas, the DOE approves the applications promptly, based on the assumption that such applications are in the U.S.' national interest. For exports to countries that do not have such a FTA with the U.S., the DOE reviews each proposal on a case-by-case basis and may deny the application if it finds the exports are not in the "public interest". Since China does not have a FTA agreement with the U.S., future gas exports to China are subject to DOE's evaluation.

⁴⁴ (People's Daily, China signs LNG deal with Petronas 2006)

⁴⁵ According to the International Gas Union, there were a total of 17 LNG exporters in the world in 2012, and China imported LNG from 11 of them.

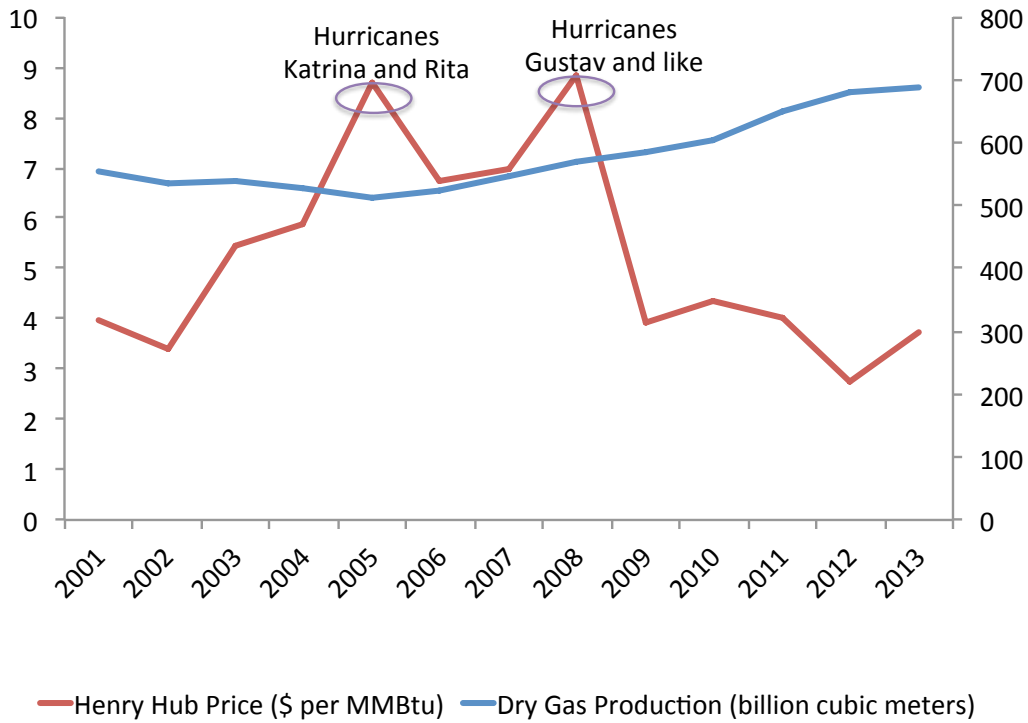
⁴⁶ (Yergin 2011)

⁴⁷ " (EIA, Annual Energy Outlook 2013 2013)

⁴⁸ In November 2013, the LNG landed prices in Japan, Korea, and China were \$15.65, \$15.65, and \$15.25 per MMBtu.

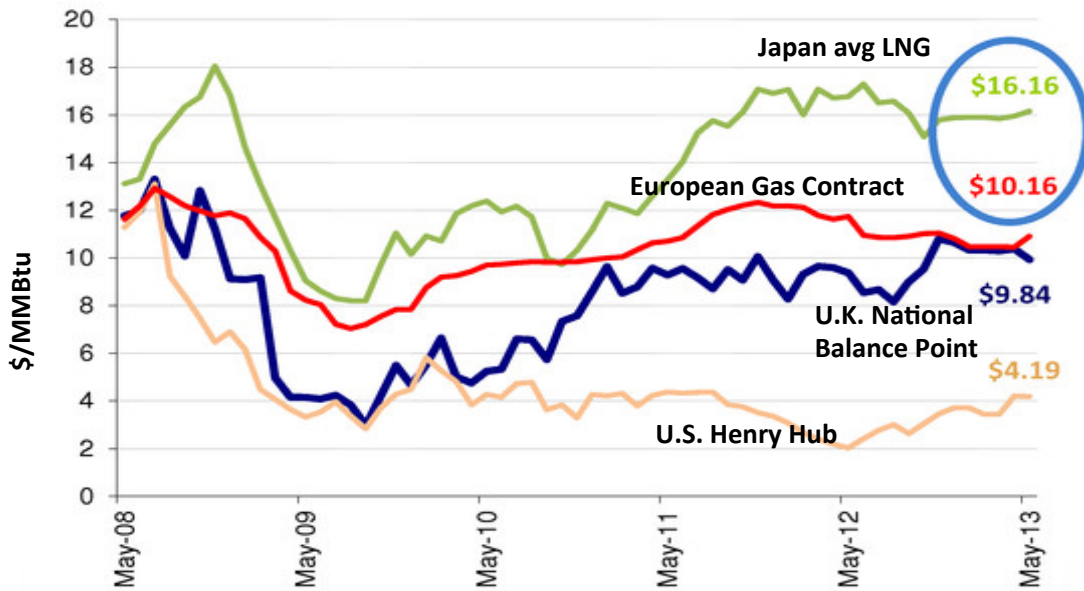
⁴⁹ As of October 31, 2012, 18 countries fell in this category, and they are Australia, Bahrain, Canada, Chile, Colombia, Dominican Republic, El Salvador, Guatemala, Honduras, Jordan, Mexico, Morocco, Nicaragua, Oman, Panama, Peru, Republic of Korea and Singapore.

Figure 3.1 U.S. Dry Natural Gas Production and Henry Hub Natural Gas Spot Price, 2001–2013



Source: U.S. Energy Information Administration

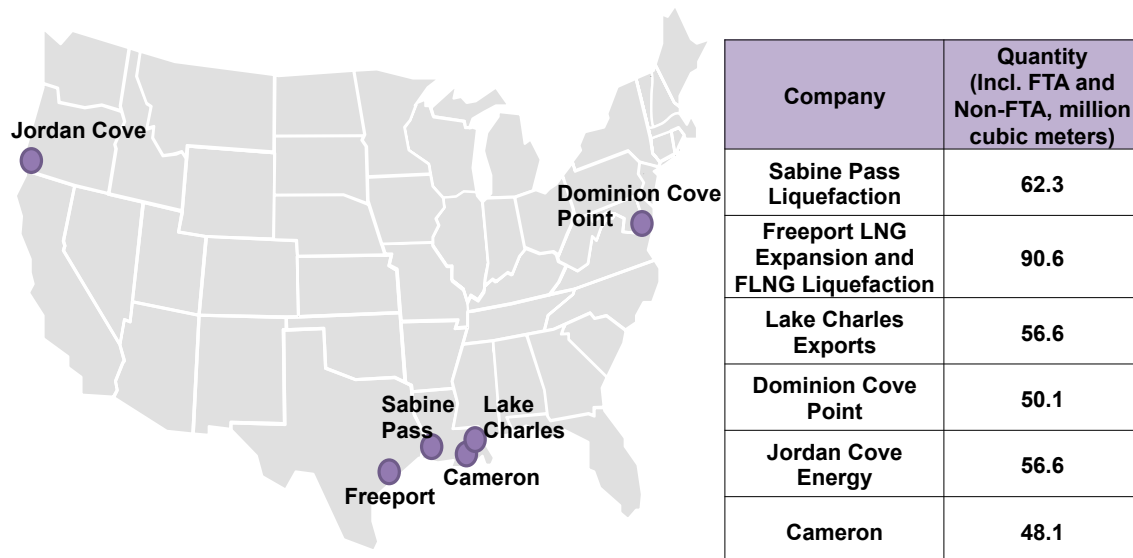
Figure 3.2 Regional Natural Gas and LNG Prices As of May 28, 2013



Source: Cheniere Energy

As of March 10, 2014, the DOE had received 31 applications from 30 different US export facilities⁵⁰ for the rights to export LNG to both FTA and non-FTA countries. The locations of these facilities included Texas, Louisiana, Oregon, and Maryland. In total, these 30 facilities have a daily export capacity of roughly 38.51 billion cubic feet (or about 1.08 billion cubic meters) for FTA countries and 35.86 billion cubic feet (or about 1 billion cubic meters) for non-FTA countries, amounting to almost 50% of current U.S. production⁵¹. Of the 31 applications, only 7 applications (from 6 facilities) have been granted both FTA and non-FTA export permits⁵². These 6 facilities include Sabine Pass Liquefaction (LA), Freeport LNG Expansion (TX), Lake Charles Exports (LA), Dominion Cove Point LNG (MD), Jordan Cove Energy (OR), and Cameron LNG (LA).⁵³ Among them, Sabine Pass is expected to be the first to start operations (late 2015), with 11% of its export capacity serving the spot market, and the remaining 89% supplying Korea Gas, GAIL India, and BG Group⁵⁴ under long-term contracts.

Figure 3.3 U.S. LNG Facilities Approved by DOE to Export to Non-FTA Countries As of March 2014



Source: Data from U.S. Department of Energy

⁵⁰ Freeport filed two separate applications.

⁵¹ (EIA, Applications Received by DOE/FE to Export Domestically Produced LNG 2014)

⁵² The rights for exporting to FTA and non-FTA countries are awarded separately. 30 facilities have applied for both export rights to FTA and non-FTA countries. 24 have been granted with the rights to export gas to FTA countries, but not all the 24 applicants have been granted with the rights to export to non-FTA countries. Among these 24, 7 of them received rights to export to non-FTA countries.

⁵³ (EIA, Applications Received by DOE/FE to Export Domestically Produced LNG 2014)

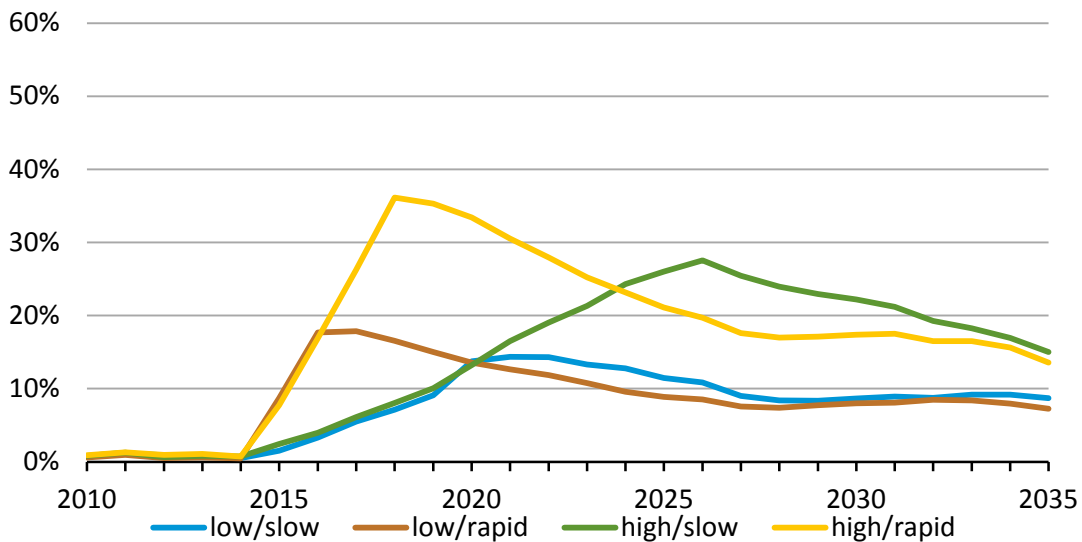
⁵⁴ (Brown 2013)

3.2 Impacts of U.S. LNG Exports

Current studies of the impact of U.S. LNG exports suggest that future LNG exports will not put too much price pressure on the domestic market, but will lead to faster price drop in the international market, which in the end will narrow the price gap between the U.S. market and the global market. To assist with its review of current and potential future applications to export domestically produced LNG, the DOE has requested the Energy Information Agency (EIA) and the NERA, an economic consulting firm, to analyze the impact of increased natural gas exports.

The EIA study, commissioned in January 2012, analyzed the impact from a policy-neutral perspective, assuming other current U.S. policies would remain unchanged during the forecasted period up to 2035. Its model analyzed various scenarios with different levels of exports. Compared to the reference scenario (no-additional-exports scenario), the annual average wellhead prices for all four scenarios⁵⁵ analyzed were higher. The high/rapid scenario led to the highest price difference in 2018, in which the gas price will be 36% higher (\$1.58/MMBtu) than the reference scenario⁵⁶.

Figure 3.4 Natural Gas Wellhead Price Difference under Different Scenarios Analyzed by EIA, Compared to the AOE2011 Reference Case



Source: U.S. Energy Information Administration (LNG Report 2012)

⁵⁵ Four scenarios are: (1) 6 billion cubic feet per day (Bcf/d), phased in at a rate of 1 Bcf/d per year (low/slow scenario); (2) 6 Bcf/d phased in at a rate of 3 Bcf/d per year (low/rapid scenario); (3) 12 Bcf/d phased in at a rate of 1 Bcf/d per year (high/slow scenario); (4) 12 Bcf/d phased in at a rate of 3 Bcf/d per year (high/rapid scenario).

⁵⁶ (EIA, Effect of Increased Natural Gas Exports on Domestic Energy Markets 2012)

The 2012 NERA study built upon the EIA report by considering global market trends and evaluating the macroeconomic impact of additional LNG exports, rather than focusing solely on the impact on domestic prices. It found that not all the quantities of exports could be sold at high enough world prices to support the domestic prices calculated by the EIA. Domestic natural gas prices increase when the U.S. exports LNG, but the global natural gas market puts a cap on how high the domestic natural gas prices in the U.S. can rise. Importers of U.S. LNG would stop purchasing from the U.S. if the wellhead price rises above that of competing supplying countries. NERA concluded that the U.S. would receive net economic benefits from allowing additional LNG exports, which would increase as the level of LNG exports increased. The losses from reduced capital and wage income of U.S. consumers would be compensated by increased trade revenue and new employment opportunities.⁵⁷ Scenarios with unlimited exports always had higher net economic benefits than corresponding cases with limited exports, according to NERA. The DOE has used the results of the study to justify its approvals of export projects.⁵⁸

In February 2014, NERA released an updated study of its 2012 research, which confirmed and extended the findings of the previous study. Under the different scenarios of exports analyzed, the impacts on domestic prices relative to the corresponding baseline of zero LNG exports range from \$0.06–\$0.49 per MMBtu in 2018, representing a 2.6%–23% increase over the baseline. Meanwhile, U.S. prices will drive down prices in regions where U.S. supplies are competitive. Contrary to what many predicted that U.S. is disadvantaged to transport gas to East Asia compared to geographically closer competitors like Australia, the data given in the study show that the U.S. may be well poised to transport gas to China, India, South Korea, and Japan at a lower cost. Other natural gas exporters, Russia and Qatar in particular, will have to accept lower natural gas prices to maintain or even increase their export sales. The new study also found that despite the projected increase in gas exports to other countries, in the U.S. the cost of producing chemicals, which is dependent on large amounts of natural gas, would remain one of the lowest in the world.⁵⁹

A study released by Deloitte in 2013, funded by Cheniere Energy, found that U.S. LNG exports would have a bigger price impact in the importing markets than in its domestic market. Deloitte modeled the price impacts of LNG exports to Asia and Europe, and found that the rate of price decrease in importing countries was several times faster than that of the price increase in the U.S. From 2016 to 2030, the projected increase of U.S. average prices is about \$0.15/MMBtu, while the price drop in Europe will be almost five times faster with an average price drop of \$0.69/MMBtu. Although the report didn't study the desirable level of U.S. LNG exports, it stated that the economics of U.S. exports would diminish as the price spread between the U.S. and importing countries shrinks. As a result of U.S.

⁵⁷ (NERA, Macroeconomic Impacts of LNG Exports from the United States 2012)

⁵⁸ (Ratner, et al. 2013)

⁵⁹ (NERA, Updated Macroeconomic Impacts of LNG Exports from the United States 2014)

LNG exports, traditional natural gas exporting countries will suffer revenue losses because of price erosion and supply displacement. Russia, the largest natural gas exporter in terms of both volume and revenue, seems to be the most vulnerable if U.S. were to export LNG to Europe, as most of Russia's exports were directed to Europe.⁶⁰

Figure 3.5 LNG Transport Cost Comparison, 2018 (2012\$/MMBtu)

<i>From</i>	U.S.	Middle East	Oceania	U.S.	Middle East	Oceania
<i>To</i>	China/India			Korea/Japan		
Regas to city gate pipeline cost	\$1.53	\$1.53	\$1.53	\$0.51	\$0.51	\$0.51
Regas cost	\$0.83	\$0.83	\$0.83	\$0.86	\$0.86	\$0.86
Shipping cost	\$2.30	\$0.93	\$0.70	\$2.15	\$1.46	\$0.81
Liquefaction cost	\$2.11	\$2.89	\$4.55	\$2.11	\$2.89	\$4.55
Wellhead to liquefaction pipeline cost	\$1.02	\$1.44	\$0.51	\$1.02	\$1.44	\$0.51
Total LNG Transport Cost	\$7.79	\$7.62	\$8.12	\$6.65	\$7.16	\$7.24

Source: Calculated based on data from the NERA 2014 study

3.3 Policy Debate on U.S. Exports

There has been heated debate about the impact of natural gas exports and whether current restrictive policies governing U.S. natural gas exports should be revised. Natural gas producers and developers of natural gas export projects argue that domestic gas prices will not rise much due to natural gas exports, because U.S. has abundant gas resources and will be able to meet its domestic demand. Conversely, natural gas consumers like Dow Chemical strongly oppose increased natural gas exports, arguing that domestic prices will spike and the economy will be hurt. The Industrial Energy Consumers of America (IECA) has also urged the government to protect domestic manufacturing by limiting natural gas exports. Environmental groups that are against shale gas exploration fear that greater natural gas exports will increase the use of fracking, leading to negative environmental consequences.

Within the policy research community, critics of current U.S. policy restrictions on LNG exports to non-FTA countries include Charles K. Ebinger and Govinda Avasarala from the Brookings Institution and James Bacchus, a former Democratic congressman and WTO judge. Ebinger and Avasarala published a

⁶⁰ (Deloitte 2013)

report in August 2013, stating that current U.S. natural gas export policies are overly ambiguous and should be revised to reflect the concrete costs of constructing export facilities and changes in the gas market⁶¹. Bacchus has written a report on behalf of the National Association of Manufacturers (NAM)⁶², warning that long delays in the approval of natural gas exports may violate U.S. obligations under WTO rules that bar “discretionary” and dilatory licensing systems, and pressing the U.S. government to expedite the approval process by removing regulatory barriers⁶³.

The House Energy and Commerce Committee held a forum in October 2013 on “The Geopolitical Implications and Mutual Benefits of U.S. LNG exports” with foreign participants – diplomats and energy advisors – from more than 10 countries including the Czech Republic, Hungary, Haiti, India, Lithuania, Singapore, South Korea, Japan, Thailand, and the Commonwealth of Puerto Rico. These foreign officials urged House members to come up with a solution to export U.S. natural gas to strategic allies and embrace its role as a world leader in energy diplomacy. Despite the uncertainties surrounding the U.S. LNG export policies, there have been observations that the DOE has sped up its approval of natural gas export applications⁶⁴ as a result of the studies showing that natural gas exports are beneficial to U.S. economy.

4. Key Factors Impacting China’s Gas Imports

In addition to the policy uncertainties surrounding the U.S. export policies of LNG, China’s future gas imports are also impacted by a number of domestic factors. This section will discuss several key factors including the prospect of a China-Russia gas pipeline, China’s domestic gas pricing mechanism and its regulations on LNG import infrastructure and permits.

4.1 Russia-China Gas Pipeline

Russia’s state gas company Gazprom and China’s CNPC have been in discussions about a gas pipeline to deliver gas from Siberia to China since early 1990s. The prolonged negotiations were mainly due to the disagreement between both parties on the gas price. China insisted that it wouldn’t pay Russia a price higher than what it has been paying to Turkmenistan, where China received most of its pipeline gas. Gazprom insisted that the price should reflect the huge cost to construct the pipeline. Another important factor delaying the pipeline was that Russia had been traditionally more focused on the European gas market rather than the Asian market.

⁶¹ (Ebinger 2013)

⁶² The NAM has been supporting increasing LNG exports because it believes that LNG exports will create jobs due to its positive ripple effect throughout the manufacturing supply chain. Dow Chemical, opposing unlimited LNG exports, withdrew from the NAM in January 2013.

⁶³ (Reuters, Group steps up pressure to speed US okay of gas, coal exports 2013)

⁶⁴ (Buford 2013)

China seems to have gained more leverage in recent negotiations because of the growing possibility that U.S. may enter the global LNG market with abundant and cheaper gas. According to Feng Yujun, an energy policy expert at the China Institute of Contemporary International Relations, Russia is already very late in entering the Chinese market, and China is not as desperate as 10 years ago due to the gas supplies it has secured from central Asia and Myanmar.⁶⁵ It is reported that CNPC and Gazprom may reach a pricing agreement, allowing the gas from Russia to reach eastern China at \$13 per MMBtu (\$10-\$11 per MMBtu at the Chinese border)⁶⁶.

Such an agreement is also a result of Gazprom's recent shift of focus from the European gas route to Asia. Gazprom has been selling gas in Europe under expensive long-term gas contracts with prices pegged to the oil price. Its market position is being challenged by the emergence of LNG shipments from other suppliers such as U.S. and Qatar. In 2013, the European Commission launched an investigation against Gazprom on issues such as fair pricing. The market challenges in the European market is forcing Russia to turn to Asia for expanding its global footprint. The recent crisis in Ukraine underscores the importance of Russian-China relationship. Russia has few export markets outside Europe, leaving it vulnerable to sanctions and competition from LNG exports from the U.S. Building the Russia-China pipeline will allow it to diversify from the European market. Also, China would want to deepen its cooperation with Russia to counter U.S. influence in the international energy market⁶⁷.

The potential pricing agreement between CNPC and Gazprom would the Russian gas more expensive than the pipeline gas from central Asia and Myanmar. According to China Customs, in January 2014, the average price of pipeline gas from central Asia was \$9.96 per MMBtu. The imported gas from Myanmar was the most expensive – \$11.45 per MMBtu on Chinese border, while the prices for gas from Turkmenistan, Uzbekistan, and Kazakhstan were \$10.09, \$8.63, and \$3.35 per MMBtu⁶⁸. Li Boqiang, Director of China Energy and Economic Research Institute at Xiamen University, said that CNPC certainly would try to negotiate for a lower price with Gazprom.

It is widely believed that China and Russia should be able to finalize the details of the pipeline gas agreement in 2014⁶⁹, and the pipeline is expected to begin operations in 2018. By 2020, 68 billion cubic meters of gas is expected to be transported through the pipeline annually. The combined expected gas flows from Russia and Turkmenistan (which is expected to reach 65 billion cubic meters) should be sufficient to meet China's demand for imported gas of 124 billion cubic meters in 2020. The progress of China-Russia gas pipeline will

⁶⁵ (Xi and Han 2014)

⁶⁶ (Hille and Hornby 2014)

⁶⁷ (Rudnitsky and Bierman 2013)

⁶⁸ (Reuters, Zhongguo yiyue yehua tianranqi ji guandao tianranqi jinchukou fenxiang shuju 2014)

⁶⁹ (People's Daily, Zhong'e nengyuan kuangri tanpan zhicha linmen yijiao 2014)

certainly intensify the competition in the Chinese market among exiting and new gas suppliers.

Figure 4.1 China Imported Gas Prices, January 2014

LNG Price (\$/MMBtu)		Pipeline Gas Price(\$/ MMBtu)	
Qatar	17.82	Turkmenistan	10.09
Malaysia	8.56	Uzbekistan	8.63
Australia	3.41	Myanmar	11.45
Indonesia	3.84	Kazakhstan	3.35
Republic of Yemen	18.62	Pipeline avg	8.38
Equatorial Guinea	18.95		
The Russian Federation	17.51		
Trinidad and Tobago	15.85		
Nigeria	16.94		
LNG avg	13.5		

Source: China Customs

4.2 Domestic Pricing Mechanism

China’s domestic gas tariffs are state-mandated, except for Guangdong and Guangxi provinces, which have adopted market-based gas tariff pilot programs. The NDRC sets the gas prices for both residential and non-residential users. Since 2005, the NDRC has adjusted gas prices only for three times, with the most recent one happening in July 2013.

The state-mandated gas tariffs are viewed as a major factor that impedes future gas imports, because it creates a gap between domestic price and the cost of imported gas, and dis-incentivizes energy companies to invest in imports. The “Big Three” have been incurring losses for importing LNG because domestic prices set by the government are often not able to cover their import costs, despite the government’s recent efforts to hike domestic gas prices. The companies found it extremely difficult to pass through the additional cost to end-users due to the lack of a market-based pricing mechanism.

According to the Ministry of Finance’s most recent document to increase prices for imported gas, since July 1, 2013, the wholesale prices for LNG and pipeline gas have been set at RMB 31.45 per GJ⁷⁰ (about \$5.3 per MMBtu) and RMB 1.11 per cubic meters⁷¹ (about \$5.1 per MMBtu)⁷². There is a wide price

⁷⁰ 1 GJ=0.948 MMBtu; 1 RMB=0.16 USD

⁷¹ 1 cubic meter=0.035 MMBtu; 1 RMB=0.16 USD

gap between the mandated wholesale price and the current importing cost – the wholesale price for LNG is only about 40% of the average prices of imported LNG (\$13.3 per MMBtu), while the wholesale price for pipeline gas is only 51% of the average prices of imported pipeline gas (\$9.96 per MMBtu) in January 2014.

In an effort to mitigate the discrepancy between domestic gas prices and the cost of imported LNG, since 2011, the Chinese Ministry of Finance has granted value-added tax (VAT) rebates to gas importing companies when importing costs are above domestic wholesale prices, and the current policy is valid until 2020. Importing companies receive the rebates on a quarterly basis. The rebate equals: $[(\text{import cost} - \text{wholesale price}) / \text{import cost}] * 100\% * \text{VAT tax}^{73}$ (the VAT for natural gas is 13%⁷⁴). That is, for a discrepancy of 60% (with a wholesale price of \$5.32/MMBtu when LNG import cost is \$13.3/MMBtu, the rebate equals: $60\% * 13\% * \$13.3 = \$1.3/\text{MMBtu}$, still leaving a deficit of about \$4.02/MMBtu. This policy was intended for mitigating losses incurred by state energy companies when importing natural gas, but certainly is not enough to incentivize future gas imports. The current policy only extends throughout 2020, but the imports under additional 25-/30-year long-term LNG contracts are unlikely to occur until 2017, and will only benefit from the tax rebates covered for three years (unless the policy is extended). Spot purchases of LNG, which are more expensive than LNG long-term contracted prices, will not benefit much from the tax refund due to the even wider price gap between the imported cost and domestic wholesale prices.

4.3 China’s Regulations on LNG Import Rights and Infrastructure

The Big Three currently dominate China’s LNG import rights and infrastructure. CNOOC, in collaboration with BP, developed China’s first LNG receiving terminal – Dapeng Terminal – in China’s southern province Guangdong. In addition to Dapeng, four other terminals developed by CNOOC are under operations, and they are located in Shanghai, Fujian, Zhejiang, and Guangdong provinces. CNPC and Sinopec are latecomers in the LNG importing market, but have been increasing their investments in recent years. CNPC operates three terminals, located in Liaoning, Jiangsu, and Hebei provinces. All of the terminals developed by Sinopec are still under construction, and the one in Qingdao, Shangdong province is expected to receive shipments in October 2014.

Figure 4.2 China’s Major LNG Import Facilities As of March 2014

Location	Developer	Capacity (billion cubic meters)	Date of Operation
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⁷² (China's Ministry of Finance 2013)

⁷³ (Netease News 2013)

⁷⁴ (China's State Administration of Taxation 2011)

Shenzhen, Guangdong (Dapeng)	CNOOC/BP	Phase I: 5.1	June 2006
		Phase II: 9.7	N/A
Putian, Fujian	CNOOC/Fujian Investment & Development	Phase I: 3.6	February 2009
		Phase II: 7.2	N/A
Shanghai	CNOOC/Shenergy	Phase I: 4.1	September 2009
Ningbo, Zhejiang	CNOOC/Zhejiang Provincial Energy/Ningbo Power Development	Phase I: 4.1	September 2012
		Phase II: 8.3	N/A
Zhuhai, Guangdong	CNOOC/Guangdong Yudean/Guangzhou Development	Phase I: 4.8	October 2013
		Phase II: 9.7	N/A
Tianjin FSRU	CNOOC	Phase I: 3.0	November 2013
Yangpu, Hainan	CNOOC/Hainan Development Holdings	Phase I: 2.8	August 2014 (expected)
		Phase II: 4.1	2017-2020 (planned)
Shenzhen, Guangdong	CNOOC/Shenzhen Energy	5.5	2015 (expected)
Jieyang, Guangdong	CNOOC/Guangdong Yudean	Phase I: 2.8	2015 (expected)
Yancheng, Jiangsu	CNOOC	Phase I: 3.6 (FSRU)	2016 (planned)
		Phase II: 8.3	2020 (planned)
Yantai, Shandong	CNOOC	Phase I: 3.0	N/A
Qinhuangdao, Hebei	CNOOC/China Power Investment	Phase I: 2.8	N/A
Zhuhai, Guangdong	CNOOC/Guangdong Yudean	Phase I: 4.1	N/A
		Phase II: 4.1	N/A
Zhangzhou, Fujian	CNOOC	Phase I: 4.1	2017
		Phase II: 8.3	N/A
Dalian, Liaoning	CNPC	Phase I: 4.1	April 2011
		Phase II: 8.3	N/A
Rudong, Jiangsu	CNPC	Phase I: 4.8	April 2011

		Phase II: 4.1	N/A
Tangshan, Hebei	CNPC/Beijing Holdings	Phase I: 4.8	December 2013
		Phase II: 9.0	N/A
Shenzhen, Guangdong (Dachanwan)	CNPC	N/A	N/A
Qingdao, Shandong	Sinopec/China Huaneng Group	Phase I: 4.1	October 2014
Lianyungang, Jiangsu	Sinopec	Phase I: 4.1	N/A
Nangang Industry Zone, Tianjin	Sinopec	Phase I: 4.1	2015
		Phase II: 9.7	N/A
Beihai, Guangxi	Sinopec	Phase I: 4.1	2015 (planned)
		Phase II: 8.3	N/A
Wenzhou, Zhejiang	Sinopec	Phase I: 4.1	N/A

Source: Data gathered through various Chinese news reports

Current Chinese regulations on gas import rights and infrastructure have been considered as a hindrance for non-state capital to enter the LNG import market. Non-state enterprises, anticipating the development of a more market-based gas-importing sector in China as indicated by the recent market-based pricing programs in Guangdong and Guangxi, have been eyeing on gaining a share in this sector. Investments from non-state companies are also expected to increase the competition for sourcing cheaper gas overseas and to make more efficient investments along the LNG import value chain. Development of new LNG receiving terminals is subject to the NDRC's approval, and one of the preconditions is having secured LNG supply contracts from overseas and received the approval from the Ministry of Commerce for the contracts. It has been extremely difficult for non-state companies to jump through the regulatory hoops and receive approvals for import rights and infrastructure.

In March 2013, ENN Energy, a large non-state gas distributor, received the approval from the NDRC to build China's first LNG bunkering project, with a capacity of 3 million tons (about 4.1 billion cubic meters)⁷⁵ in Zhoushan, Zhejiang province. It is reported that ENN was able to receive green light from the NDRC because it had secured long-term LNG supply from Canada at a very attractive

⁷⁵ (NGV Global News 2013)

price. ENN also promised that they would only supply residential gas in Zhoushan (a municipality consisting of only islands) and gas to LNG-fueled international ships, and would not compete with the LNG terminals of state-run companies⁷⁶.

Many industry analysts regard ENN's Zhoushan LNG bunkering project as a sign that the Chinese central government is going to relax the regulations on import rights and infrastructure, and it is expected that local governments would be given the rights to approve import rights and infrastructure, which may reduce the regulatory barriers for non-state capital to enter the LNG import market. However, the NDRC and the Ministry of Commerce have confirmed that they are not considering of decentralizing the approval of import rights and infrastructure.⁷⁷ It is reported that many industry experts think, as China is increasingly dependent on imported gas, the central government will be more interested in allowing non-state companies to enter the gas import market. Such capital is more incentivized than state-companies to seek gas supplies at cheaper prices.

5. Conclusion

As part of its strategy to curb pollution and pursue cleaner energy sources, the Chinese government has pledged to increase the consumption of natural gas, which has historically been underrepresented in the country's energy mix. China is expected to experience rapidly increasing demand for imported natural gas through pipelines and LNG vessels within the next decade, at least. It will need to import 124 billion cubic meters of natural gas in 2020, more than tripling its imports in 2012 (38 billion cubic meters), to achieve its natural gas consumption goal. To meet the increasing demand, China has been exploring options to increase natural gas imports through both pipelines and LNG vessels.

Cheap and abundant gas in the U.S., as a result of the shale gas revolution, has generated enormous interest in China about the possibility of importing LNG from the U.S. However, uncertainties surrounding U.S. natural gas export policies reinforced China's impression that importing gas from the U.S. may be a difficult and prolonged process. Several studies predict that the future influx of gas from the U.S. into the international market will lead to a decline in natural gas prices worldwide. As a result, even if China does not import LNG from the U.S., it is likely to benefit from the decrease in LNG prices in the global market.

The mere possibility of importing gas from the U.S. has given China more leverage in its negotiations with Russia over the China-Russia gas pipeline. Russia, afraid of the influx of U.S. LNG to Europe, where most of its gas exports are directed, has started shifting its focus from Europe to Asia. It is expected that

⁷⁶ (CNENERGY 2013)

⁷⁷ (Dongfang Daily 2013)

Russia and China will finalize the gas pipeline agreement by the end of 2014, given the recent progress the two countries have made in their negotiations. By 2020, the China-Russia gas pipeline is expected to deliver 68 billion cubic meters of gas from Russia to China annually, meeting more than half of China's total demand for imported gas of 124 billion cubic meters. A secured supply of pipeline gas from Russia may depress China's appetite for LNG imports from additional sources including the U.S.

The state-mandated gas tariff mechanism in China has resulted in losses of gas importing companies – mainly the Big Three energy companies, because the mandated gas prices are not sufficient to cover the costs of imported gas. China's non-state capital, anticipating the development of a more market-based gas-importing sector in China, has been eyeing on gaining a share in this sector. However, high barriers for any non-state capital to enter the gas-importing sector have further hindered efficient investments made along the LNG import value chain. Favorable regulatory reforms will incentivize Chinese companies, in particular non-state enterprises, to pursue cheaper natural gas supplies overseas, thereby increasing China's competitiveness as a gas importer in the international market.

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