Fueling the Dragon

Understanding China's Natural Gas and LNG Demand

Batt Odgerel

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EPRINC
Est. 1944

ABOUT EPRINC

The Energy Policy Research Foundation, Inc. (EPRINC) was founded in 1944 and is a not-for profit, non-partisan organization that studies energy economics and government policy initiatives with special emphasis on oil, natural gas, and petroleum product markets. EPRINC is routinely called upon to testify before Congress as well to provide briefings for government officials and legislators. Its research and presentations are circulated widely without charge through posts on its website. EPRINC's popular Embassy Series convenes periodic meetings and discussions with the Washington diplomatic community, industry experts, and policy makers on topical issues in energy policy.

EPRINC has been a source of expertise for numerous government studies, and both its chairman and president have participated in major assessments undertaken by the National Petroleum Council. In recent years, EPRINC has undertaken long-term assessments of the economic and strategic implications of the North American petroleum renaissance, reviews of the role of renewable fuels in the transportation sector, and evaluations of the economic contribution of petroleum infrastructure to the national economy. Most recently, EPRINC has been engaged in an assessment of the future of U.S. LNG exports to Asia, technical challenges to the energy transition, and the growing importance of the North American petroleum production platform as an essential instrument of energy security.

EPRINC receives undirected research support from the private sector and foundations, and it has undertaken directed research from the U.S. government from both the U.S. Department of Energy and the U.S. Department of Defense. EPRINC publications can be found on its website: www.eprinc.org.

ABOUT THE AUTHOR

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EXECUTIVE SUMMARY

The People's Republic of China (China) has emerged as a key player in the global natural gas market in the past decade, surpassing Japan as the top natural gas importer and the largest LNG importer in 2018 and 2021, respectively. China's role in determining Asian natural gas trends—especially, gas pricing and LNG trade—is increasingly important as the country looks to replace greater volumes of coal with natural gas to implement its programs to reduce local air pollution.

Understanding China's natural gas and liquefied natural gas (LNG) demand is of major importance to policymakers and LNG exporting companies in the United States. Today, the United States is the second-largest supplier of LNG to China, only exceeded by Australia. China's reliance on U.S. LNG is likely to rise in the coming decades as a growing number of U.S. exporters have signed long-term contracts with Chinese gas companies.[1]

Key Findings

▸ **Air pollution will continue to be the main driver of future gas demand growth in China.**

China's growing gas appetite is largely driven by its shift from coal to cleaner energy sources as part of the central government's campaign against air pollution. Despite considerable progress in reducing air pollution since 2017, many Chinese cities still suffer from unhealthy levels of air quality in winter heating months. Per its carbon neutrality target, the State Council is also encouraging greater use of natural gas as a "bridge fuel" to reduce its carbon emissions.

▸ **Reference scenarios show China's gas demand may nearly double by 2050.**

The main scenarios of major energy modeling groups, including Equinor and the IEA, show that China's natural gas consumption will increase from 372 billion cubic meters (bcm) in 2021 to up to 678 bcm in 2050. If realized, such large growth will make the Chinese market far greater than the pre-pandemic European gas market and give China an enormous influence over global gas trade. Even under the most optimistic outlook, however, natural gas would constitute just 16% of its energy mix.

▸ **LNG imports will likely provide a third of China's gas demand in the medium term.**

LNG has accounted for the largest share of China's incremental gas demand since 2015 in comparison to domestic output and gas imports via pipelines. Due to limited growth in domestic gas production, imports will likely provide almost half of the total domestic gas consumption by 2030, with LNG's contribution surging from the current 29% to 33%.

▸ **Given the growth prospects for China's natural gas imports, the interdependence between China and the global gas market will further deepen.**

As China adds more natural gas to its energy mix, the country will increase its reliance on ever-larger volumes of imports. This results in rising import dependence for an essential fuel and

greater capacity to alter market expectations, traded volumes, contract terms, and pricing for world LNG markets.

▸ The projected LNG import growth of 27%-72% by 2030 represents large uncertainties.

EPRINC estimates China's LNG imports to grow from 78.9 Mtpa in 2021 to between 100.3 million metric tons per annum (Mtpa) and 135.9 Mtpa in 2030, increasing its share of global LNG demand from 20.8% to 22%-30%. The demand uncertainty of over 35 Mtpa by 2030 is substantial, nearly equal to India's current annual LNG imports. The wide range in LNG demand outlook illustrates major uncertainties in gas pricing, China's domestic production and pipeline gas import volumes as well as its economic conditions.

▸ Regional gas demand profiles vary according to policies and economic conditions.

China's domestic natural gas supply must move long distances to serve demand centers: three inland provinces produce more than two-thirds of total production whereas demand is concentrated in the coastal provinces. Northern winter-heating provinces mainly use natural gas in the residential sector owing to government policies to fight air pollution in urban areas. Gas use in industry is more widespread in wealthier, coastal provinces like Jiangsu where factories replaced coal-fired industrial boilers with gas-fired boilers.

▸ There exists significant growth potential for natural gas demand in some industrial sectors and power generation that are still heavily reliant on coal.

China has been implementing stricter environmental standards to limit particulate emissions and has increased subsidies to encourage the replacement of coal-fired boilers with gas-fired boilers. These initiatives have been concentrated in both winter heating provinces and manufacturing provinces. As a result, gas demand has increased substantially in China's residential, commercial, and industrial sectors. However, growth in power generation and energy-intensive industrial sectors, such as cement and steel has lagged due to cost and regulatory issues.

▸ Medium-term natural gas infrastructure developments look promising with expected increases in LNG regasification and natural gas underground storage capacities.

Infrastructure bottlenecks have been among the main challenges to China's natural gas development. Based on recent progress in ramping LNG regasification capacity and China's continued focus on peak shaving capacity, the medium-term gas infrastructure outlook is assessed positively. These improvements could be further strengthened by China's liberalization reforms and increased infrastructure access to second-tier companies.

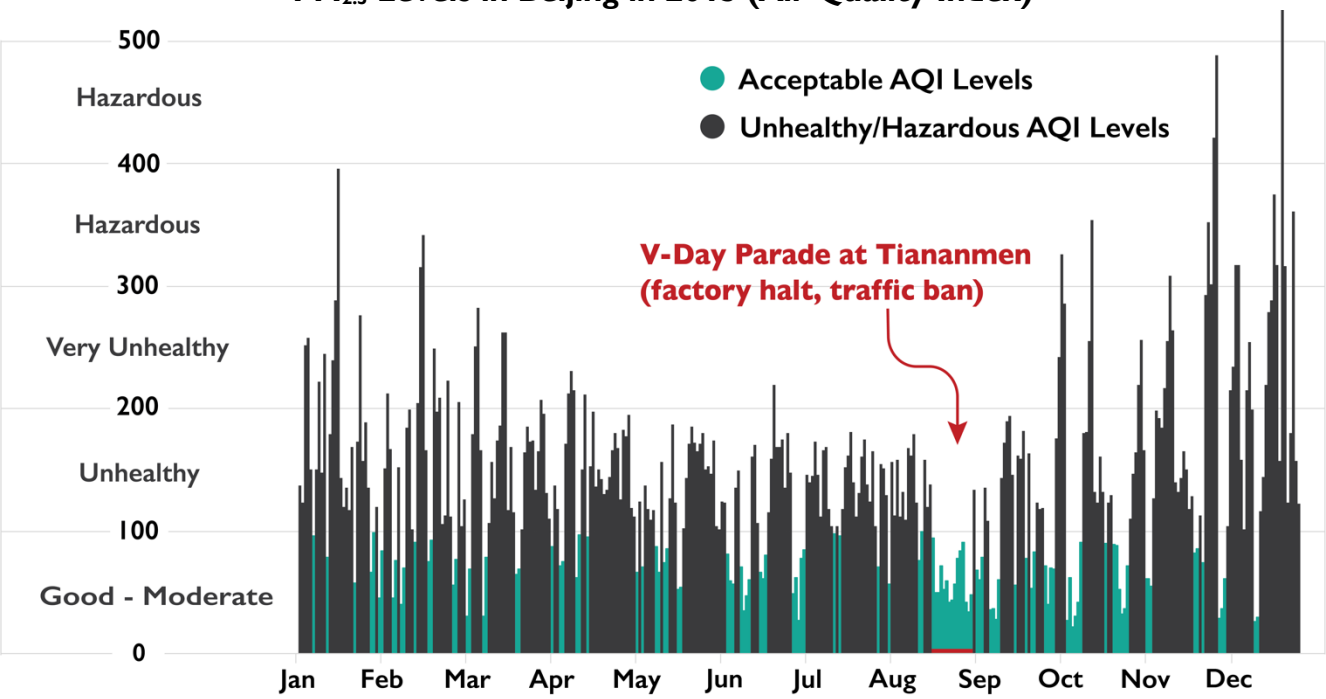
NATURAL GAS AS A LONG-TERM SOLUTION TO CHINA'S AIR POLLUTION AND SUSTAINABILITY

On one morning of fall in 2015, Chinese President Xi Jinping cheerfully looked up to the country's state-of-the-art military aircraft that painted Beijing's blue skies leaving multiple color trails as they flew over Tiananmen Square. The high-profile military parade commemorating the end of World War II was hardly a mere display of China's military capabilities; it also aimed to show all kinds—including ridding itself of environmental pollution—of prosperity under the rule of the Communist Party of China (CPC). Such a masquerade came at extremely high costs. In the run-up to the parade, the government imposed temporary controls on industrial activities, power generation, and construction, including a weeklong shutdown of coal-fired power plants, closures of or reduced production at 10,000 factories, and a construction halt of 9,000 sites—all to warrant a glimpse of clean air for the event (Figure 1).[2] Such drastic pollution controls were repeated in the municipality during the 2008 Summer Olympic and Paralympic Games[3] and the 2022 Winter Games.

Air pollution is an acute problem in China's cities, which begs a long-term solution rather than temporary factory shutdowns and traffic bans. China's five-year plans and supporting documents offered natural gas, along with electricity and renewables, as a key alternative source to coal in its efforts to fight air pollution. As a result, China has achieved significant pollution reductions since 2017, reducing the monthly average levels of fine particulate matter ($PM_{2.5}$) from "hazardous" (over 200 points on Air Quality Index) to "moderate" in Beijing and other cities. However, further progress is needed as Chinese cities continue to experience days with poor air quality. For example, Beijing had 109 days of unhealthy and 11 days of very unhealthy air quality in 2021 (Figure 2).

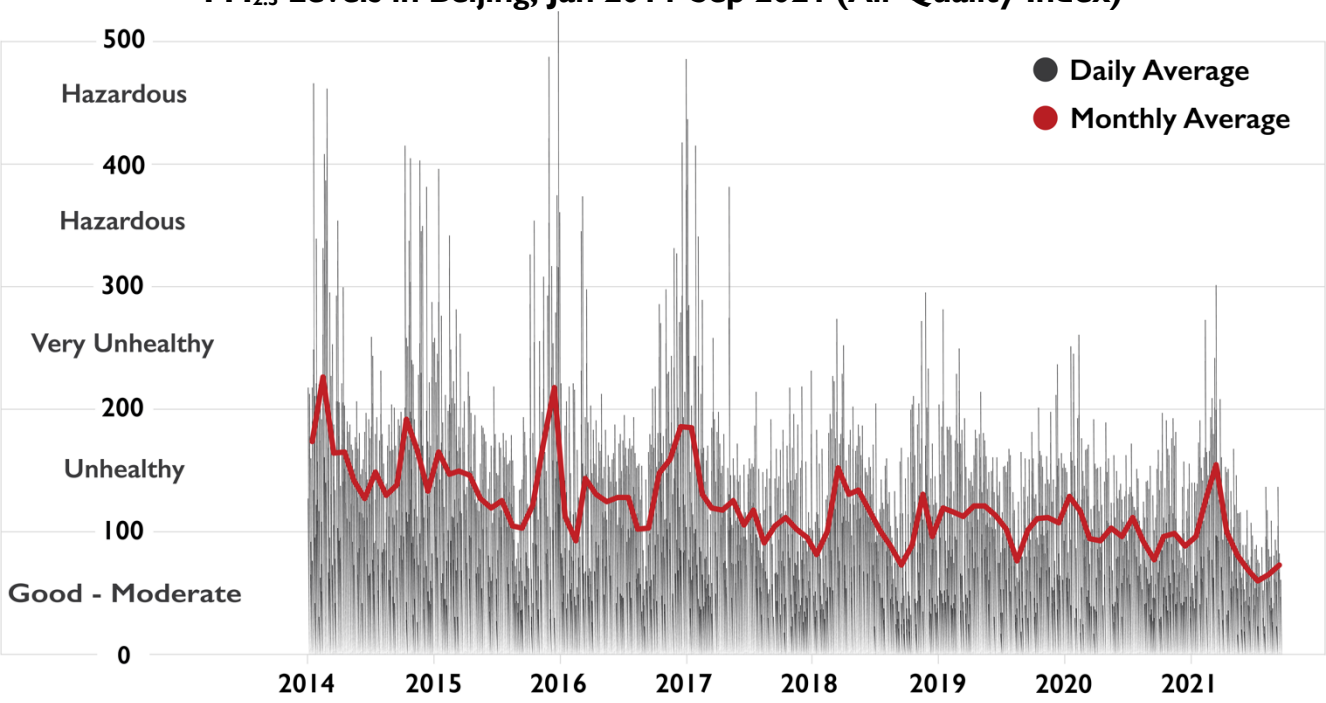
Photo: China Daily "Military aircraft dazzle spectators with stunts", September 3, 2015.

Figure 1
$PM_{2.5}$ Levels in Beijing in 2015 (Air Quality Index)



EPRINC analysis based on data from the World Air Quality Project

Figure 2
$PM_{2.5}$ Levels in Beijing, Jan 2014-Sep 2021 (Air Quality Index)

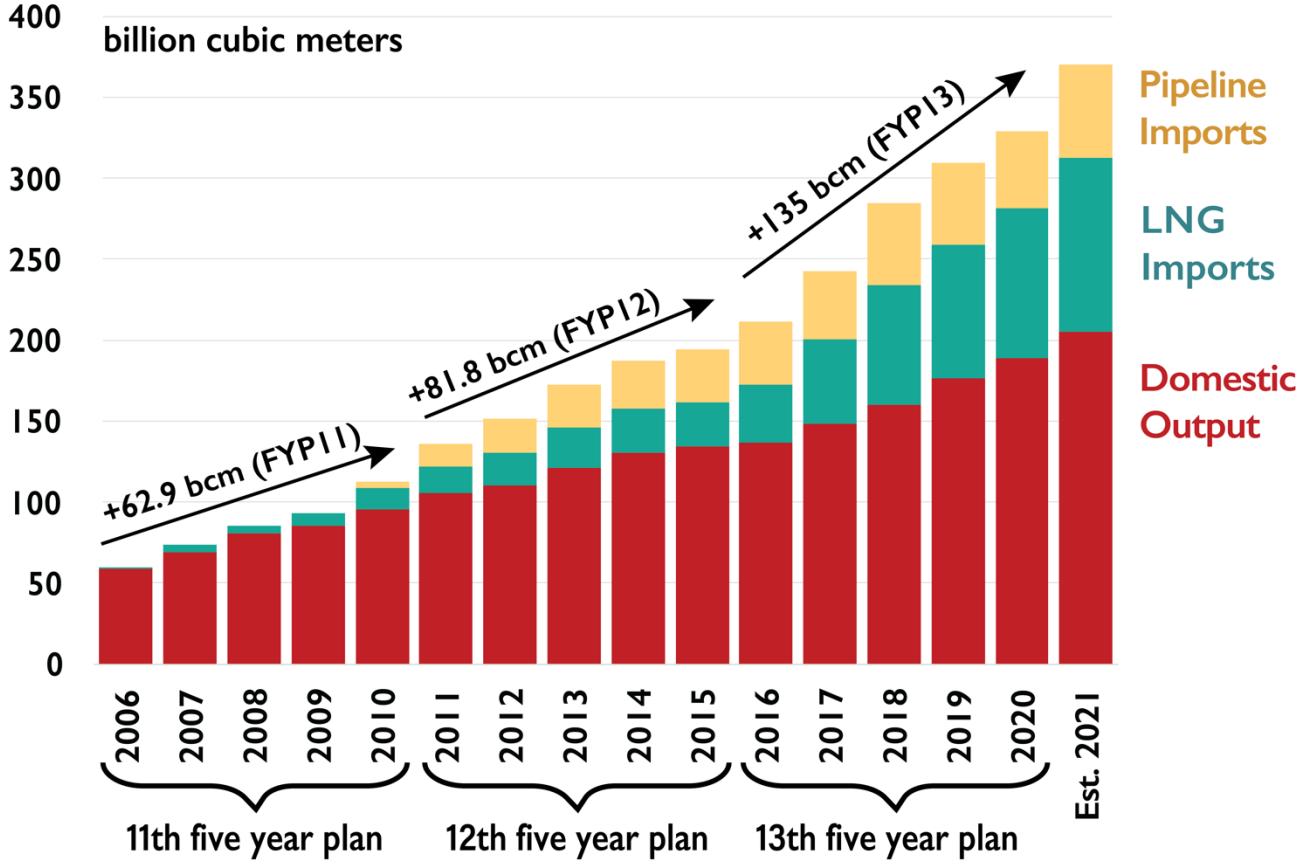


EPRINC analysis based on data from the World Air Quality Project

KEY SUPPLY SOURCES AND DEMAND CENTERS IN CHINA

Driven by clean air policies and new supporting infrastructure, China's natural gas consumption grew fastest in the 13th five-year plan (FYP) from 2016-2020, with the incremental consumption reaching 135 bcm at an average annual growth rate of 27.4% (Figure 3).[4] Between 2015 and 2021, the biggest volumetric growth of 80.3 bcm was witnessed in LNG imports, as the rapid progress in gas consumption was far greater than its domestic output growth of 70.7 bcm (Figure 4).[5] Natural gas imports via pipelines were less significant due to little additional pipeline import capacity, except for the Power of Siberia pipeline from Russia.

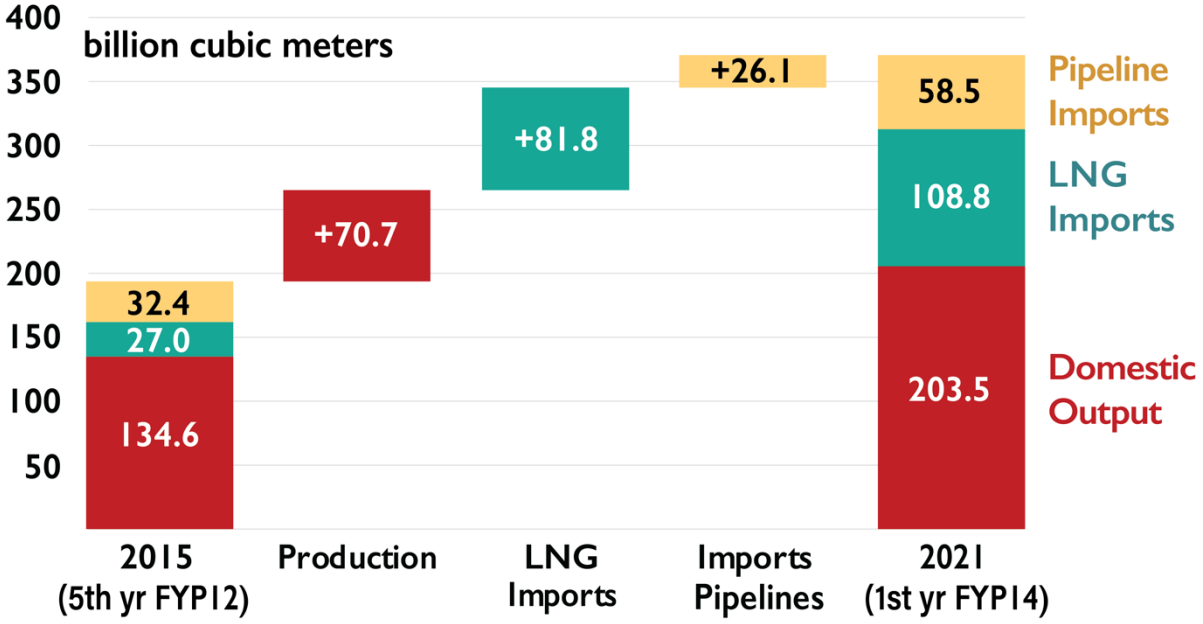
Figure 3
China's Gas Production and Imports



EPRINC analysis based on data from China Customs, China Energy Statistical Yearbook and BP

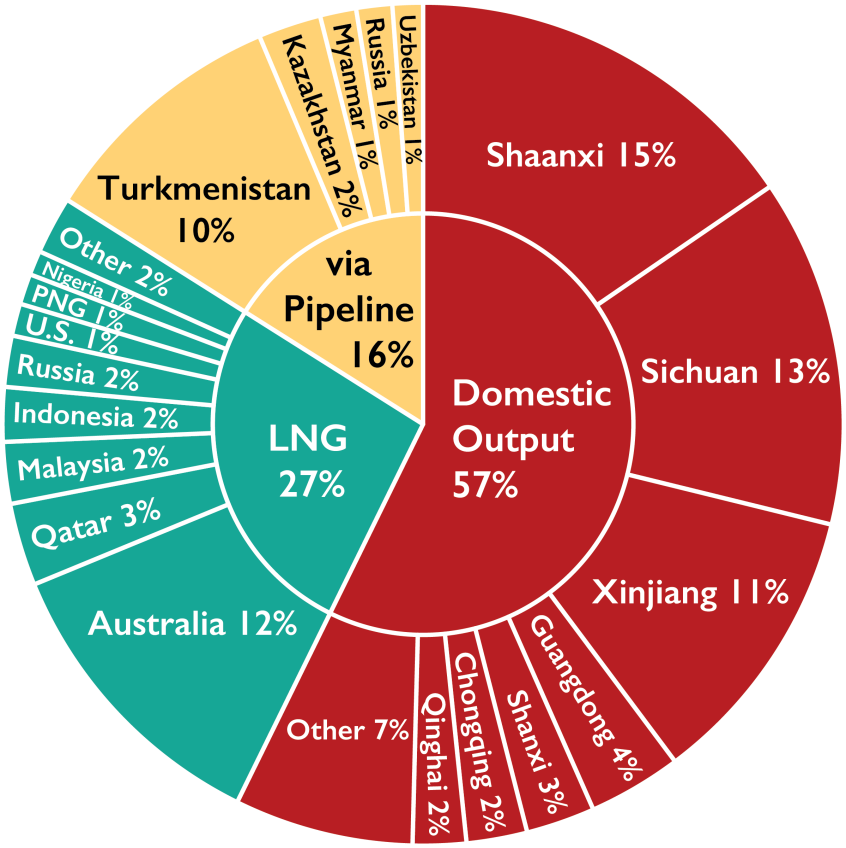
China's natural gas supply sources are well diversified. In 2020, imported natural gas made up 43% of the country's total consumption. Australia and Turkmenistan were China's top LNG and pipeline natural gas suppliers, accounting for 12% and 10%, respectively, of its total gas demand in that year. Additional supply came from over 10 countries in Eurasia, Southeast Asia, the Americas, the Middle East, and Africa (Figure 5).[6]

Figure 4
China's Incremental Gas Supply Since End of FYP12



EPRINC analysis based on data from China Customs, China Energy Statistical Yearbook and BP

Figure 5
China's Main Natural Gas and LNG Supply Sources (2019/2020)



EPRINC analysis based on data from China Energy Statistical Yearbook and BP

Domestically, there are large gas fields in nine key basins, including Sichuan, Ordos, Tarim, Qaidam, and Junggar.[7] Shaanxi, Sichuan, and Xinjiang—the three provinces sitting atop the largest fields in the central and western parts of the country—constitute almost 70% of China's domestic production.[8] Nevertheless, gas-consuming centers are mostly in the eastern and southern coastal regions where there is a higher demand for residential and industrial consumption because of economic conditions and policy support. As such, the main gas-consuming and producing regions generally do not overlap (Figures 6 and 7).[9]

Figure 6
Mainland China: Gas Producing Regions (2019)

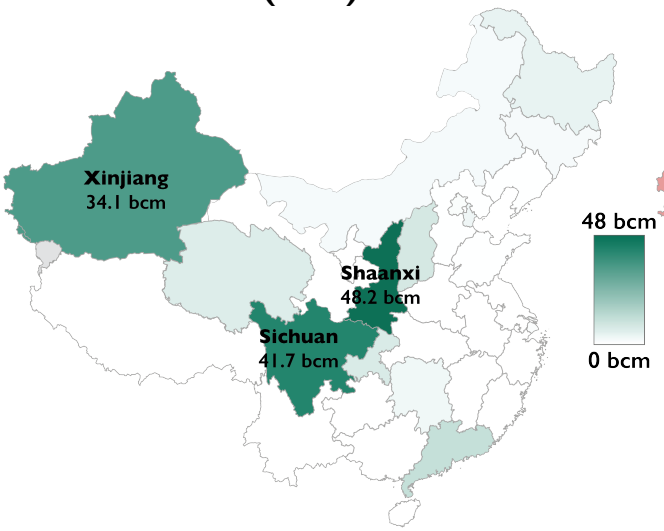
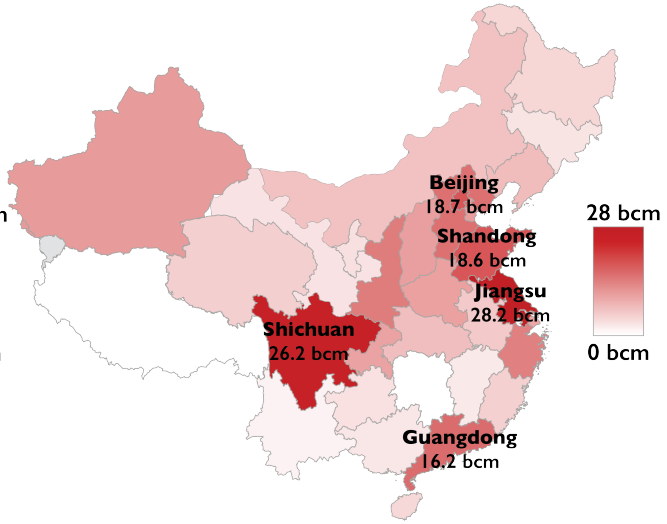


Figure 7
Mainland China: Gas Consuming Regions (2019)

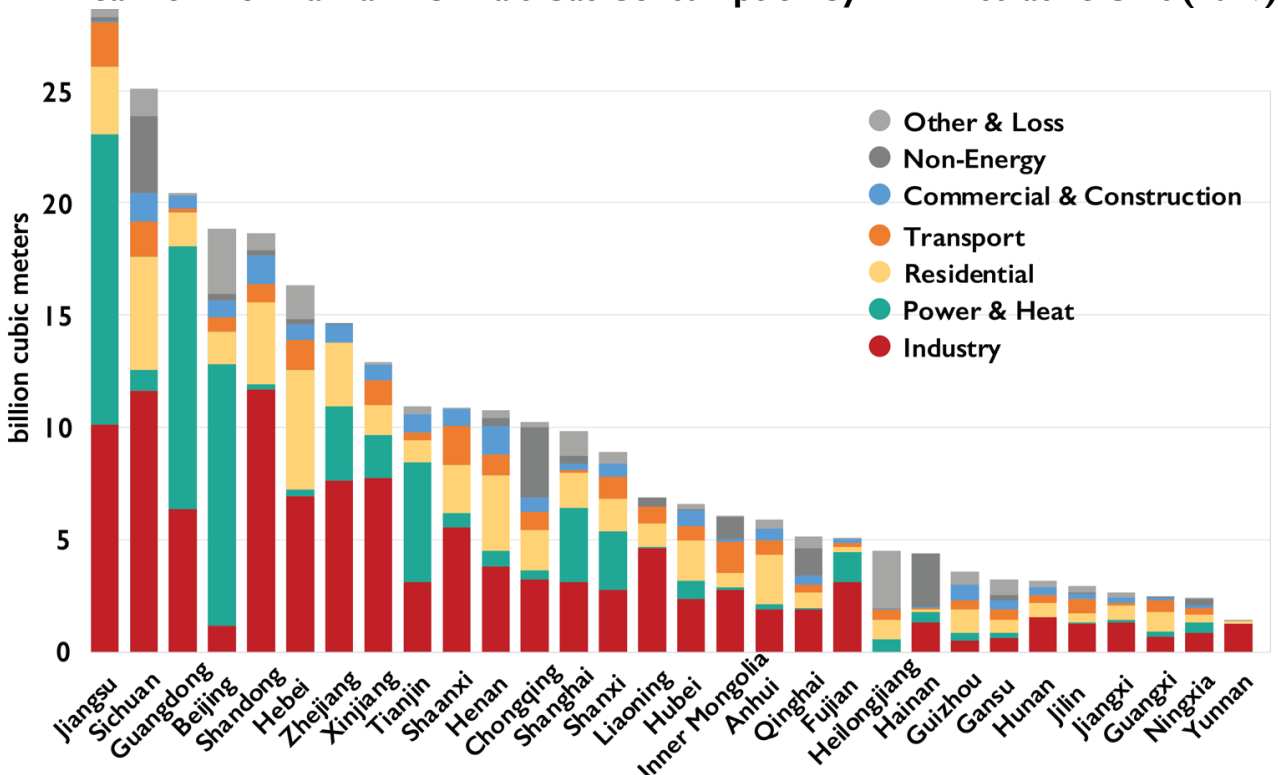


EPRINC analysis based on data from China Energy Statistical Yearbook 2020

In the residential sector, for example, gas consumption per capita is highest in the key gas-producing provinces as well as the Beijing-Tianjin-Hebei region due to China's coal-to-gas switching policy. In 2017, the Ministry of Environmental Protection introduced a regional plan to carry out unified emission reduction measures against high $PM_{2.5}$ pollution in two municipalities (Beijing and Tianjin) and 26 cities in the surrounding regions.[10] The State Council expanded this effort with a three-year action plan called the "Blue Sky Defense" to reduce sulfur dioxide and nitrogen oxide by 15% and $PM_{2.5}$ density by 18% by 2020 compared to the 2015 levels. Under these plans, the central and provincial governments provided subsidies to millions of households to switch from coal to gas or electricity.

Chinese provinces' gas demand profiles vary according to economic and industrial conditions as well as policy implementation. To give a few examples, in Jiangsu, the second wealthiest province and the largest gas-consuming province, power generation and industry account for 81% of its gas consumption. Beijing is the capital city and an administrative center, and thus Beijing has limited industrial consumption (6% of its gas consumption) and most of its gas demand comes from power generation (62%). Hebei is among the poorest provinces in terms of GDP per capita, which explains its very slow shift from coal-fired power generation to gas-fired power generation (Figure 8).[11] Throughout the country, industry was the largest gas-consuming sector (112.7 bcm) as of 2019, followed by power generation (61.2 bcm), the residential sector (48.2 bcm) and transport (19.7 bcm).

Figure 8
Breakdown of Mainland China's Gas Consumption by Administrative Unit (2019)



EPRINC analysis based on data from China Energy Statistical Yearbook 2020.
Energy transformation such as liquefaction and gas works are excluded from the analysis.

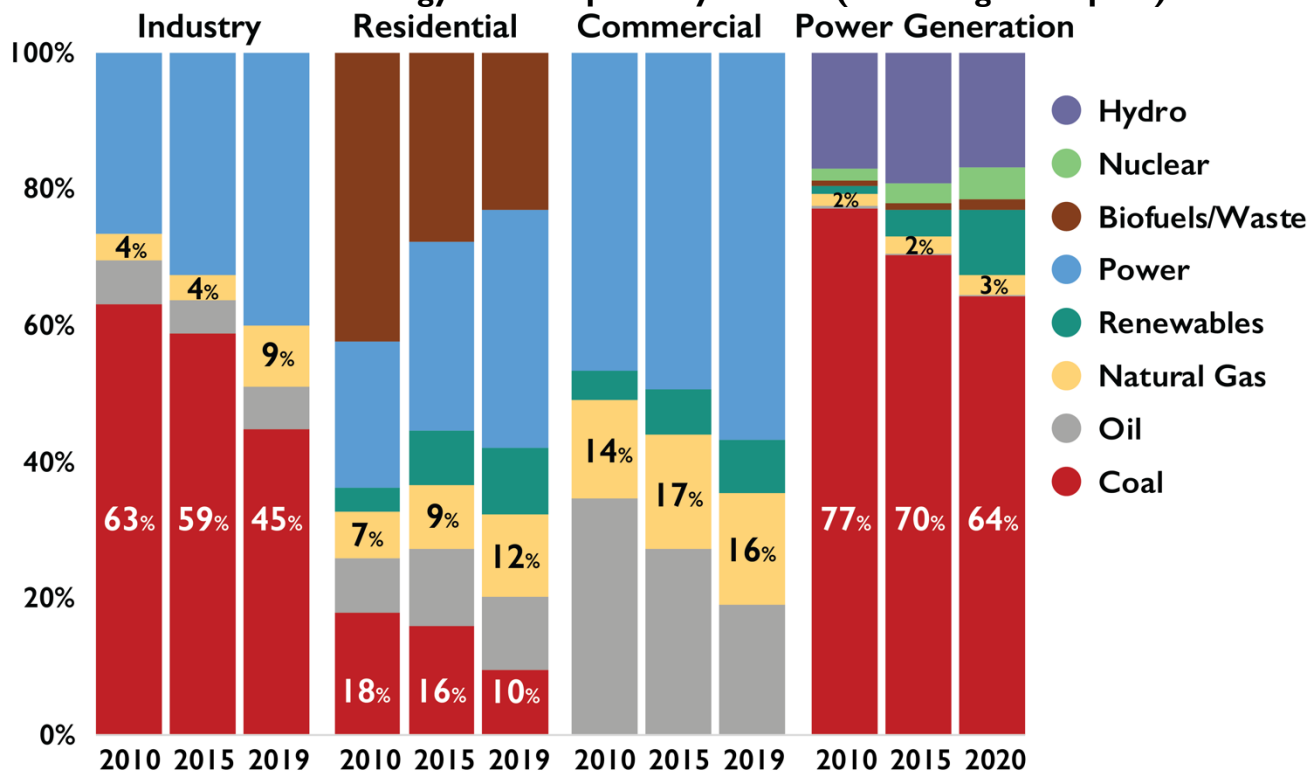
To meet the growing gas demand in various sectors, China has given priority to increasing exploration and production (E&P) by means of additional exploration investments and laws permitting foreign enterprises to acquire E&P rights. The State Council also issued the *Notice on Reduction of Resource Tax Assessed on Shale Gas* (2018), which applied a reduction of 30% to the resource tax assessed on shale gas from 2018 to 2021. Despite these efforts, conventional and shale gas production failed to achieve its 5-year production targets (shale gas output reached 20 bcm in 2020, which is well short of the targeted 30 bcm).

GROWTH POTENTIAL OF NATURAL GAS CONSUMPTION FOR POWER GENERATION AND INDUSTRY continued

Natural gas remains a relatively small source of energy, accounting for just 8% of China's energy mix at the end of 2020.[12] As of 2019, natural gas constituted 12% and 16% of the residential and commercial sector demand, respectively. However, its share remains no more than 10% in industrial energy consumption and just around 3% in power generation. The tiny shares in these energy-intensive sectors offer both opportunities and challenges for the future growth of natural gas consumption in China (Figure 9).

In industry, natural gas demand as a percentage of coal combustion has grown dramatically in light industries and petrochemicals. But its share remains a fraction of coal consumption in more energy-intensive, heavy industries such as construction and iron and steel (Figure 10).[13] Although industrial gas use is expected to continue growing, cost remains the main challenge because cheap coal still serves as the pillar of Chinese manufacturing centers. In power generation, natural gas is still a costlier as well as much more volatile option for Chinese utilities. As a result, the share of natural gas in power generation continues to be much smaller than coal (Figure 11).[14] But as China moves to impose stricter environmental requirements, natural gas has the potential to constitute a significantly higher proportion of electricity and heat generation in the medium term.

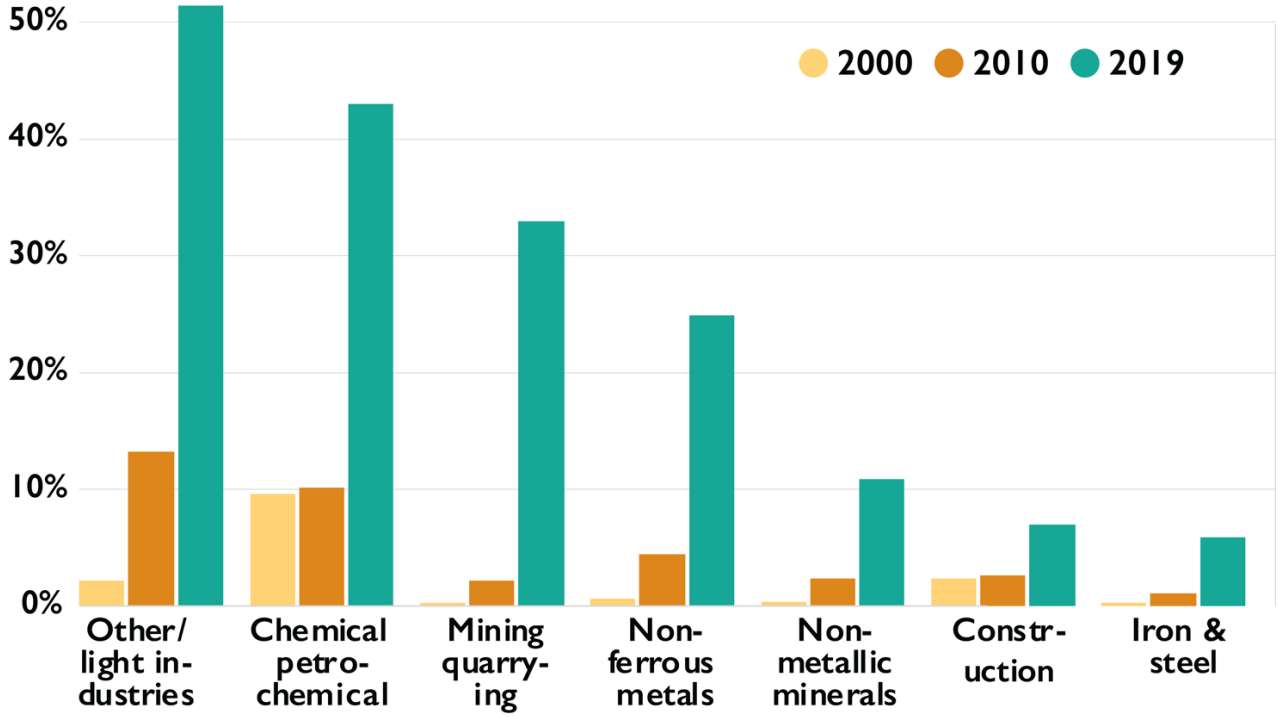
Figure 9
China's Final Energy Consumption by Source (Excluding Transport)



EPRINC analysis based on data from IEA World Energy Balances and National Bureau of Statistics China

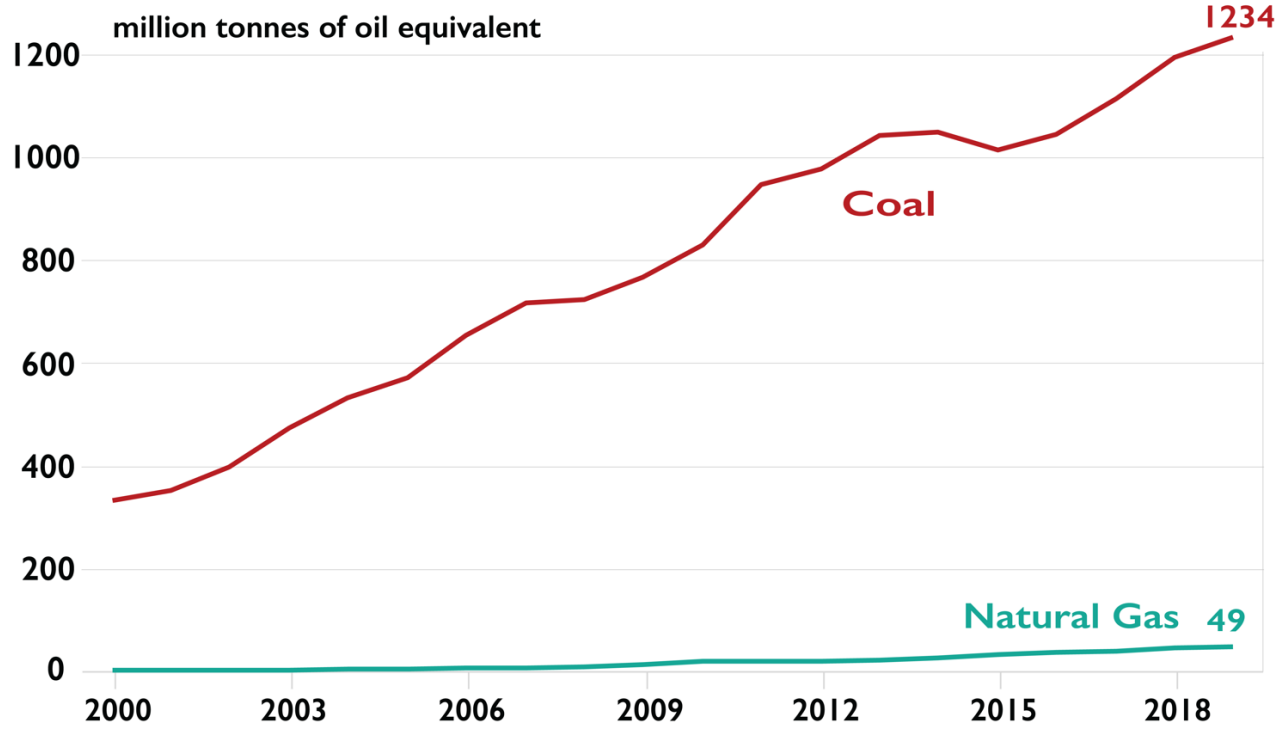
GROWTH POTENTIAL OF NATURAL GAS CONSUMPTION FOR POWER GENERATION AND INDUSTRY continued

Figure 10
Gas Consumption in Industry as Percentage of Coal Consumption



EPRINC analysis based on data from IEA World Energy Balances and National Bureau of Statistics China

Figure 11
Power Generation by Fuel: Coal vs. Gas (2000-2019)



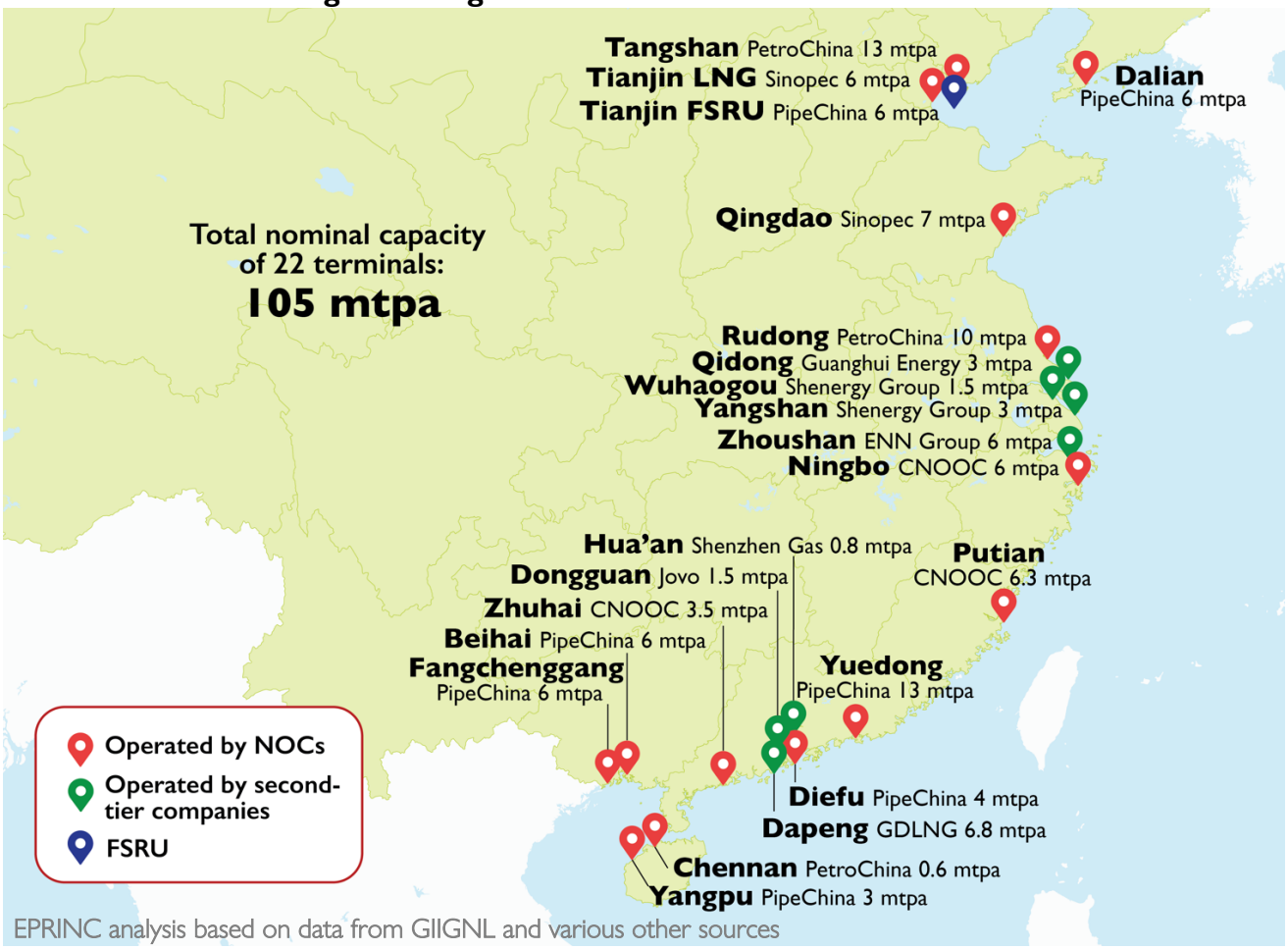
EPRINC analysis based on data from IEA World Energy Balances and National Bureau of Statistics China

CONTINUED INCREASE IN LNG TERMINAL AND UNDERGROUND STORAGE CAPACITY

As of March 2022, China had 22 operating LNG regasification receiving terminals with a total nominal capacity of 105 million metric tons per annum. Until recently, almost all LNG terminals were owned and operated by the three main National Oil Companies (NOCs): PetroChina (CNPC), CNOOC, and Sinopec. Since the creation of the national pipeline operator PipeChina (formally, China Oil and Gas Pipeline Network) in 2019, many of the NOCs' assets, including LNG terminals, have been transferred to the new company.

As China's gas market matures on the strength of the ongoing liberalization reforms, second-tier companies—private or province-backed—are playing a more visible role than before. Seven of the existing 22 terminals are now operated by second-tier companies—i.e., Guanghui Energy, Shenergy Group, ENN Group, Shenzhen Gas, Jovo, and GDLNG. Additionally, because of the third-party access scheme, smaller companies that do not own terminals have now access to the spare capacity of most of these terminals (Figure 12).

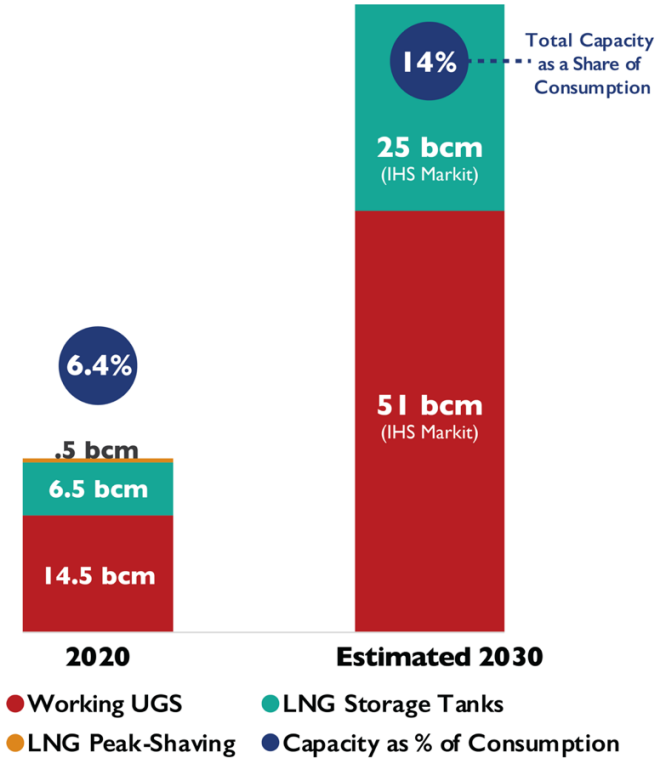
Figure 12
Existing LNG Regasification Terminals in Mainland China



CONTINUED INCREASE IN LNG TERMINAL AND UNDERGROUND STORAGE CAPACITY continued

In addition to LNG terminals, underground storage (UGS) facilities are an important component of China's natural gas and LNG market development. With limited storage capacity, China found itself scrambling for additional gas supply during the winter heating season in 2017 when its total gas storage capacity covered just around 3% of its annual consumption.[15] In response to the chronic storage shortages, the National Development and Reform Commission (NDRC) and other ministries jointly issued the *Opinions on Accelerating the Utilization of Natural Gas*, which targeted working UGS at 35 bcm by 2030.[16] IHS Markit's Xiao Lu made an even more optimistic projection of the country's total storage capacity reaching 76 bcm per year in 2030.[17] That capacity estimate is approximately 14% of China's projected annual consumption of 550 bcm, which may put China on par with the United States (16%) and is more than the world average of 12% (Figure 13). It is uncertain whether China will attain these numbers given the geological challenges unique to the country; however, recent developments (including, Sinopec's new 10 bcm UGS[18]) suggest that Chinese NOCs will be able to boost their storage capacities considerably in the medium term. Having sufficient peak-shaving capacity will yield considerable benefits such as less severe price fluctuations and seasonality.

Figure 13
China's Total Gas Storage Capacity: IHS Markit's Projection



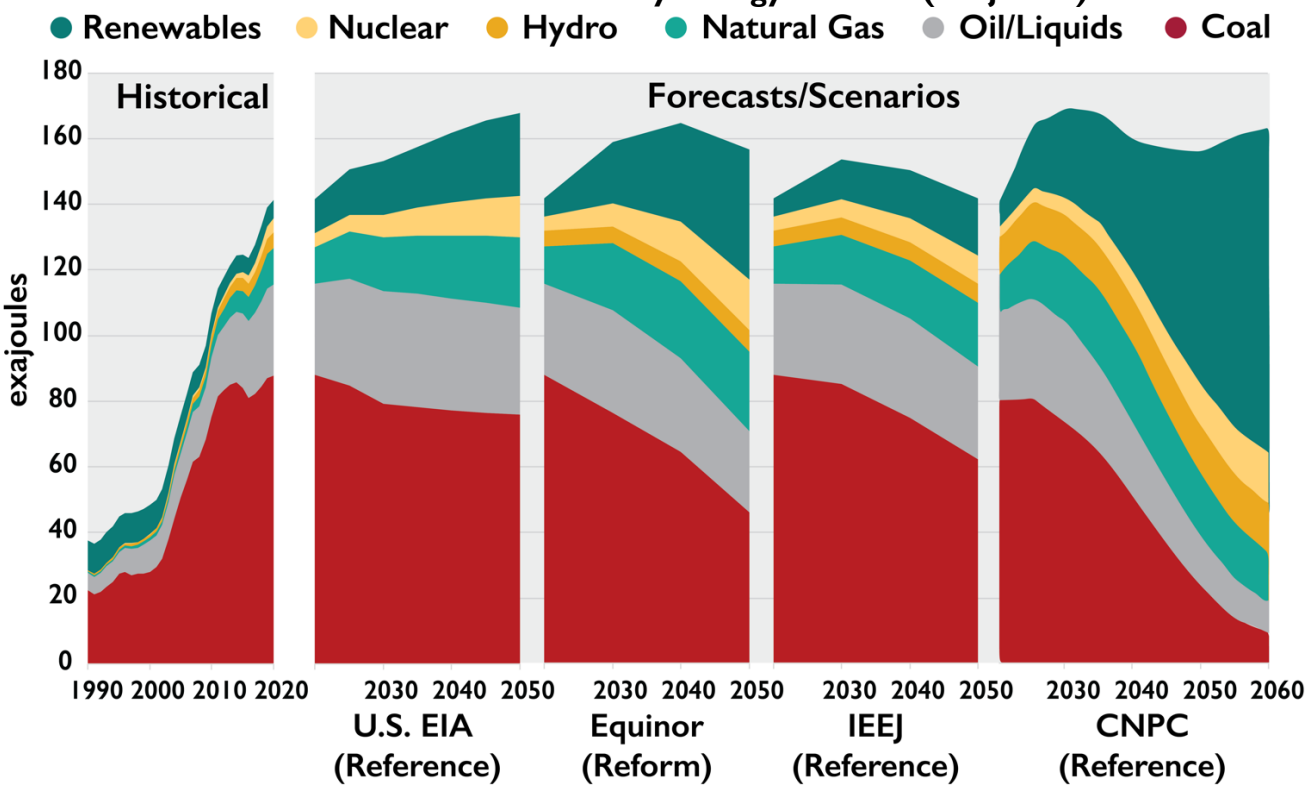
EPRINC figure based on data from Shi Weijun (NGW Magazine) and IHS Markit

LONG-TERM SCENARIOS OF CHINA'S GAS DEMAND

Selected energy modeling groups' reference and aspirational scenarios show a wide range of possibilities of China's future gas demand growth although all of them agree that demand will be higher in 2050 than in 2020.[19] The U.S. Energy Information Administration, the Institute of Energy Economics, Japan, OPEC, and the International Energy Agency's main scenarios and Equinor's "Reform" scenario expect China's gas demand to be 520 bcm to 678 bcm in 2050. However, some appear to considerably underestimate the medium-term growth rate through 2030. Given China's high growth rates in recent years and the enormous coal-to-gas switching potential, EPRINC expects the country's total demand in the medium term to be on the higher end of the scenarios (530 bcm-575 bcm as early as 2030).

According to the China Natural Gas Development Report 2021, issued by the State Council, China's gas demand could reach between 550-600 bcm by 2030. Such an enormous increase will make China's gas market equal to or larger than the European gas market before the pandemic. Additionally, the Chinese national oil company CNPC forecasts stable natural gas consumption through 2060 even under a carbon neutrality regime (Figure 14).[20] These scenarios as well as Chinese official documents on natural gas reflect the importance of natural gas as a bridge fuel to achieve its long-term sustainability goals (Figure 15).

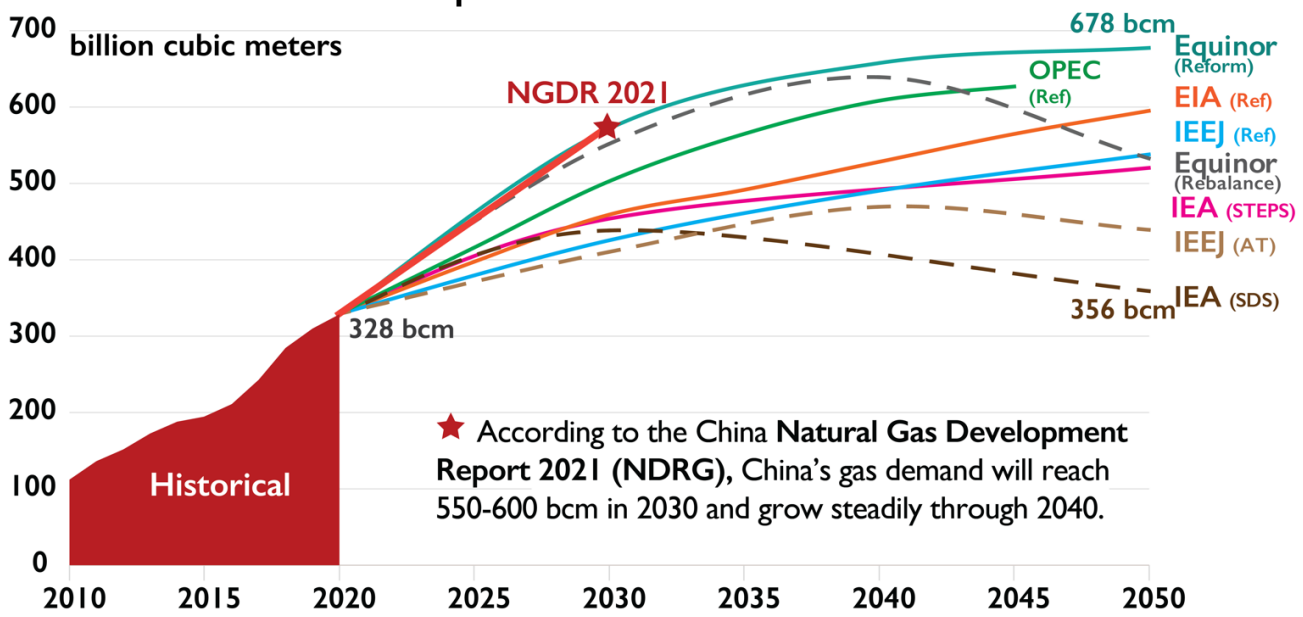
Figure 14
Forecasts of China's Primary Energy Sources (Exajoules)



Sources: IEA WEB, U.S. EIA IEO 2021, Equinor Energy Perspectives 2021, IEEJ Outlook 2022, CNPC Outlook 2021. Note: EIA's Renewables include Hydro; EIA's oil/liquids include biofuels and other liquids

LONG-TERM SCENARIOS OF CHINA'S GAS DEMAND continued

Figure 15
Reference and Aspirational Scenarios of China's Gas Demand

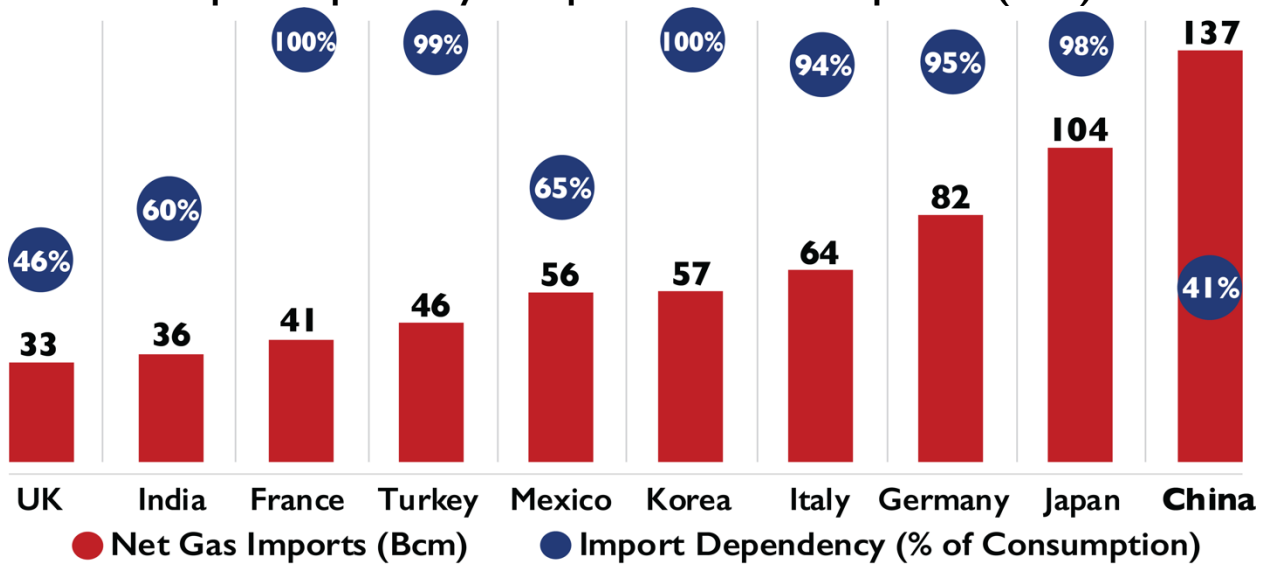


Sources: Most recent long-term outlook reports of the companies

IMPORT DEPENDENCY AND BUYING POWER

Despite being the biggest importer, China is less dependent on imports than the rest of the top ten gas importing countries (Figure 16).[21] With more buying power and comparatively less exposure to imports, China may gain some leverage in natural gas negotiations.

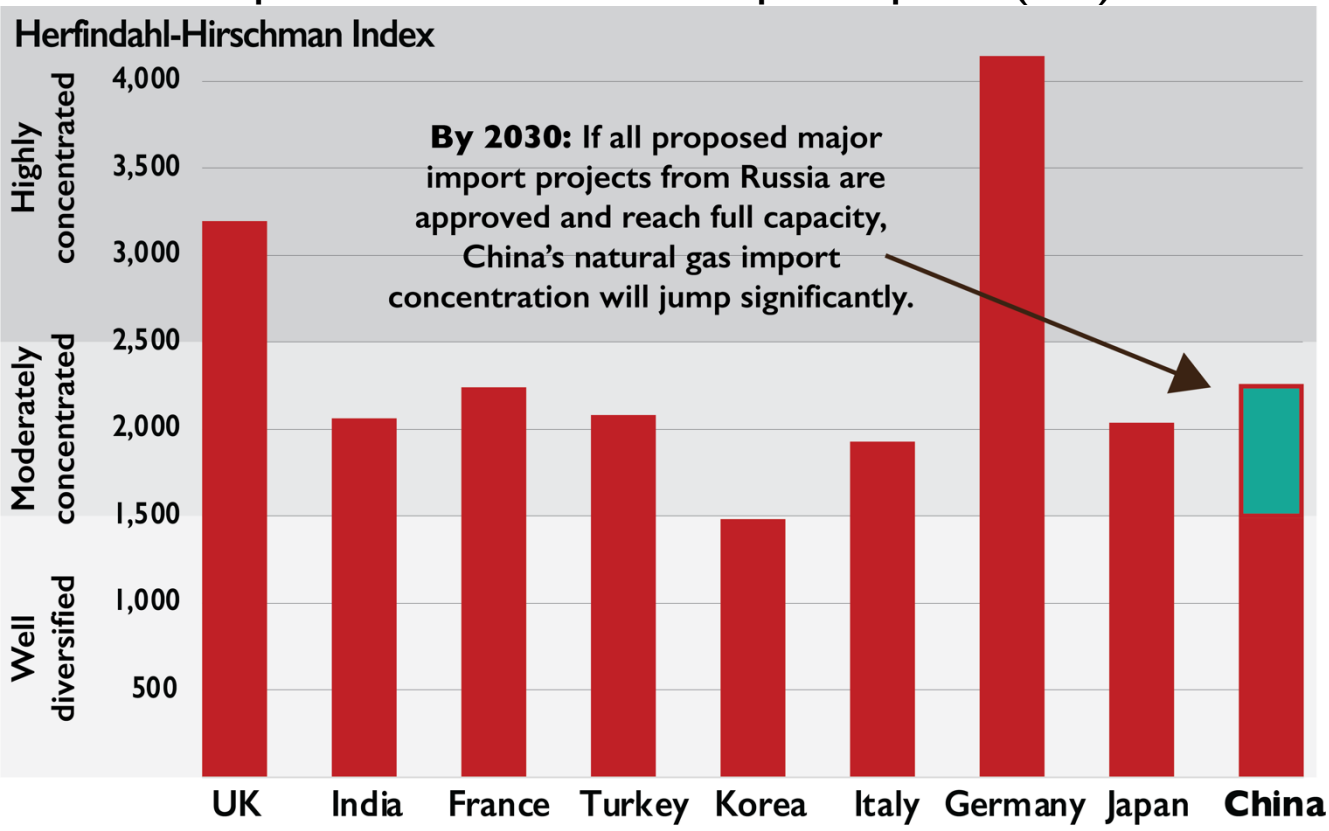
Figure 16
Import Dependency of Top 10 Natural Gas Importers (2020)



EPRINC figure based on data from BP Statistical Review of World Energy and EIA

China also has been able to diversify its natural gas import sources. As of 2020, only China and South Korea had "well-diversified" import sources among the top 10 importing countries, according to an EPRINC estimate using the Herfindahl-Hirschman Index (HHI) methodology.[22] This, however, may change depending on future Sino-Russian energy trade agreements. With the Power of Siberia and additional pipeline capacity from Sakhalin, China is likely to import 48 bcm per year of pipeline gas from Russia in the second half of the 2020s. Recently, Russia has pushed for the construction of a new pipeline called the Power of Siberia II (officially "Soyuz Vostok") pipeline with a design capacity of 50 bcm per year through Mongolia although China has yet to make any official announcement on its prospects.[23] If this project is approved, China could be importing around 100 bcm per year from Russia in the 2030s. That would change China's import concentration from "well-diversified" to "moderately diversified" on the HHI scale. Regardless of the fate of the proposed pipeline projects, China is positioned to gain greater leverage as a key buyer of LNG as well as pipeline gas in the coming decades (Figure 17).[24]

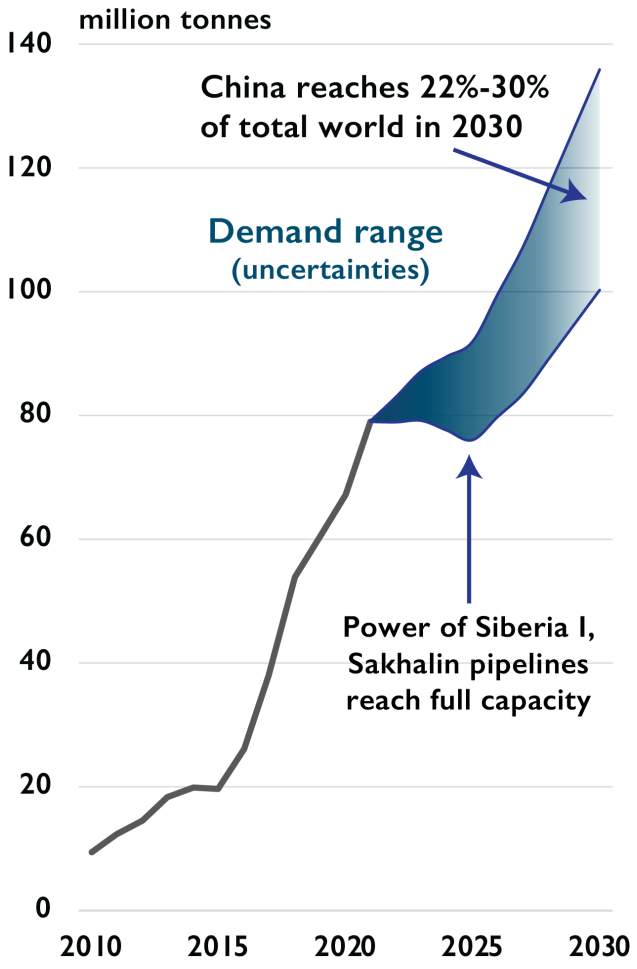
Figure 17
Import Source Concentration of Top Gas Importers (2020)



EPRINC analysis

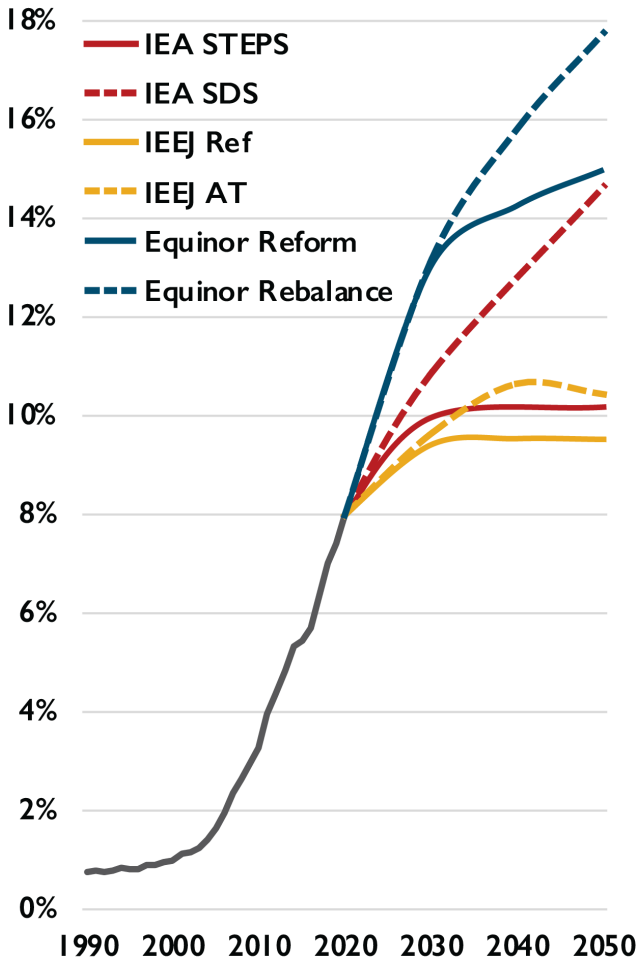
EPRINC's analysis shows that China's LNG imports will likely grow from 78.9 Mtpa to between 100.3 Mtpa and 135.9 Mtpa in 2030 (Figure 18). This assumes modest domestic output growth and total gas demand of 526 bcm to 575 bcm from estimates of Chinese NOCs and official documents,[25] and the Power of Siberia I (38 bcm) and Sakhalin (10 bcm) pipelines reaching full capacity nearly on schedule (with a 2-year delay for the latter). Based on Morgan Stanley[26] and BloombergNEF's[27] separate projections of the global LNG demand in 2030, China could be importing 22%-30% of total world LNG supply in 2030, compared with 20.8% in 2021. This is facilitated by the reference scenarios of China's overall natural gas market accounting a greater share of the global total, between 10% and 18% in 2050, up from 9.2% in 2021 (Figure 19).[28] Major uncertainties remain in pricing, domestic production, pipeline gas imports from Russia and, most importantly, China's own economic conditions (including the rate of coal-to-gas switching).

Figure 18
China's LNG Demand Forecast



EPRINC analysis

Figure 19
China's Gas Demand as % of World



EPRINC analysis based on energy outlook reports

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PAST REPORTS IN THE EPRINC CHINA SERIES

Check out our previous report *China's Search for Blue Skies: Understanding LNG's Role* (April 2019) on eprinc.org (https://eprinc.org/wp-content/uploads/2019/08/Chinas_Search_for_Blue_Skies.pdf)!

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ENDNOTES

[1] The long-term agreements include those between Cheniere and ENN (0.9 Mtpa, 13 years), Cheniere and Sinochem Group (0.9 Mtpa, 17.5 years), Cheniere and Foran Energy Group (0.3 Mtpa, 20 years), and Venture Global and Sinopec (4 Mtpa, 20 years).
[2] *China moves to ensure clean air for military parade*. English.news.cn. (Aug 17, 2015). Retrieved March 12, 2022, from https://web.archive.org/web/20150919034424/http:/news.xinhuanet.com/english/2015-08/17/c_134527293.htm
[3] *IOC praises efforts to reduce air pollution in Beijing*. The Guardian. (Aug 7, 2008). Retrieved March 10, 2022, from https://www.theguardian.com/world/2008/aug/07/china.olympics2008
[4] Note that the average annual growth (the average of annual growth rates) here is different than the compound annual growth rate (CAGR). The author calculated the amounts using data from China Bureau of Statistics, China Customs, and BP's Statistical Review of World Energy 2021.
[5] China Bureau of Statistics, China Customs, and BP's Statistical Review of World Energy 2021.
[6] BP Statistical Review of World Energy 2021.
[7] Jinxing Dai, Wei Wu, Chenchen Fang, Dan Liu, "Exploration and development of large gas fields in China since 2000". Natural Gas Industry B, Volume 2, Issue 1, 2015, Pages 1-8, https://doi.org/10.1016/j.ngib.2015.02.001.
[8] China Energy Statistical Yearbook 2020.
[9] EPRINC figure based on data from China Energy Statistical Yearbook 2020.
[10] The plan's official name is "2017 Air Pollution Prevention and Management Plan for the Beijing-Tianjin-Hebei Region and its Surrounding Areas." The surrounding areas include some but not all cities in Hebei, Shanxi, Shandong, and Henan provinces.
[11] EPRINC analysis based on data from China Energy Statistical Yearbook 2020. GDP estimates are from China Statistics Bureau and other sources. Energy transformation such as liquefaction and gas works are excluded from the analysis.
[12] Multiple reports citing the National Development and Reform Commission and Statistical Bureau of China.
[13] EPRINC analysis based on data from IEA World Energy Balances and China Energy Statistical Yearbook 2020.
[14] EPRINC analysis based on data from IEA World Energy Balances and China Energy Statistical Yearbook 2020.
[15] Dan Mueller, et al., *Underground Gas Storage in China Developing a World Class Program*, Environmental Defense Fund (2019). http://blogs.edf.org/energyexchange/files/2019/05/DevelopingUndergroundGasStorageinChina.pdf
[16] National Development and Reform Commission. *Notice on Issuing the Opinions on Accelerating the Utilization of Natural Gas* (Jul 24, 2017). http://www.gov.cn/xinwen/2017-07/04/content_5207958.htm
[17] Xiao Lu, *How will China's gas storage development alter LNG import seasonality?* IHS Markit. Retrieved April 4, 2022, from https://ihsmarkit.com/research-analysis/how-will-chinas-gas-storage-development-alter-lng-import.html.
[18] *我国中东部地区最大储气库一期工程通过竣工验收*. Gov.cn. (Mar 1, 2022). http://www.gov.cn/xinwen/2022-03/01/content_5676347.htm
[19] In IEA's Sustainable Development scenario, for example, China's gas demand will be 356 bcm in 2050, higher than 328 bcm in 2020.
[20] The reference scenarios analyzed are from: U.S. EIA's International Energy Outlook 2021, IEEJ Outlook 2022, OPEC's World Oil Outlook 2021, IEA's World Energy Outlook 2021 (Stated Policies Scenario), Equinor's Energy Perspectives 2021, CNPC's World and China Energy Outlook 2021.
[21] Analysis based on data from BP's Statistical Review of World Energy 2021.
[22] The Herfindahl-Hirschman Index is "a common measure of market concentration and is used to determine market competitiveness" and "calculated by squaring the market share of each firm [country] competing in a market and then summing the resulting numbers. It can range from close to zero to 10,000." https://www.investopedia.com/terms/h/hhi.asp.
[23] Gazprom Paves Way to New China Gas Deal as Sanctions Hit Russia. Bloomberg. (Feb 28, 2022). Retrieved March 14, 2022, from https://www.bloomberg.com/news/articles/2022-02-28/gazprom-paves-way-to-new-china-gas-deal-as-sanctions-hit-russia.
[24] EPRINC analysis based on data from various official sources.
[25] Includes Tang Shanhua's, an official from PipeChina, estimate of 526 bcm and the Natural Gas Development Report's estimate of 550-600 bcm.
[26] Morgan Stanley Research estimated the global LNG market would rise 25%-50%, which would be around 442 Mtpa-530 Mtpa from the 2020 base. Jessica Jaganathan. *LNG demand to rise 25-50% by 2030, fastest growing hydrocarbon - Morgan Stanley*. Nasdaq. (Oct 25, 2021). Retrieved April 21, 2022, from https://www.nasdaq.com/articles/lng-demand-to-rise-25-50-by-2030-fastest-growing-hydrocarbon-morgan-stanley-2021-10-25.
[27] Asia to Dominate Long-Term LNG Demand Growth. BloombergNEF. (Sep 12, 2018). Retrieved April 21, 2022, from https://about.bnef.com/blog/asia-dominate-long-term-lng-demand-growth/.
[28] World gas demand was 4,063 bcm in 2021. IEA. *Gas Market Report, Q4 2021*. https://www.iea.org/reports/gas-market-report-q4-2021