

December 2019

China's Natural Gas Development Report – Reality Check

Introduction

China recently released its Natural Gas Development Report (NGDR) for 2019, which reviews recent developments in the country's gas sector and sets out plans for the years ahead. This is the fourth iteration of the NGDR, penned jointly by the National Energy Administration and the Development Research Center (under the State Council) with inputs from the national oil companies (NOCs). The past two years of stellar gas demand growth have framed a narrative, at least in western markets, that China's future demand growth will remain in double-digit percentage rates and be heavily dependent on liquefied natural gas (LNG). The narrative that emerges from Chinese planners' thinking is much more complex, assessing the various domestic challenges (bureaucratic and industrial structures, the perennial challenge of price reform, and market liberalization). This year, these challenges are considered in the context of the US–China trade war—although this is not explicitly mentioned—as manifested in the rising concern about energy security.

With Premier Li Keqiang's announcement in October¹ that the coal-to-gas switching programme has been slowed, particularly for heating in northern China this winter, the previous explosive growth in Chinese gas demand, on which many overseas gas producers have focused to justify their projects, looks set to lose pace. Whether this is a reflection of economic pressures—a sign that industrial users are at the forefront of the economic deceleration or simply of the high cost of gas compared to coal and renewables—or even the result of political concerns over China's supply security, the effect is the same. China's outsized impact on global gas markets is shrinking in 2019.

In this paper we look at this recent history as well as the country's future ambitions and assess whether the past provides sufficient foundation for China's future plans in the gas sector. While the NGDR is an important statement of the government's ambitions, its targets are vague and even seemingly concrete deliverables are not set in stone. As such, this is not a binding document, but rather a framework for thinking about future development. We do not expect the impact to be negative for the state-owned gas companies, as they were closely involved in preparing the NGDR.

We start with a short commentary on Chinese gas demand, since the rapid pace of growth has been one of the most significant influences on the global gas market and a key tenet of government policy. We profile the global context for China's position in the gas market and then the government's own assessment of developments in the country's gas sector over the past year. We then set out the NGDR's view of the future opportunities and challenges for China's gas sector, followed by the government's view of the future development of the gas sector and its institutional framework, to which

¹ *World Gas Intelligence*, 23 October 2019.

we add minor annotations. Finally, we assess the 2019 NGDR in totality, analysing which of its proposals are broadly desirable and have a reasonable prospect of being achieved, which continue to face challenges in being implemented and where a satisfactory resolution is not in sight, and then highlighting developments on the ground in China that affect these objectives.

Chinese gas demand

The NGDR suggests that the rate of gas consumption growth should slow to around 10 per cent this year (against early forecasts from China National Petroleum Corporation (CNPC) and others of an 11 per cent-plus increase²) with the absolute level of demand reaching around 310 billion cubic metres per annum (bcma). Recent data from the National Development and Reform Commission (NDRC) point to implied demand rising by 10.4 per cent year-on-year (y-o-y) in the first eight months of the year, suggesting that growth may indeed end up being within this 10–11 per cent-plus range. The gas demand growth forecast in the 2019 NGDR attracted considerable media attention at the time of its publication, since last year's growth was 17.7 per cent and there were concerns that slowing economic growth caused by the US–China trade war was making itself felt in the gas demand numbers. The reality is that due to a combination of slower economic growth—which is only in part due to the US–China trade war—and concerns about insufficient gas supplies to meet switching demand, China is slowing down its aggressive coal-to-gas switching programme, which has in turn curtailed the country's gas demand growth this year.

That said, in 2018 the NGDR underestimated growth, forecasting a 13.5 per cent y-o-y increase in gas demand, which ended up being too low. While the expectations in the 2019 NGDR are lower, this year's forecast seems more likely to materialize. It seems clear that the Chinese government is willing to accept slower economic growth, and with it slower gas demand growth, as Beijing holds off on costly economic adjustments. The government still has an optimistic assessment of the medium-term outlook for the gas sector, however, predicting that gas demand will continue to rise until 2050. Interestingly, the 2019 NGDR does not reiterate goals set out in the 2018 report for gas to account for 10 per cent, 14 per cent, and 15 per cent of the energy mix in 2020, 2030, and 2050 respectively. This does not necessarily indicate a revision of these goals, even though, as noted in a recent paper,³ the view that 2019 will be a year of slower gas demand growth in China is now widely held.

As illustrated in Figure 1, demand in 2018 was 280 billion cubic metres (bcm). Forecasts for demand in 2019 from the major Chinese oil companies range between 305 bcm and 310 bcm, suggesting growth in the range of 9–10 per cent, which seems reasonable and ties in fairly closely with the actual year-to-date growth of 10.4 per cent as well as the government's forecast of 10 per cent growth for 2019 in the NGDR. Demand in 2020 remains harder to predict, with forecasts from the NOCs and industry observers ranging between 320 bcma and 360 bcma. The 2020 demand outlook depends not only on what happens with the coal-to-gas switching policy, as the government may need to accelerate new connections to meet the 2021 targets in the Air Pollution and Control Plan, but also on changes to the broader economy, which in turn influence industrial demand.

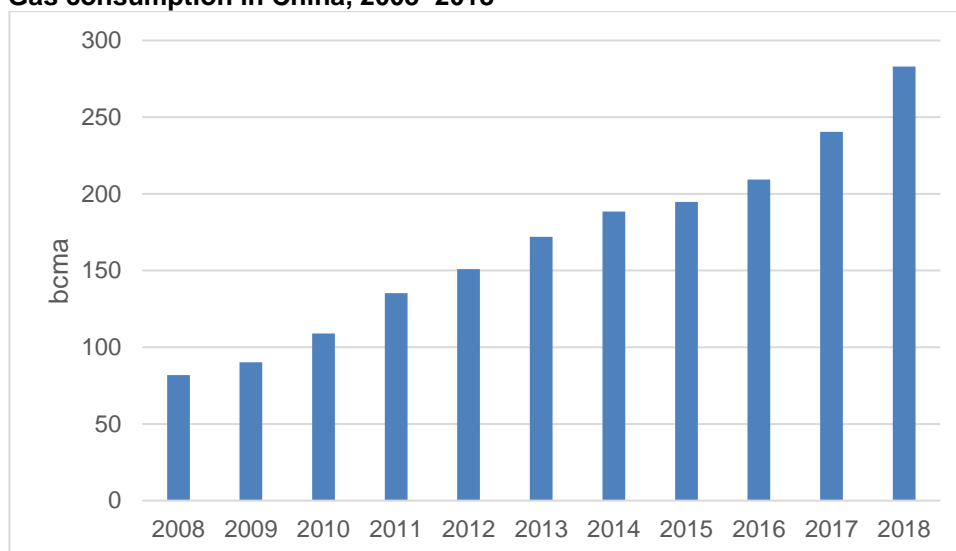
Most observers remain optimistic about the medium-term outlook for gas in China. The oil companies expect 2030 demand to be in the range of 500–540 bcm and certainly the Chinese government—in its public statements at least—expects that gas demand will continue to grow out to 2050, although the oil companies themselves seem to view some of the numbers being mentioned by government as overambitious.⁴ It is important to note that the government's forecasts are often generated in close consultation with the industry supplying the data and guidance to the government, but the companies then, in turn, frame their outlooks based on the broader policy framework.

² *Natural Gas Insight*, 7 March 2019, https://interfaxenergy.com/reports/ngi/NGI_060319_1551891903.pdf.

³ 'Glimpses of China's energy future', Michal Meidan, OIES, 19 September 2019, <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2019/09/Glimpses-of-Chinas-energy-future.pdf?v=69e1aafecccc5>.

⁴ *World Gas Intelligence*, 11 September 2019.

Figure 1: Gas consumption in China, 2008–2018



Source: BP Statistical Review of World Energy, 2019.

Global context

The 2019 NGDR describes the global gas market in 2018 and outlines China's position within it. Last year saw a continuation of the steady increase in global gas supply and demand, with both rising by around 5 per cent over the previous year. As a region, North America showed the largest increase in both supply and demand in absolute and percentage terms at 9–10 per cent. Demand growth in the Asia-Pacific region, at 7 per cent, was proportionately higher than the global increase in demand, while supply growth at just 4 per cent fell short in relative terms—increasing the region's import dependency from 21 per cent in 2017 to more than 23 per cent of consumption last year.

Clearly, China was the driver of this increased regional import dependency—the country's gas demand (already considerably higher than its gas production) rose at twice the rate of its production growth, exacerbating its own import dependency problem, which rose from 38 per cent of consumption in 2017 to 43 per cent last year.

The Chinese government notes in the NGDR that the locus of gas demand continues to move east across the world, that more countries are involved in the global gas trade and that spot trading of LNG in the Asia-Pacific region has become more active. Within China, Beijing notes that it has continued to gradually and steadily develop its gas sector. It concludes in its assessment that 'the demand for gas during the peak period in winter has been effectively guaranteed'.⁵

China's demand and supply

With the continuing rapid increase in Chinese gas consumption in 2018, gas represented 7.8 per cent of total energy consumption against the government's target of 8.3–10 per cent by 2020, suggesting that at least the lower end of this range may now be achieved by 2020. According to the NGDR, maximum daily gas consumption was 20 per cent higher than in the previous year. Looking ahead, however, given that existing pipeline capacity is only just able to handle current demand, additional pipeline capacity, more storage, and increased connectivity across the network will be essential to ensure that China's gas supply system can continue to meet the country's growing gas needs—even if demand grows at rates lower than recent historical levels.

⁵ 'China Natural Gas Development Report 2019', p. 1, <http://biee.org.cn/ueditor/php/upload/file/20190903/1567476202249928.pdf>

Industrial and city gas use were the largest components of demand in 2018, with power generation and the chemical industry a distant third and fourth. This breakdown looks set to continue since it was the industrial and city gas sectors which showed the largest increase in demand, together accounting for the lion's share of the 35 bcm increment seen in 2018 (equivalent to the entirety of Dutch gas demand).

The government highlights the fact that, for the second year in a row, growth in gas production has exceeded 10 bcma after recent years of lacklustre growth. Capital expenditure rose by 20 per cent and discoveries were made in the Tarim and Junggar Basins as well as in the Bohai Sea. However, even this improved rate of production growth has not kept pace with growth in demand and the government explicitly acknowledges this, noting that the volume of natural gas imports has increased further and import pressure has continued to rise.⁶ Import volumes were up 32 per cent in total in 2018, with pipeline gas volumes rising by 20 per cent to represent more than 40 per cent of total imports. LNG volumes rose even more strongly at a 40 per cent growth rate and accounted for almost 60 per cent of total imports. With international prices rising during the winter heating season, the NOCs' losses on the sale of imported gas expanded over the period.

However, government and industry plans to mitigate shortages of gas at times of peak demand have also been moving forward. The government issued a number of notices focused on improving connectivity across the pipeline network⁷ and the storage infrastructure.⁸ Additional northbound gas transmission capacity of 60 million cubic metres per day—through greater pipeline interconnectivity—was added in the 2018/19 winter period and enabled the government to declare that the supply of gas to northern China had been guaranteed. A 12 per cent increase in storage capacity helped provide a buffer for peaks in demand through greater volumes of underground gas storage (UGS), as well as LNG storage at the import terminals. That said, the winter of 2018/19 was warm in relative terms, and the majors had stocked up on LNG well ahead of the winter. With a more modest buying profile in 2019, a cold winter may once again threaten China's ability to satisfy peak winter demand.

Future opportunities

In the 2019 NGDR, the government notes that the development of China's gas industry 'is facing an important period of strategic opportunities', but also admits that the development of the entire industry still has a long way to go, particularly with respect to sector reform.⁹

The NGDR identifies the major opportunities for the sector as:

- Strengthening the overall sector through increased domestic exploration and development, increasing the diversity of imported gas supplies, and completing the development of a market-based pricing system for gas in China.¹⁰
- Increasing further the volume of storage capacity available to the sector.¹¹
- Providing subsidies for the development of other types of unconventional gas, such as tight gas.¹²

⁶ 'China Natural Gas Development Report 2019', p. 8.

<http://biece.org.cn/ueditor/php/upload/file/20190903/1567476202249928.pdf>

⁷ 'Notice on accelerating the promotion of key interconnection projects of natural gas infrastructure in 2018 and 2019', NDRC, www.ndrc.gov.cn.

⁸ 'Special measures for the management of investment in the central budget for the construction of emergency gas storage facilities in key areas', NDRC, http://www.ndrc.gov.cn/fzggqz/gdzctz/tzqz/201807/t20180730_893895.html

⁹ 'China Natural Gas Development Report 2019', p. 12

¹⁰ 'Several opinions of the State Council on promoting the co-ordinated and stable development of natural gas', State Council, http://www.gov.cn/zhengce/content/2018-09/05/content_5319419.htm

¹¹ 'Opinions on accelerating the construction of gas storage facilities and improving the market mechanism for ancillary services for gas storage and peak shaving', NDRC, National Energy Administration (NEA), http://www.ndrc.gov.cn/zcfb/qfxwj/201804/t20180427_883777.html.

¹² 'Notice on the interim measures for the administration of special funds for the development of renewable energy', MoF, NDRC, http://www.gov.cn/xinwen/2019-06/20/content_5401801.htm

- Reforming the upstream oil and gas system through more effective use of mining rights transfers.¹³
- Abolishing the requirement that only joint ventures and co-operation are allowed for the exploration and development of gas and the requirement that Chinese entities must control the building and operation of gas pipeline networks in cities with a population of over 0.5 million people.¹⁴
- Reforming the gas pipeline system and creating a national pipeline company.¹⁵
- Unifying the residential and non-residential gas price in China.¹⁶

Current major challenges

On the other side of the equation, the NGDR identifies the major challenges as:

- The steady increase in natural gas imports creating a challenge to China's energy security.
- Oil and gas production activities needing to be balanced with environmental protection and the need for more detailed regulations to ensure that this is handled in the most effective manner.
- The lack of sufficient gas storage capacity and the long lead time to develop new capacity, which are likely to remain an issue for the gas sector in the medium term.

Future gas sector development in China

The NGDR restates the belief that the development of the country's gas industry into one of China's main energy sources is a key route towards achieving the national aim of a clean, low-carbon, and efficient energy system. Yet, energy security concerns are listed this year as the number one challenge for the gas sector, a stark contrast with the assessment in the 2018 NGDR that the global LNG supply system was becoming increasingly diversified and flexible. Indeed, in 2018 the NGDR pointed out that China's main challenge was imperfect co-ordination within industry and ministries in China. The emphasis on energy security in this year's NGDR underpins China's desire to increase exploration and development in the sector. In addition, expanding the country's gas grid, increasing gas storage capacity, and speeding up sector reform are all highlighted as important elements for the future development of the sector.

Globally, gas represents 23 per cent of total energy consumption. In China, this figure is less than 8 per cent.¹⁷ With respected energy forecasters such as McKinsey¹⁸ predicting that gas will be the only fossil fuel to grow in importance in the future, gas is predicted to overtake coal to be the second-largest global energy source by around 2035. That suggests considerable scope for the further development of the sector, certainly in China and indeed, as we note earlier, the government believes that Chinese gas demand will continue to increase until 2050.

On the specifics of the supply-side of the equation, the government has decided to focus in this year's NGDR on several different areas, in both the upstream and downstream segments.

¹³ 'Circular on providing further clarity on issues concerning collection and administration of income from the transfer of mining rights', Ministry of Finance, http://www.fdi.gov.cn/1800000121_23_74853_0_7.html.

¹⁴ 'Special management measures (negative list) for the access of foreign investment (2019)', NDRC, Ministry of Commerce, <http://www.ndrc.gov.cn/zcfb/zcfbl/201906/W020190628615780569680.pdf>.

¹⁵ 'Opinions on the reform and implementation of the operation mechanism of oil and gas pipeline networks and measures for the supervision and administration of fair opening of oil and gas pipeline network facilities' (2019), NDRC, NEA, http://www.ndrc.gov.cn/zcfb/qfxwj/201905/t20190531_937971.html

¹⁶ 'Notice on the rationalization of gate price of residential gas', NDRC, http://www.ndrc.gov.cn/zcfb/qfxwj/201805/t20180525_887218.html.

¹⁷ *BP Statistical Review of World Energy*, 2019, <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2019-full-report.pdf>.

¹⁸ 'Energy 2050: Insights from the ground up', November 2016, <https://www.mckinsey.com/industries/oil-and-gas/our-insights/energy-2050-insights-from-the-ground-up>.

The first intention is to further develop the Sichuan Basin (which contains around a quarter of China's conventional and unconventional gas reserves) as a major gas production area because of the scale of its reserves. The ultimate ambition for the region, without any timeframe being attached to it, is that it should provide a third of China's domestic gas production (through the intensified development of deep gas, tight gas, and shale gas), with the potential for the production of shale gas to outstrip conventional gas production from the region. One constraint identified by the government is that the region is fairly densely populated and the environmental impact of gas production will need to be balanced against the desire to improve China's energy security.

Similar to the Sichuan Basin, the government also wants to focus on increasing development of gas reserves in the Ordos Basin (17 per cent of China's reserves) and in the Tarim Basin (21 per cent) in Xinjiang, although reading between the lines it seems less convinced this will be as successful as the Sichuan Basin. Here the aim is to focus on the development of tight gas in the Ordos Basin and ultra-deep gas in the Tarim Basin.

Offshore production remains a focus for the future. Gas reserves in the Bohai Sea, the East China Sea, and the northern part of the South China Sea are estimated to represent around one-sixth of China's total reserves. Here, however, development has been relatively slow compared to other parts of China and the government's objective is to speed up the pace of development of offshore reserves, although it sets out no concrete plans on how to achieve this.

Unconventional gas is not overlooked in the government's plans either. The commercial exploitation of shale gas is currently limited to the shallow and middle layers of the Sichuan Basin. The government wants to see the focus of shale exploration extended outside Sichuan with the aim of increasing shale gas output by as much as 10 bcma—although no timescale is given for this increase. Current production is also around 10 bcma, with consensus forecasts of 13–15 bcma production by 2020. In addition, Beijing wants to extend coal bed methane (CBM) production to the Ordos Basin and the Qinshui Basin in Shanxi Province, with the ultimate goal being overall Chinese CBM output of 10 bcma.

The fifth stated objective of the NGDR is to increase the rate of construction of natural gas storage capacity. China's current capacity represents less than 6 per cent of total consumption, which compares poorly with the global average of 12–15 per cent of consumption. Beijing acknowledges that the construction process has been too slow because of space constraints and the lack of sufficient financial incentives to build more capacity. The intention is now to focus the development of new gas storage facilities in areas of either gas production or gas import and further review the commercial environment for gas storage investment.

Given plans to further integrate the pipeline system in the Bohai Bay area, the central government aims to construct new LNG import terminals in the same area to enhance supply security of the important Beijing-Tianjin-Hebei region. It notes that environmental regulations in the area are strict and acknowledges that it will be a complex process to ensure that development can go ahead while meeting those environmental requirements, suggesting that it will require substantial government support. Currently, 12 million tonnes per annum (Mtpa) of new capacity is planned through to 2023, with an additional 15 Mtpa at various stages of the planning and approval process.

The plan also sets out an objective of developing alternative energy sources in a sensible manner, although its main focus is on the development of coal-produced gas and the development of clean heating mechanisms using biogas.

Finally, diversity of supply is a key priority. That means maintaining a wide range of countries supplying gas to China, with a variety of import locations and transport options being kept available. Chinese companies are encouraged to 'go abroad' to secure resources for the nation and develop LNG projects to bring those resources back to China.

Institutional framework of the gas sector

In this section of the plan, the government highlights six separate areas of institutional development that require attention. Key among these is policy and financial support for increasing China's reserves and production – this is clearly a priority for Beijing. Proposals include the abolition or reduction of the special petroleum levy to encourage exploration, alongside a specialized oil and gas exploration risk fund. In addition, Beijing proposes preferential tax rates for heavy oil and high-sulphur gas, among other hydrocarbons, as well as support for the construction of additional gas storage.¹⁹

Further reform of the oil and gas sector is also part of the government's plans: increased competition in the upstream segment, including more competitive transfers of licence blocks between interested parties through a public and transparent process with a speedier government approval process. Pipeline infrastructure will be strengthened and development carried out more speedily, while the tariff for use of national pipelines will be determined on a reasonable basis—although what constitutes 'reasonable' is left vague. Finally, the plan notes that seasonal pricing will be promoted, which is a positive development in that it will allow seasonal gas shortages to be reflected in prices.

To improve the country's reserves and production growth (Figure 2 and Figure 3 below), the plan proposes a focus on cutting-edge technology, including overseas technology, as a way of improving the country's performance.

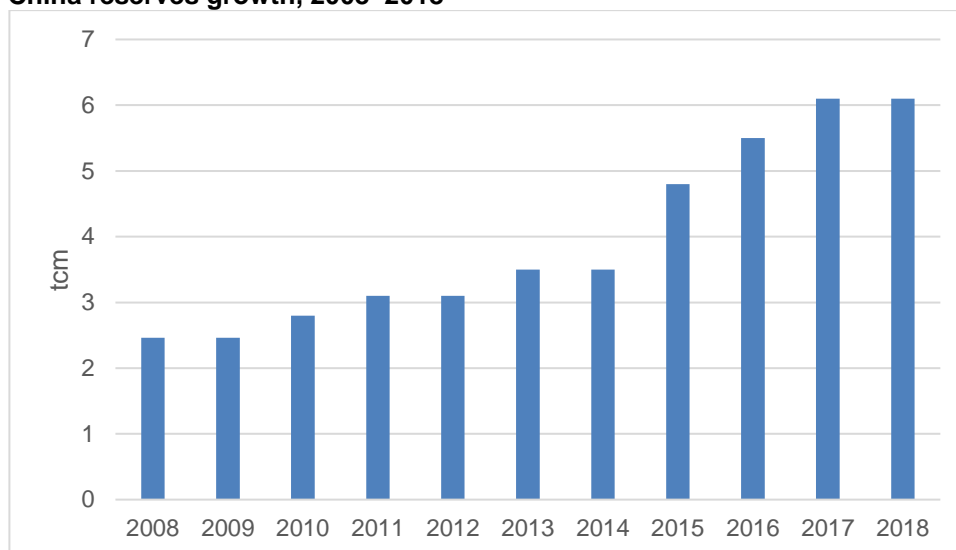
Bureaucratic processes can often slow down or prevent the approval of projects in China, and one of the plan's objectives is to improve the business environment in the areas of oil and gas production. The aim is to encourage hydrocarbon development while at the same time protecting the environment when exploration, development, and infrastructure expansion are carried out.

The structure of gas consumption should also be developed on a rational basis, with household consumption given priority over interruptible industrial consumers, transport use, power generation and, right at the end, the chemical industry. Gas use in the power generating sector should primarily focus on peak shaving and distributed energy products. The government also plans to stress energy conservation and gas saving to the wider population.

Finally, there are concrete proposals on promoting the market-oriented reform of gas prices, with the aim of reducing the overall cost of gas to consumers (particularly the industrial sector). Seasonal gas pricing—aiming to reduce peak gas demand in the winter—and interruptible contracts will also be implemented to both manage demand and encourage the construction of gas storage facilities. Together, these are market-oriented price reforms that should lower costs while at the same time allowing for seasonal shortages to be reflected in those costs.

¹⁹ 'China Natural Gas Development Report 2019', p. 24

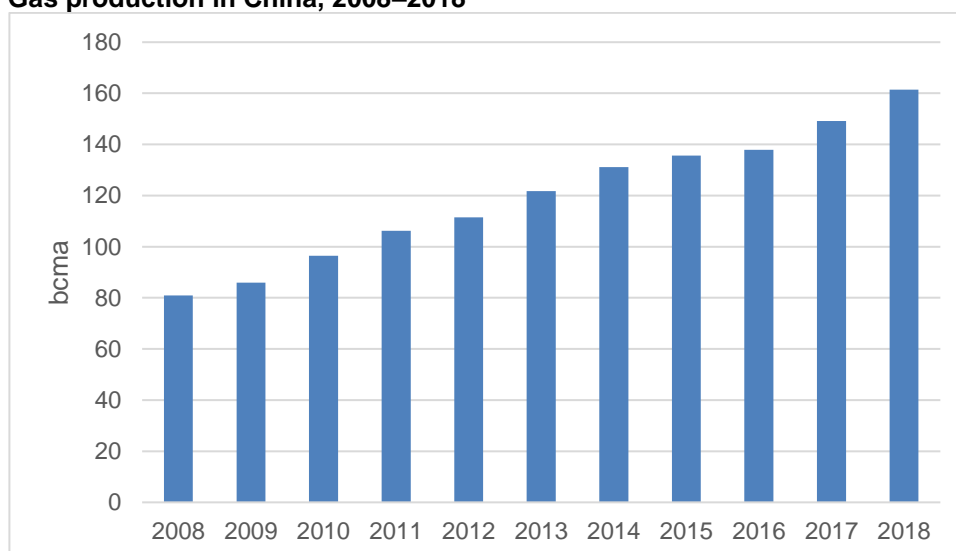
Figure 2: China reserves growth, 2008–2018



Source: BP Statistical Review of World Energy, 2019.

Note: tcm = trillion cubic metres.

Figure 3: Gas production in China, 2008–2018



Source: BP Statistical Review of World Energy, 2019.

Assessing the 2019 NGDR

We can divide the report's aims and proposals into two main groups. The first are those that are long-standing, broadly desirable based on the government's assessment of China's challenges, and with a reasonable prospect of being achieved in a moderate timescale. The second are those that, while also long-standing, have faced significant challenges in being addressed or resolved and where a satisfactory resolution is either not in sight or likely to be challenging to achieve.

The long-standing, desirable, and potentially achievable objectives include:

- **Increasing domestic exploration and development.** This is an obvious objective for the government to continue to press for, since it ties in with the next objective. Tax reductions and subsidies have been used in an effort to encourage exploration in more remote areas and for more difficult-to-recover types of gas.

- **Increasing gas production as a way of reducing China's dependence on imported energy**, which Xi Jinping stated in August 2018 as a security issue for China. The challenge here is that China currently uses too much coal in its energy mix and as a result has poor air quality, which the government wants to improve. While using more gas can lead to improved air quality, this comes at the expense of supply security because China imports a very high proportion of its oil and gas consumption: 73 per cent of oil and 43 per cent of gas used was imported in 2018.

Specifically in the gas sector, the coal-to-gas switching programme has undoubtedly improved the country's air quality, but import dependency has continued to rise, up from 30 per cent just five years ago to 43 per cent last year (Figure 5). A concerted effort to reduce import dependency would require greater domestic investment on the part of the Chinese NOCs as well as seeking to acquire more overseas assets, which would in any case be problematic as their output would need to be brought back to China for the country to control them. So, in the absence of sustained increases in profitability, both of these are likely to require increased borrowing at a time when the government wants to reduce the country's high debt levels. The government has, however, highlighted that for the second year in a row growth in domestic gas production has exceeded 10 bcma (and the latest production numbers from China suggest this year may also reach that target with 1H19 output rising 9.7 per cent against an increase of 9.1 per cent in 2H18). While this is a pick-up from disappointing previous years, it is still below the absolute growth in consumption, meaning that while the growth in import dependency has slowed, the absolute level of import dependency continued to climb, as illustrated in Figure 4 and Figure 5 below.

CNPC reported very strong 2018 results in March²⁰ as well as strong 1H19 numbers in September,²¹ although its 3Q19 results were disappointing because of lower global oil prices.²² Its annual plans included an increase of 25 per cent in exploration in 2019, with most of that spending going into the gas segment.²³ Assuming that these plans are followed through, strategically CNPC's move also makes sense—the government is keen on higher domestic gas production and the profits on domestic gas subsidize loss-making imports. CNPC has said that gas will make up 50 per cent of its total output by 2020 and 55 per cent by 2030, although its guidance on its own domestic gas production growth in 2019 is just 5.6 per cent (implying output of 115 bcma²⁴). Given that the government still has a 2020 national gas production target of 200 bcma, industry observers have suggested that PetroChina's targets are not that ambitious. China National Offshore Oil Corporation (CNOOC) is also reported to be offering five offshore blocks in the Pearl River Delta,²⁵ which underscores its desire to increase both its own output and international involvement in China's upstream sector, particularly the deepwater acreage in the delta. CNOOC's strategy presentation in January revealed that its 2019 domestic output target had been increased by 9 per cent, while its international target had been reduced by 12 per cent.

There has also been a reasonable degree of progress in encouraging international oil companies to become involved in the domestic upstream, as a way of growing domestic

²⁰ 'PetroChina Annual Report, 2018'

<http://www.petrochina.com.cn/ptr/zqbg/201909/4c11178689e44973aa796b4346ec4c4a/files/34684a8db9f8485595a71959d7695a47.pdf>

²¹ 'PetroChina Interim Report, 1H2018'

<http://www.petrochina.com.cn/ptr/zqbg/201909/4c11178689e44973aa796b4346ec4c4a/files/34684a8db9f8485595a71959d7695a47.pdf>

²² 'PetroChina 3Q Report, 2018'

<http://www.petrochina.com.cn/ptr/jdbq/201910/7ee14bc6924f408099c4f9d8c6e8431d/files/d3b65c8547174a15b7784e300538ae68.pdf>

²³ *Natural Gas Insight*, 7 March 2019.

²⁴ 'PetroChina Annual Report, 2018',

<http://www.petrochina.com.cn/ptr/ndbg/201904/d9b6e14b8e0145d2bd3d075e0136dfee/files/39f6f62593624c6bbda8ecf626d2e282.pdf>

²⁵ *Natural Gas Insight*, 27 June 2019.

production. The government has lifted restrictions on foreign investment in upstream oil and gas, as well as in city gas distribution companies. This is both a consequence of the US–China trade standoff, with the latter seeking to demonstrate that it continues to pursue reforms and is willing to open up its energy sector, and a long-held desire to create additional opportunities in the domestic economy for private Chinese companies.

- **Developing increased UGS capacity**, which is now seen as a critical element in the Chinese gas industry value chain. A shortage of effective UGS capacity has meant that, at times, peak demand could not be met causing shortages across the country—particularly in the north, where winter weather leads to an annual spike in demand. Most current UGS is relatively landlocked and far from demand centres, albeit close to the main pipeline trunks, since the storage is in depleted fields. With capacity of just 5–6 per cent of consumption compared to 12–15 per cent across the rest of the world, more storage is clearly needed despite the issues surrounding land acquisition and the challenged profitability of the storage segment.

The focus on additional gas storage capacity in areas of existing production and around the import terminals makes sense, as these are going to be areas where gas infrastructure already exists and hence where the addition of new infrastructure is likely to be less difficult compared with a greenfield site. The NOCs are adding a lot of storage; CNPC, for example, is targeting an additional 11 bcm of capacity by 2020 and a total of 15 bcm by 2025. Where this capacity is added at regasification facilities, the use of trucks and pipelines can increase the send-out. The 2019 NGDR contains figures suggesting that total capacity at the end of 2018 was 14 bcm at both underground facilities and import terminals, although reported figures are now above this at 18.5 bcm, suggesting that some new facilities have been commissioned this year.²⁶

The central government did liberalize storage prices some years ago as a way of increasing the volume of gas storage in the country, allowing owners to negotiate directly with buyers and mandating storage targets. The fact that the NGDR highlights that China still has insufficient gas storage capacity is perhaps an implicit admission that the past policies have not been entirely successful and that a new approach is needed.

Developments on the ground in Shandong, Jiangsu, Sichuan, and Chongqing reflect the challenges caused by a shortage of storage capacity. For example, the Shandong provincial government has published its guidance on the development of its gas sector and it looks as if a shortage of storage capacity (which is only around 0.6 per cent of its provincial demand²⁷) has created bottlenecks and persuaded the government to move more slowly on coal-to-gas switching. CNOOC is starting work on a new regasification terminal at Binhai in Jiangsu province, which will also include an expansion of the terminal's planned storage capacity, which it aims to commission in the third quarter of 2021.

Sichuan province has storage capacity of just 1 per cent of its consumption,²⁸ which leaves it at risk of disruption. The Sichuan government and PetroChina have partnered on the possible future development of depleted gas fields into UGS, and overall the government's focus seems a little more on increasing UGS rather than on developing more LNG storage capacity. This is similar to PetroChina's deal with companies in Chongqing to build a 1.5 bcm capacity storage facility in Tongluoxia costing \$830 million. Towngas has considered opening up its salt cavern-based gas storage facility in Changzhou to third parties—perhaps the first indication that the idea of third-party access to infrastructure has spread from terminals and pipelines to storage facilities.

- **Diversifying import sources and gas sourcing routes.** China's plans to continue to diversify its import sources and the routes by which gas reaches the country are entirely sensible, not just in view of the trade war with the US, which has led to tariffs on imports of US LNG. Clearly

²⁶ *World Gas Intelligence*, 5 June 2019.

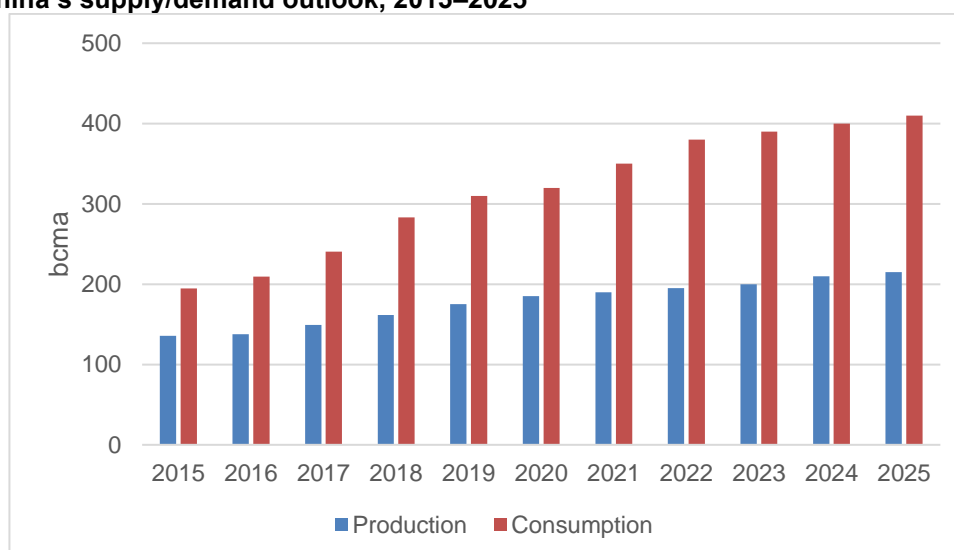
²⁷ 'China Gas: Pipeline company reform has potential to stimulate gas demand but recent price cut unlikely to have any impact', Stephen O'Sullivan, OIES, April 2019, <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2019/04/China-Gas.pdf?v=79cba1185463>.

²⁸ *Natural Gas Insight*, 31 January 2019 and 30 May 2019.

Chinese oil companies have already been searching overseas for gas reserves and the major NOCs each have portfolios of gas assets that could be delivered to China. These may equally be more sensibly developed for other markets, with the proceeds of those developments being used to finance the acquisition of more cost-effective LNG deliveries into China.

There are constraints on this, of course. Just as China wants to diversify its supply sources, so do gas producers want to diversify their markets, while several have concerns about Chinese influence over their economies, such as East Timor and Papua New Guinea where Australia and China both have commercial and strategic interests.²⁹ China could also accelerate negotiations on new pipelines, including the long-discussed Line D from Central Asia and additional pipelines from Russia. But Beijing is likely to wait and see how the Power of Siberia pipeline from Russia ramps up (with the start scheduled for 1 December 2020) and recurring supply outages from Turkmenistan during the crucial winter months are also a cause for concern. Finally, pipeline investments are low on the list of priorities until the new midstream pipeline company is launched.

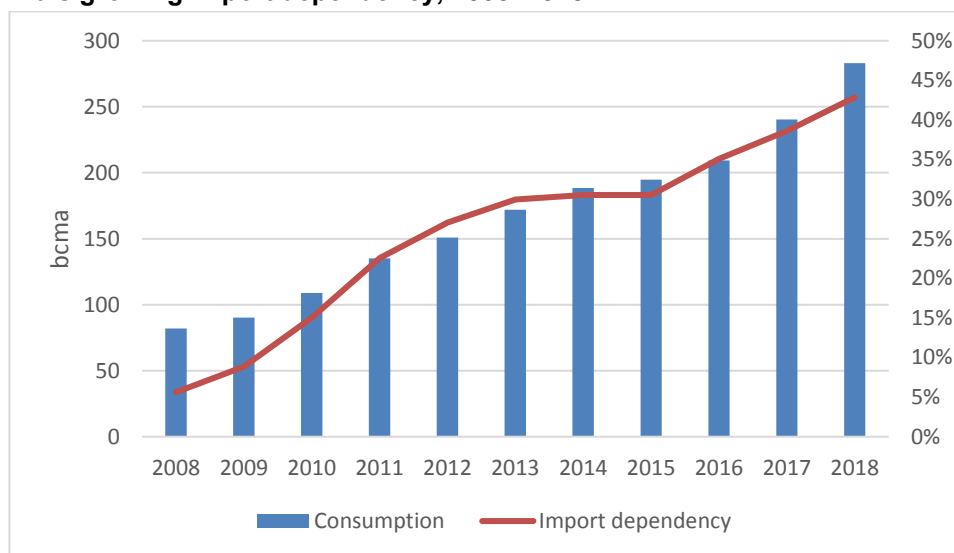
Figure 4: China’s supply/demand outlook, 2015–2025



Source: NDRC, industry forecasts.

²⁹ *Natural Gas Insight*, 7 February 2019.

Figure 5: China’s growing import dependency, 2008–2018



Source: BP Statistical Review of World Energy, 2019.

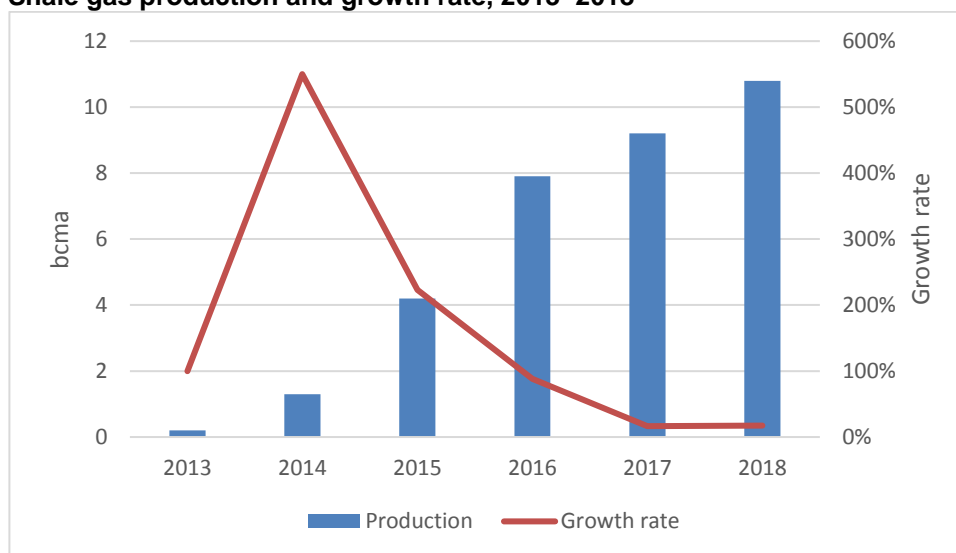
Those objectives that are more challenging to achieve, despite—or because of—their long-standing nature include:

- Raising production in the country’s key gas-producing region of the Sichuan Basin,** which has been a key producing area since the 1960s with significant reserves of both conventional and unconventional gas. This is clearly a part of China’s overall production objective. The government’s plans to increase output from Sichuan appear to focus to a great extent on hard-to-recover reserves, such as deep gas, shale gas, and tight gas. These are challenging reserves for China to develop, since it has typically set ambitious unconventional gas production targets in the past and then failed to meet them, despite undoubtedly making some progress towards them. CNPC’s own forecast of China’s shale gas output suggests a threefold increase in output to 35 bcma in 2025 and to 100 bcma in 2050.

State-owned power producer China Huadian withdrew from the shale gas sector earlier this year. The company won five of the shale gas exploration licences offered in 2012, but has now relinquished most of them. The government’s aim was to stimulate development in the shale gas sector by involving non-NOCs. However, none of the companies that won licences—including China Huadian—had ever drilled a gas well and several have noted that they did not know what they were getting into when they entered the sector. With the withdrawal of China Huadian and the financial difficulties faced by the other shale gas neophytes, shale looks increasingly like an industry dominated by the Chinese NOCs, since both Shell and BP have also withdrawn from the sector.

PetroChina announced last month that it had found substantial shale gas reserves in Sichuan, although how much is economically recoverable has yet to be determined. However, at the same time the company also seemed to downplay its short-term production expectations. While the national target remains 30 bcma by 2020, even 20 bcma currently looks to be optimistic given current production of 10–12 bcma (Figure 6).

Figure 6: Shale gas production and growth rate, 2013–2018



Sources: Ministry of Natural Resources; *Natural Gas Insight*.

- Developing other production areas.** The position is similar with other production developments. In the Ordos Basin (where CNPC expects to increase production by 6 per cent this year³⁰) and in Xinjiang (where a 4 per cent increase is expected³¹), tight gas seems to be a focus and we would have the same concerns about the likelihood of success here as we do about Sichuan. In addition, looking at the offshore production areas of the Bohai Bay, East China Sea, and South China Sea, development has been relatively slow for a range of reasons—technical complexity, cost, relations with international partners—and these issues will need to be overcome if offshore production is to make the contribution that the government expects from it.
- Developing CBM.** CBM output is forecast to remain relatively modest over the next few years, although CNPC expects it to reach 40 bcma by 2050. These are relatively ambitious forecasts and clearly tie in with the government’s objectives of increasing domestic output and reducing the level of import dependency. Synthetic natural gas (SNG) has also failed to deliver the volumes that were expected when the projects were launched. The initial government aim was for China to produce 50 bcma by 2020, but 2018 output was just 2.3 bcma from five pilot projects, most of which have been hampered by issues of access to PetroChina’s pipeline network, which have undermined the plants’ economics. As we note in the 19 September report,³² the SNG target seems unlikely to be achieved and a 50 per cent level of import dependency for China seems more realistic.

Even the government’s targets set in the NGDR (10 bcma of CBM output) seem uninspiring given that China produced 9 bcma as recently as 2017.³³ Nevertheless, some changes are underway. Shanxi Gas Group, a company established in 2018 to promote the development of

³⁰ *Natural Gas Insight*, 7 March 2019.

³¹ *Natural Gas Insight*, 7 March 2019.

³² ‘Glimpses of China’s Energy Future’, Michal Meidan, OIES 19 September 2019, <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2019/09/Glimpses-of-Chinas-energy-future.pdf?v=69e1aafeccc5>.

³³ Bloomberg New Energy Finance, cited in *China Daily*, 21 February 2019, <https://www.chinadailyhk.com/articles/218/208/130/1550743774994.html>.

CBM in Shanxi, has had a whole series of assets injected into it by its shareholders with the aim of consolidating the sector and improving the prospects of CBM development.³⁴

- **Growing alternative gas sources.** While the government's plan to develop alternative energy sources in an orderly matter is undoubtedly sensible, we question whether the focus on coal gas and biogas is sufficient and whether other alternative energy sources should also be a focus of development. Biogas in China has typically been developed at the household level, although the 13th Five-Year Plan envisaged up to 3,000 larger facilities being in place by the end of the plan. To date, there is no indication as to how many have actually been constructed. Nevertheless in March 2019 the NDRC set a biogas output target of 30 bcm by 2030 to replace coal in rural areas.
- **Achieving pricing reform.** A key element of sector reform relates to pricing reform, such as seasonal pricing and interruptible contracts. While the 2019 NGDR states that the price of the various links in the gas sector chain will be liberalized to bring down the cost of energy for end users, how effectively this is done will influence the cost of gas to these end users and hence the trajectory of future demand.

The planned midstream company is likely to be a key influence on the achievement of these objectives, with issues like the absolute level of tariffs and third-party access to the pipeline network being part of the process of trying to deliver lower gas prices. The intention is to have greater transparency in the sector (particularly regarding costs) to improve its regulation. Ostensibly the government believes that a national pipeline company—where pipelines are not controlled by individual oil companies and third-party access to those pipelines is available to new entrants and smaller gas companies—will lead to lower gas prices in China and thereby stimulate demand. The fact that the government still controls wholesale gas prices in China—almost certainly in the case that removing the controls leads to higher prices—suggests that the government does not fully believe its own stated position.

Depending on the valuation of the pipeline assets contributed to the new company and reflecting the fact that the significant investment needed to expand China's gas pipeline network will need to be financed, an argument could be made that domestic gas prices may actually have to rise to secure an expansion of the network.

In addition to the proposed new pipeline company, the introduction of seasonal pricing and interruptible contracts is a step forward in developing a more market-focused gas pricing framework in China. What will determine whether these pricing objectives can be met will be how effective they are in managing gas demand growth, although as yet there appear to be no concrete plans nor a firm timetable for any implementation.

A number of examples of developments around China illustrate the challenges involved in achieving the government's pricing objectives. In 2018 the government of Guangdong province—which has the highest city gate prices in China (along with Shanghai) and was facing the diktats of central government policy to reduce pollution³⁵—tried to reduce the price of gas from PetroChina, but received a cool response. The government then decided in January 2019 to reduce the costs of gas that it could control, capping pipeline transmission and distribution tariffs as well as introducing subsidies for low-income households and expanding the province's gas grid with the aim of encouraging coal-to-gas switching.

Guangdong has generally been successful in encouraging this energy transition in the power sector. The 43 planned gas-fired power plants will increase the amount of targeted gas-fired capacity by almost 50 per cent, with the addition of these plants' 12 gigawatts of capacity. This is substantially faster growth than in 2018, when its capacity grew by just 2.6 per cent

³⁴ *Natural Gas Insight*, 11 April 2019.

³⁵ *Natural Gas Insight*, 7 February 2019 and 20 June 2019.

(compared with 10 per cent growth for China as a whole). This occurred because of gas supply limitations, with the NOCs diverting many of the available gas supplies to northern China where the winter was very cold.³⁶ Reflecting this and to ensure that gas-fired power can grow more quickly in the upcoming winter, the province's plans include two new LNG terminals (PetroChina in Jieyang and Jovo Group in Jiangmen), with construction expected to begin next year, as well as five additional gas storage facilities which should ensure that supply is better geared to meet the province's rising demand.

In line with this theme of controlling costs, Fujian's provincial government wants to take control of the onshore Haixi pipeline which, unlike pipelines in other provinces, the government does not control. The provincial government sees this as a way of stimulating gas demand (which is only around half the planned level) since the commercial profit motive—and hence the desire for higher pipeline tariffs—will be reduced in importance.

In Beijing the city's monopoly gas supplier, Beijing Gas Group, is set to expand its range of gas sources as a way to reduce the cost of gas and stimulate demand to reduce the pollution afflicting the city. Gas demand in northern China spikes in the winter and this tightness increases prices in the region given that the city receives domestic gas only through the Shaanxi–Beijing pipeline system, one coal-to-gas plant and one LNG import terminal in the neighbouring province of Hebei. In the near future, however, Beijing will start to receive Russian gas through the new Power of Siberia pipeline from East Siberia, which is set to start operating at the end of this year. In addition, works are underway to improve the connectivity of four LNG terminals that are close to Beijing, while Beijing Gas is considering building its own LNG import terminal in Tianjin. Finally, CNOOC has discovered a sizeable gas field offshore of Beijing, which may ultimately deliver gas to the city. The aim is to use these additional gas supplies to secure lower winter prices and increase gas consumption in the city, enabling it to meet the government's strict air quality targets.

Since Beijing has typically been short of gas during the winter, industrial users have paid a premium for their gas (to reflect the higher cost of gas from Central Asia that Beijing Gas contracts to meet the increased demand). This reduces their demand and enables residential users to remain supplied. In winter 2018/19, gas reportedly cost Beijing Gas significantly more than the average cost of gas imports to China, and while PetroChina can only charge a maximum premium of 20 per cent in the winter, Beijing's limited range of alternatives has meant that securing lower prices has been difficult. Gas currently represents around 35 per cent of the energy mix in Beijing and this is expected to rise to 40 per cent over the next few years.

It is in the area of overall sector reform that achievements generally fall short of ambitions. Issues such as competitive transfers of licence blocks, faster infrastructure construction, and a 'reasonable' process of pipeline tariff-setting are all easy to say but harder to implement. The creation of a national pipeline company has been under discussion for some considerable time, with the most recent developments being the appointment of three Chinese banks to work on its creation based on the NOC's pipeline assets and moves by industry players to consolidate assets (such as Kunlun Energy's acquisition of city gas companies to compensate for when it loses its pipeline assets).

Conclusions

China's 2019 NGDR is the latest in a series that set out the government's broad vision for the gas sector. It takes account of the views of the NOCs as well as, this year, growing concerns about energy supply security. China's gas demand has risen at very high rates in recent years and the prevailing view was that this would continue—with profound implications for LNG demand, given that it has supplied

³⁶ *Natural Gas Insight*, 20 June 2019.

this rapid demand growth. Now, with 2019 likely to show supply growth of just 10 per cent, assumptions are being rethought.

Gas does look as if it will reach the lower end of the Chinese government's range for its contribution to national energy supply by 2020. Gas production growth has picked up and has now exceeded 10 bcma for the past two years, although that still leaves import dependency rising steadily as demand grows faster in absolute terms than supply.

The NGDR focuses extensively on the government's response to this rising import dependency—without explicitly saying as much. Increasing domestic exploration and production (of conventional and unconventional gas) and continuing to diversify imports (such as the start-up of the new pipeline from Russia by the end of this year) are both key goals in the years ahead. Similarly, additional infrastructure (LNG import terminals, gas storage facilities, and pipeline interconnections) will increase the system's flexibility in dealing with rapid increases in demand, such as those seen in northern China during winter.

The challenges to these plans include the need to balance increased output with environmental protection, as well as the current infrastructure constraints, which will take some time to be resolved.

We have analysed the NGDR and divided its aims into those which are feasible in the short to medium term and those which are going to be more challenging to achieve in anything other than the long term. The first category includes achieving higher levels of domestic exploration and development, the construction of additional UGS storage capacity, and further diversification of imports. We believe that it will be more difficult to achieve some of the government's other objectives, such as increasing unconventional output in major basins such as Sichuan and Ordos, where lofty production targets have often been set and gone unmet. Pricing and sector reform are both certainly on the agenda, with plans for a market-based pricing framework and the creation of a national pipeline company, but are likely to be challenging to achieve and to take longer than the government anticipates.