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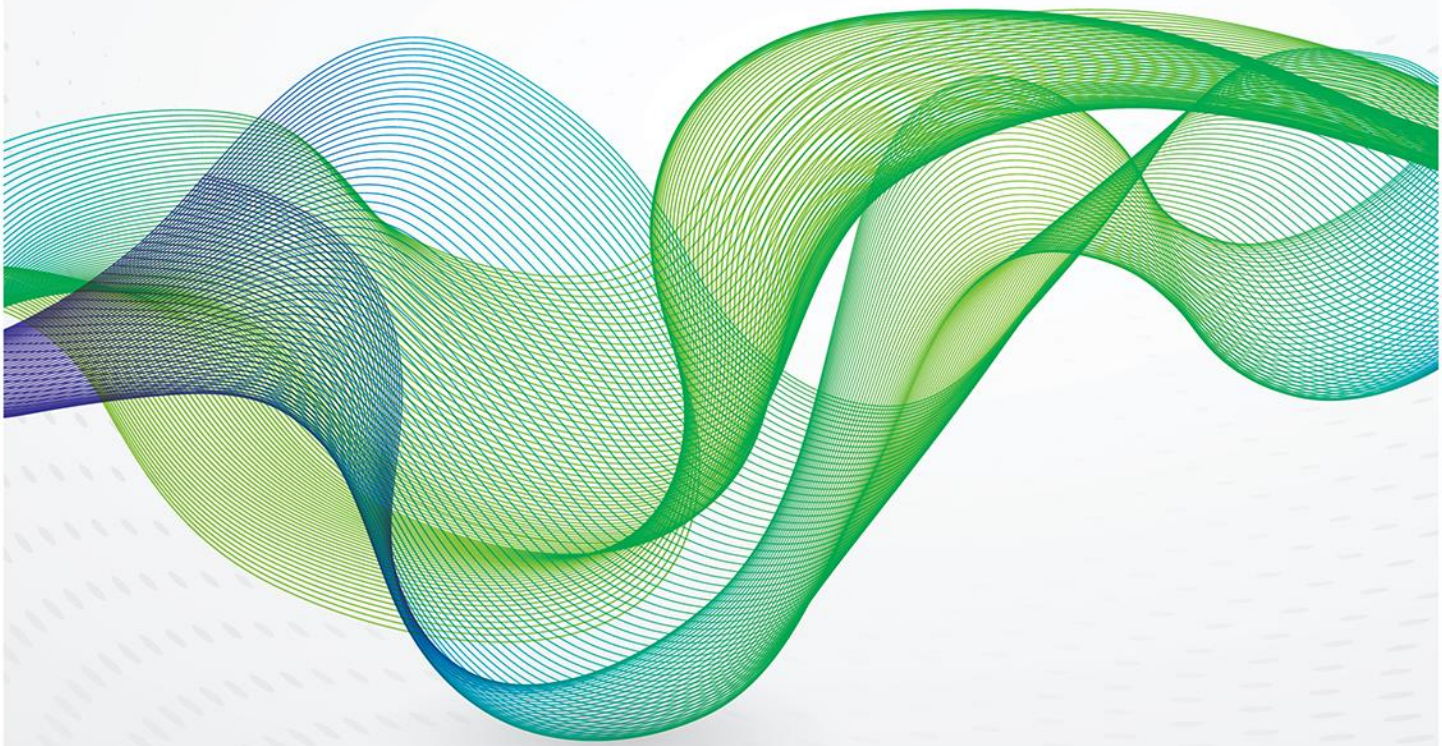
Central Asian Gas:
prospects for the 2020s



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Simon Pirani, Senior Research Fellow, OIES

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Preface

The gas sectors of countries in Central Asia have traditionally been of interest because of their connection to Russia, but over the past decade this link has increasingly become less relevant as exports to China have started to dominate. This has had significant commercial and political consequences across the region, as well as influencing Sino-Russian energy relations, and as such the question of the future of gas production in Central Asia remains a vital one. Simon Pirani therefore presents this detailed working paper as an update and development of his earlier work on the subject, as he reviews the gas production and export potential of the key Central Asian producers, Turkmenistan, Kazakhstan and Uzbekistan. Each has its own unique characteristics but all have vital questions to answer about their energy future, in particular: how reliant do they want to be on China for a significant part of their export revenues; how close or distant do they want their ties to Russia to be; how many, if any, alternative markets for their gas exports will it be possible to develop; and can they develop greater domestic demand for their gas production into alternative export industries (such as petrochemicals) that could provide further added value? Simon Pirani addresses all these issues in this working paper, which we hope will be of interest not just to analysts of the Eurasian gas sector but to all those who have an interest in the geo-strategic implications of Central Asian gas in the global marketplace.

James Henderson
Director, Natural Gas Programme
Oxford Institute for Energy Studies

Executive summary

Over the last decade, China has replaced Russia as the main export destination for Central Asian gas. Total exports in 2018 were 46.8 Bcm to China, 16.1 Bcm to Russia and 5.7 Bcm of intra-regional trade. Due to strong gas demand in China, in the early 2020s, the Central Asia-China pipeline corridor will be used close to its 55 Bcm/year capacity. An expansion to 85 Bcm/year is possible, by construction of Line D from Turkmenistan via Uzbekistan, Tajikistan and Kyrgyzstan to China, but this is unlikely to go ahead until it is seen as strategically necessary by China, that is probably not before the late 2020s. The main source of additional volume to China will be Turkmenistan; Kazakhstan has committed to 10 Bcm/year until 2023, after which its exports to China will fall; Uzbekistan will probably contribute around 10 Bcm/year.

Central Asian exports to Russia may decline still further. The main destination for Kazakhstan's exports is Russia: 12.3 Bcm in 2018, compared to 3.8 Bcm from Uzbekistan. Turkmenistan resumed exports to Russia at a low level of about 1 Bcm/year in 2019. However, in the 2020s Kazakhstan is expected to be short of gas.

Turkmenistan has, in recent years, started production at the supergiant Galkynysh field. This will be its main source of incremental production in the 2020s. There are some doubts about Turkmenistan's ability to manage development of this field, and one possibility is that Chinese activity in the upstream will further increase. Projects operated by Chinese National Petroleum Corporation (CNPC) of China and Petronas of Malaysia now account for more than one quarter of Turkmen output; CNPC has undertaken field development and construction of processing capacity at Galkynysh. Turkmenistan remains heavily dependent on hydrocarbon export revenues and its autarchic and dysfunctional political system is under strain; this may produce changes in the 2020s, but predictions of a major political crisis have not been borne out.

Uzbekistan produces similar volumes of gas to Turkmenistan (55-60 Bcm/year in recent years) but most of this is consumed domestically. Unlike Turkmenistan, Uzbekistan has, since 2016, undergone considerable political reform. Autarchic, state-driven economic policies have been abandoned with a view to opening the economy to foreign investment. Gas sector reform is part of this. The major foreign investor in Uzbek gas production is Lukoil, which in 2018 produced 13.4 Bcm of the national total of 57.4 Bcm. Lukoil's output has risen in recent years as Uzbekneftegaz's has fallen. Uzbekistan intends to increase its exports to China from 6.5 Bcm in 2018 to at least 10 Bcm. Competition between export and the domestic market for gas volumes is evident and will sharpen during the 2020s.

Kazakhstan is predominantly an oil producer that works closely with international oil companies, and is different from Turkmenistan and Uzbekistan in this respect. Gas is, therefore, of secondary importance and most gas is produced in association with oil at the three major projects (Tengiz, Karachaganak and Kashagan). Until the mid-2010s, the volume reinjected to support pressure in oil reservoirs was in a similar range to that produced as sales gas. The proportion of sales gas has risen in recent years but the government projects that sales gas volumes, and consequently volumes available for export, will fall between now and at least the mid-2020s. At the same time, domestic consumption is expected to grow. Having completed the Beineu-Shymkent pipeline linking the western producing areas with the main consuming areas in the south-east, Kazakhstan is investing further in gas transportation infrastructure and gasification. Thus its exports will probably fall, from 7-8 Bcm each to China and Russia in the early 2020s, to less than half that in the late 2020s.

Other export routes mooted for Central Asian gas – via a Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipeline to India, and via a Trans Caspian pipeline to Azerbaijan, Turkey and Europe – remain economically infeasible. While TAPI might have gone ahead as a chiefly political project, the shift in US foreign policy makes that extremely unlikely. While exports to Azerbaijan, either via a small Trans-Caspian link or as swaps via Iran, are possible, large-scale Turkmen exports to Europe may be ruled out.

Kazakhstan's domestic gas market will expand during the 2020s, as could Kyrgyzstan's, where Gazprom of Russia is now investing in gas distribution and supply. Uzbekistan's market may well contract, as price reforms and energy efficiency measures take effect. There is insufficient information about Turkmenistan's domestic gas sector to judge its progress. One significant change, in Turkmenistan and Uzbekistan, is the completion of major petrochemicals projects using gas as feedstock. Several more are planned, as a means of providing a diversified source of export revenues. The future of these ventures is uncertain, though, because while petrochemicals markets in Asia are expanding, they remain extremely volatile.

Acknowledgements

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Introduction

This paper reviews the gas production and export potential during the 2020s of the Central Asian producers: Turkmenistan, Uzbekistan and Kazakhstan. The Central Asian countries have, in the last decade, become a key supplier to China's rapidly expanding gas market, and that role will continue to expand during the 2020s. The 55 Bcm/year pipeline corridor to China is now operating at close to capacity. The question for the 2020s is whether – or more probably, when – a fourth string will be added to the three existing lines, bringing the corridor's capacity to 85 Bcm/year. Exports to Russia have also recovered from a nadir reached in recent years but may not expand further. Export routes to south Asia, or Turkey and Europe, remain elusive. The Central Asian producers, with support from Japanese and other east Asian companies, have also begun to develop petrochemical capacity using gas as feedstock, and both Turkmenistan and Uzbekistan have opened major complexes in the last two years. These and other developments in domestic gas markets, including those of Kyrgyzstan and Tajikistan, are also covered here. The paper covers the period since 2010, and prospects for the 2020s.[1]

Map 1: Central Asia (Political)

Source: Wikimedia / Creative commons licence

[1] For additional details on gas production, readers are referred to an earlier, comprehensive publication: Pirani, S. (2012). *Central Asian and Caspian Gas Production and the Constraints on Export,* NG69. Oxford: OIES
Other relevant publications from OIES are: Henderson, J., Pirani, S. and Yafimava, K. (2012). 'CIS Gas Pricing: Towards European Netback?', in Stern, J. (ed.), *The Pricing of Internationally Traded Gas,* Oxford: OUP/OIES
Pirani, S. (2014). 'Central Asian and Caspian gas for Russia's balance', in Henderson, J. and Pirani, S (eds.), *The Russian Gas Matrix: how markets are driving change,* Oxford: OUP/OIES
Pirani, S. (2018). *Let's not exaggerate: Southern Gas Corridor Prospects to 2030,* NG135. Oxford: OIES
Two other useful sources are: Raimondi, P. P. (2019). *Central Asia Oil and Gas Industry: the external powers' energy interests in Kazakhstan, Turkmenistan and Uzbekistan,* FEEM Working Paper 6. Milan: Fondazione Eni Enrico Mattei
On legal and political contexts, Boute, A. (2019). *Energy Security along the New Silk Road: energy law and geopolitics in Central Asia,* Cambridge: Cambridge University Press

1. Turkmenistan

Introduction

Turkmenistan, the Central Asian producer with the largest gas reserves and the greatest export potential, has now established itself as a major supplier to China. The 30-35 Bcm/year exported to China has now replaced exports to Russia as the mainstay of Turkmenistan's gas business, and of its export revenues. Exports to Russia, which ceased completely in 2015, resumed in April this year, but only at around one Bcm/year; exports to Iran have stopped, apparently permanently.

Along with the shift from Russia to China as the main export destination, Turkmenistan's gas sector has changed in two other significant ways. First, having shunned international oil companies, and having been hesitant about working with foreign investors, Turkmenistan now relies on two foreign companies – Chinese National Petroleum Corporation and Petronas – for more than one quarter of its gas output. This proportion may increase further. Second, after years of plans and promises, last year Turkmenistan commissioned a major petrochemicals plant, at Kiyanli, which could become a significant source of revenue. The economics of a gas-to-liquids plant, opened in 2019 at Ovan-Depe, are less obviously promising.

These trends will probably continue in the 2020s. Exports to China could increase, but probably only in the second half of the 2020s. This will depend on the construction of a fourth string of the Central Asia-China pipeline corridor, to raise its capacity to 85 Bcm/year from 55 Bcm/year. Turkmenistan certainly has sufficient resources to supply whatever gas China decides to buy. But the extent of its ability to develop these – in terms of governance, technology, skilled labour and capital – is less clear. One possible scenario is a further expansion of Chinese participation in production.

The changes in Turkmenistan's gas balance since 2010 are shown in Table 1.

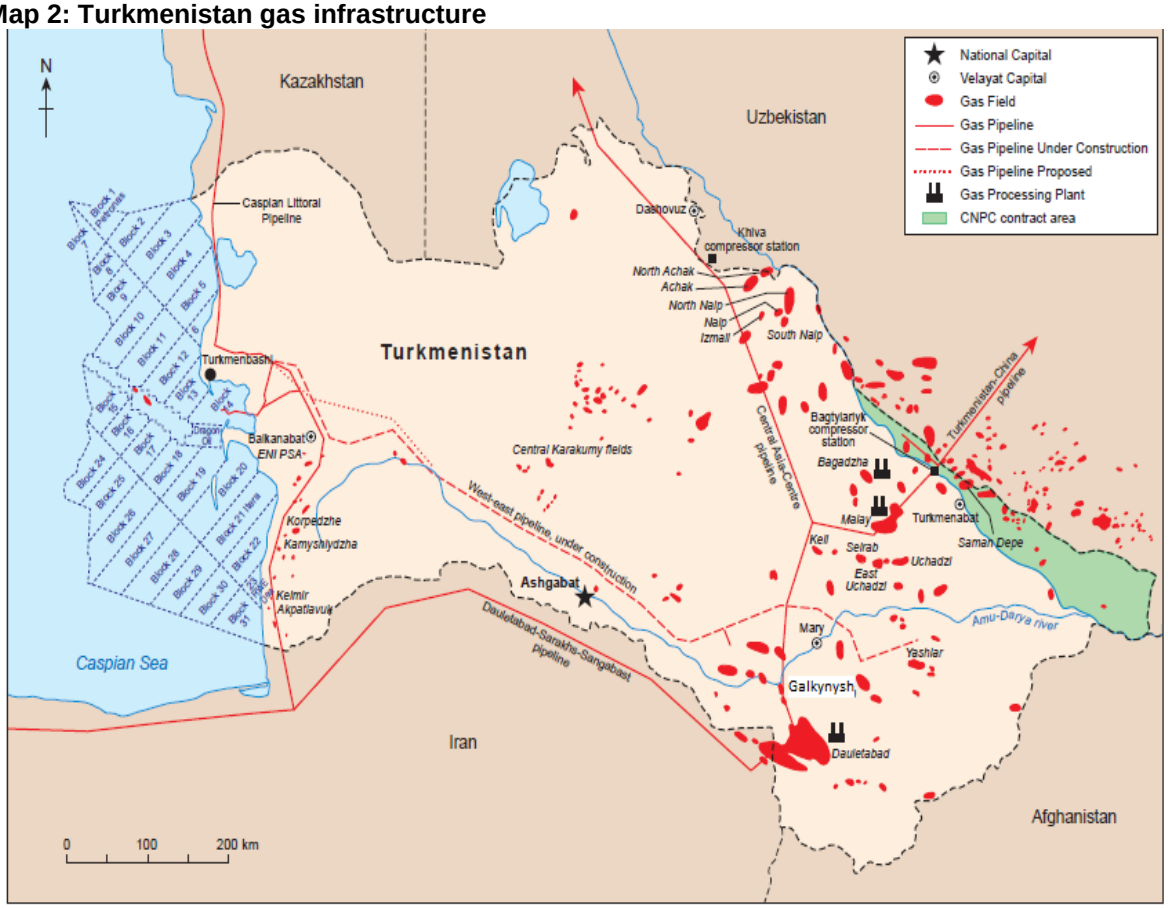
Table 1: Turkmenistan gas balance, 2010–2018

Bcm	2010	2011	2012	2013	2014	2015	2016	2017	2018
Production (sales gas)	**40.1**	**56.3**	**59.0**	**59.0**	**63.5**	**65.9**	**63.2**	**58.7**	**61.5**
Total gas balance	**40.1**	**56.3**	**59.0**	**59.0**	**63.5**	**65.9**	**63.2**	**58.7**	**61.5**
Domestic consumption	**18.9**	**20.7**	**17.6**	**18.7**	**20.0**	**27.0**	**25.5**	**22.9**	**24.5**
Export (total)	**21.2**	**35.6**	**41.4**	**40.3**	**43.5**	**38.9**	**37.7**	**35.8**	**37.0**
To/through Russia	10.7	11.2	10.9	10.9	11.0	3.1	0	0	0
To Iran	7.0	10.0	9.0	5.0	6.0	7.0	7.0	0	0
To Azerbaijan (swaps via Iran)	0	0	0	0	0	0	0	1	1
To Kazakhstan	0	0.3	0	0.3	1	1	1.3	1.5	1.5
To China	3.5	14.1	21.5	24.1	25.5	27.8	29.4	33.3	34.5

Sources: BP Statistical Review, Gazprom, China customs data, Kazakhstan imports information. For details see Appendix

The statistics presented are unreliable, but the best available. The total production figures in Table 1 are from the BP Statistical Review, which in turn relies on official statistics. It is likely that in 2015-17 the total production figures, and the domestic consumption figures, are overstated by up to 10 Bcm/year; there may be similar overstatements in other years. This is further discussed below, under the sub-heading *Production*.

Map 2: Turkmenistan gas infrastructure



Source: OIES

Note: The East West Pipeline, marked as 'under construction', is complete, but not being used

Political and economic context

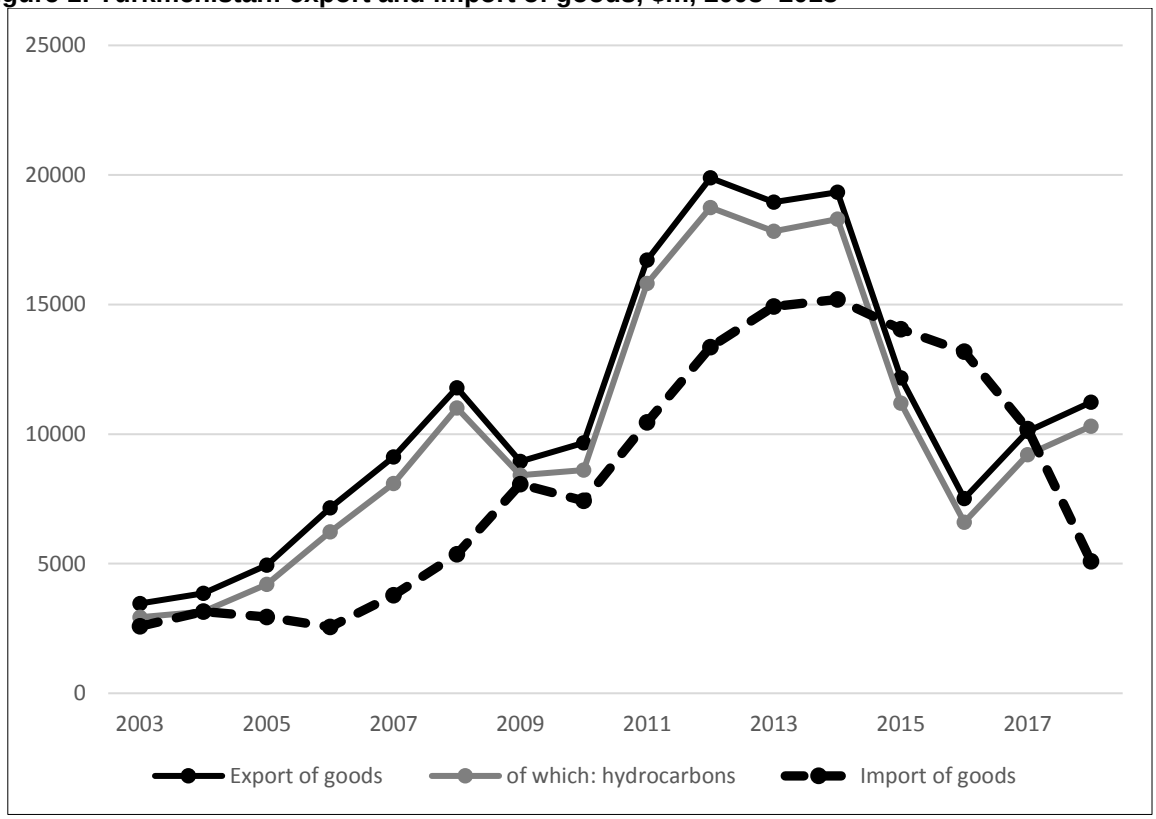
Hydrocarbons, overwhelmingly gas with some oil products, account for the lion's share (more than 90 per cent) of Turkmenistan's export revenues. The sharp reduction in exports to Russia in 2009, from around 40 Bcm/year to 10 Bcm/year, and in recent years the weakness of gas prices internationally, therefore had a disproportionate impact on Turkmenistan's economy.

The government does not publish any meaningful economic statistics. The International Monetary Fund (IMF) publishes estimates based on information provided by the authorities, but these are a poor reflection of the real state of the economy. For example, the IMF has estimated Turkmenistan's annual GDP growth at between seven per cent and ten per cent in 2009–13, and at between six per cent and nine per cent in 2014-18.[2] Observers have used externally observable data such as trade statistics, supplemented by observations of the informal exchange rate, as more accurate indications of the economy's progress.

Figure 1 shows Turkmenistan's trade balance since 2003. After a period of rising revenues, mainly from gas exports to Russia, there was a downturn in 2009–10. But the start-up of the export trade to China, and strong oil and gas prices, resulted in a renewed increase in export revenues, to record levels in 2012–14. There was then a sharp fall, with export revenues in 2016 the lowest for a decade, followed by a renewed upturn.

[2]IMF press releases, IMF 'Turkmenistan and the IMF' <https://www.imf.org/en/News/Articles/2019/04/10/pr19112-turkmenistan-imf-staff-completes-2019-article-iv-mission>

Figure 1: Turkmenistan: export and import of goods, $m, 2003–2018



Source: IMF

After registering a negative trade balance in 2015 and 2016, Turkmenistan returned to the black in 2018. The IMF attributed the fall in imports to 'declining public investment and a more active use of foreign exchange regulations, which have weighed on private investment and consumption'.[3] Its staff report continued:

> The resulting significant decline in imports, together with higher-than-expected hydrocarbon prices, have turned the external balance into a surplus. The improvement [...] is likely to be temporary, given that the official exchange rate remains above the equilibrium value, investment is expected to rise and the outlook for hydrocarbon prices is subdued. Risks are tilted to the downside [...].

The IMF's comments on the exchange rate are corroborated by media reports on the chronic shortage of cash in the Turkmen economy, and the sharp rise in 2018 in the unofficial (i.e. black market) exchange rate. While the manat is officially pegged at 3.5 to the US dollar, the unofficial rate rose from 10 to the dollar in January 2018 to 29 to the dollar in June 2018. The rate then fell again, to around 18-19 manats to the dollar in June 2019, and to 17-17.5 in July 2019.[4]

There has been a shortage of manats, leading to queues and crowds at cash machines, and also severe shortages of goods to spend money on, including of essential foodstuffs (including flour, cooking oil and sugar), in some localities. This has given rise to queuing, sporadic rationing and police action restraining domestic trade. For several years, foreign companies, working with state-owned companies in Turkmenistan, including some from Germany, Turkey, Russia and Belarus, have

[3]IMF press release no. 19/112, 'IMF Staff Completes 2019 Article IV Mission to Turkmenistan', 10 April 2019
[4]Reuters, 'Foreign companies struggle in cash-strapped Turkmenistan', 4 June 2018; Bne Intellinews, 'Bread sellers demand passports as Turkmenistan's economic crisis goes from bad to worse', 18 June 2018; Chronicles of Turkmenistan, 'The dollar value in Turkmenistan drops down by 1-2 manats', 3 July 2019

reported difficulties in getting paid. Earlier this year Unionmatex (Germany), Belgorkhimprom (Belarus) and MTS (Russia) made public details of legal actions to recover sizeable debts.[5]

Another external indicator of Turkmenistan's economy, and indeed society, is migration. Media reports have highlighted the government's efforts to discourage young, skilled workers from leaving the country. But UN statistics show that the level of emigration is not untypical for a developing country, and that Turkmenistan has the lowest ratio of emigrants to total population of the Central Asian countries.[6]

The conclusion is that, while Turkmenistan's economy has been severely affected by the fall in gas export revenues, this may not lead to fundamental political change. A recent report published by the Foreign Policy Centre argued that Turkmenistan is 'teetering on the edge of catastrophe',[7] and pictured:

> …a regime under enormous pressure as years of economic turmoil place unprecedented strain on a rigid but potentially brittle political structure. Hunger and hyperinflation are being managed by further increasing the scale of human rights abuse and the level of intrusion into people's lives.

This reflects a danger of exaggeration. The report convincingly establishes that there are local, potentially chronic, shortages of essential food items including flour and cooking oil – but does not provide any evidence of famine, which the word 'hunger' might imply. While there is inflation, discussed above, there is as yet no hyperinflation. Turkmenistan is suffering a grave economic crisis that could indeed be sorely aggravated by the inflexibility of its political system, and in turn produce a political crisis. But this is not the only prospect. A recovery in gas prices, and even a gradual increase in exports to China and Russia, could stabilise the trade balance, or at least prevent its further deterioration. This might further postpone political change that, while almost inevitable at some stage, may not come in the short or medium term.

Production

There have been three significant changes in the profile of Turkmenistan's gas production in recent years. First, the supergiant Galkynysh field has come on stream, and, according to a recent report by the authorities, now has 30 Bcm/year of production and processing capacity. Second, production has risen rapidly at two fields operated by foreign companies – CNPC's onshore production sharing agreement (PSA) at Bagtyarlyk, output from which is exported to China, and Petronas's block no. 1 Caspian offshore project, output from which is sold to Turkmengaz for processing onshore. These two projects comprised less than one-tenth of Turkmenistan's total production in 2011, but since 2017 have comprised more than one quarter. Third, although hardly any information is available about Turkmengaz's production capabilities, it appears that the constraints on output levels remain on the demand side, and that Turkmengaz and its partners – while struggling to meet peak demand in the winter of 2017–18 on the Chinese route – have, overall, reduced output in response to lower export and domestic demand.

[5]Reuters, 'Foreign companies queue up to sue cash-strapped Turkmenistan', 17 April 2019; Pannier, B. (July 2019), 'Food lines in a land of marble', Foreign Policy Centre, *Spotlight on Turkmenistan,* London: FPC.

[6]Khronika Turkmenistana, 'Iz-za migratsii v Turkmenistan ne khvataet uchitelei i vrachei', 2 April 2019; RFE/RL, 'Turkmenistan clips wings of citizens fleeing economic woes', 16 April 2018; International Organization on Migration database. Turkmenistan's ratio of emigrants to total population is lower than the other Central Asian countries, even if the total population figure is adjusted downwards from the official statistic (5.98 million) to a lower estimate reflecting international observers' assumptions (4.5 million)

[7] Adam Hug, "Conclusions and Recommendations", Foreign Policy Centre, *Spotlight on Turkmenistan* (London: FPC, July 2019), p. 39

Table 2 presents the available information on production, broken down by company and destination. In particular, it divides the output of Turkmengaz, the state-owned company, between gas exported to China, and gas used for other export routes (Russia, Iran and Kazakhstan) and the domestic market. During the 2010s, the Galkynysh field has become the main source of exports to China. In 2010 when these exports began, Galkynysh was not yet producing gas, and the Chinese route was presumably supplied from Dauletabad, Turkmenistan's second largest field, and other fields in the south-east of the country. By 2014, Galkynysh had 10 Bcm/year of capacity available, and by 2019, 30 Bcm.

Readers' attention is drawn to the row 'Turkmengaz, for other export routes and the domestic market'. These estimates have been arrived at by subtracting the volumes exported to China from Turkmenistan's total output as reported by BP (as Turkmengaz does not report production volumes). In 2015-17, in particular, these estimates are likely to be too high. In those years, exports fell sharply, with Russia ceasing purchases in 2015 and Iran in late 2016. BP, presumably in the absence of more accurate information, reported total production in the same range as previously (56-66 Bcm) – suggesting that domestic consumption leaped up in 2015, to 27 Bcm from 20 Bcm the year before. In reality, Turkmenistan probably produced less gas in response to the sharp reduction in aggregate demand.

Table 2: Turkmenistan gas production by company and destination, 2009–2019

Bcm		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019 est
Total production (sales gas)		**33.3**	**40.1**	**56.3**	**59.0**	**59.0**	**63.5**	**65.9**	**63.2**	**58.7**	**61.5**	**62**
Turkmengaz and other state-owned companies												
Turkmengaz: to China, including from Galkynysh*		**0**	**1.0**	**11.0**	**18.1**	**19.6**	**19.2**	**15.5**	**17.8**	**20.5**	**25.7**	**25.8**
Turkmengaz: for other export routes and the domestic market**		**33.2**	**35.5**	**40.2**	**34.1**	**32.7**	**33.4**	**36.2**	**30.4**	**23.0**	**19.5**	**18.9**
	Exports to Russia	*11.8*	*10.7*	*11.2*	*10.9*	*10.9*	*11.0*	*3.1*	*0*	*0*	*0*	*0*
	Exports to Iran	*7.0*	*7.0*	*10.0*	*9.0*	*5.0*	*6.0*	*7.0*	*7.0*	*0*	*0*	*0*
	Exports to Kazakhstan	*0*	*0*	*0.3*	*0*	*0.3*	*1*	*1*	*1.3*	*1.5*	*1.5*	*1.5*
	For domestic market	*14.4*	*17.8*	*18.7*	*14.2*	*16.5*	*15.4*	*25.1*	*22.1*	*21.5*	*18.0*	*17.4*
Private companies												
CNPC: under PSA at Bagtyarlyk*		**0.1**	**3.6**	**4.6**	**5.5**	**5.5**	**9.1**	**12.5**	**12.8**	**13.0**	**13.0**	**13.2**
Petronas: offshore Caspian block no. 1				**0.58**	**1.28**	**1.23**	**1.75**	**1.69**	**2.22**	**2.16**	**3.33**	**4.15**
Private companies, as % of total		0.03	8.9	9.2	11.4	11.4	17.1	21.5	23.8	25.8	26.5	28

* Total Turkmen exports to China are those from Turkmengaz, plus those from CNPC at Bagtyarlyk. In this table, I have used total volumes exported, and CNPC volumes exported, as reported by CNPC. The sum is slightly larger than the volumes reported by the Chinese customs authorities, used in table A; in most years this difference was 1-2 bcm, but in 2018 it was substantial (more than 4 bcm larger)

** This row includes all gas not exported to China. It also includes small volumes from Turkmenneft, the state-owned oil producer

Sources: total production: BP statistical review, author's estimate (2019), CNPC, Petronas and Turkmengaz export to China, presentations at Turkmenistan gas congress, Avaza, May 2019. Other exports: Table 1

Significant developments on production reported publicly are as follows:

Galkynysh. The first phase of Galkynysh field development, for output of 10 Bcm/year, was completed in 2013 by Chuanqing Drilling Engineering Company, a CNPC subsidiary. CNPC proprietary technology was installed for gas purification and processing. All this capacity – for production, gas gathering and processing – started operation in 2014.[8] For the second phase, Turkmengaz agreed with a consortium including Gulf Oil & Gas, Petrofac International and LG International to undertake field development, and install gas gathering infrastructure and gas processing capacity, for a further 20 Bcm/year. In September 2013, when Turkmenistan agreed with China to increase total gas exports to 65 Bcm/year by 2020 (see *Prospects for export in the 2020s*, below), CNPC announced that it had signed a turnkey engineering, procurement and construction contract for the second phase, with

[8]Reported on the CNPC website 'CNPC in Turkmenistan' page, viewed in May 2019 but not available in October 2019

capacity of 30 Bcm/year, to be completed by 2018. It is unclear how the Middle Eastern and Chinese consortia worked together.[9]

In August 2019, the Turkmen government web site gave a rare progress update, indicating that the second phase was complete. It said that Galkynysh now had more than 40 production wells, with an average flow rate of two million cubic metres a day (i.e. at least 29.2 Bcm/year in total), and 30 Bcm of gas processing capacity. A previous report, in 2017, had said there were 29 wells in place, of which 13 would be operational at the end of that year, and that Turkmengaz had earmarked 20 Bcm/year from Galkynysh to export to China.[10]

Galkynysh is now producing more than 20 Bcm/year, considerably below the numbers mentioned by Turkmen officials during the development phase. Moreover, it seems that in the winter of 2017-18 in particular, Turkmenistan was unable to meet nominations from China at peak times (see below): this may have been related to difficulties in bringing on capacity at the field. Further field development, mentioned in the government's report, could raise total output to 95 Bcm/year. However, no timescale for this development has been made public, and the authorities have stated that its main purpose is to supply the Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipeline, completion of which is in no way assured (see *Prospects for export in the 2020s*, below[11]).

Another future possibility is that gas from Galkynysh and other fields in south-east Turkmenistan will find markets to the west – for example, export to Russia, Kazakhstan or Azerbaijan, and/or domestic uses. The East-West pipeline, which links these fields to gas transmission infrastructure in western Turkmenistan and can carry 30 Bcm/year, was completed in 2015, but then capped.[12]

Bagtyarlyk. This field, near Turkmenistan's border with Uzbekistan, is operated by CNPC under a production sharing agreement (PSA). It started production in 2009 and has now reached its plateau output of 13 Bcm, all of which is exported to China.[13]

Turkmengaz's other fields. No information has been made available in recent years. The largest fields, Dauletabad, Malay and the Uchadzi group, are in south-east Turkmenistan near to Galkynysh. In western Turkmenistan, Turkmengaz produces gas at Korpedzhe, and there are some associated gas volumes from Turkmenneft's oil fields.

Offshore. Petronas, which produces oil from Block 1 in the Turkmen sector of the Caspian Sea, started bringing associated gas offshore for processing and sale to Turkmengaz in 2011. By 2018, output had reached 3.3 Bcm, bringing the cumulative total since 2011 to 16.6 Bcm. Petronas projects 4.1 Bcm of gas will be produced in 2019.

The Block 1 project is notable for two reasons. Firstly, it is the first project to produce any substantial gas volumes in the Turkmen sector of the Caspian, after several false starts in the 1990s and 2000s.[14] Secondly, Petronas is the first non-Turkmen producer to agree terms for selling gas to Turkmengaz. It is reported that gas from Block 1 is the main feedstock for the new Kiyanli petrochemicals plant (see below).

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[9] Pirani, S. (2012). *Central Asian and Caspian Gas Production and the Constraints on Export,* NG69, 29-30. Oxford: OIES; CNPC press release, 'CNPC and Turkmengaz ink an agreement', 6 September 2013

[10] Turkmenistan Zolotoi Vek website, 'TEK Turkmenistana: innovatsionnost' i eksportnyi potentsial', 2 August 2019; *Argus FSU Energy*, 'Slow progress at Galkynysh', 8 August 2019

[11] *Natural Gas World*, 'Turkmenistan to work with Japan to further develop Galkynysh', 18 October 2015; Reuters, 'Turkmenistan has started work on a natural gas pipeline to Afghanistan, Pakistan and India', 15 December 2015; Turkmenistan Zolotoi Vek, 'TEK Turkmenistana', 2 August 2019.

[12] Khaitun, A. 'Energeticheskie perspektivy Turkmenistana v Evraziiskom regione', *Nezavisimaia Gazeta*, 12 December 2017; Cutler, R. 'How Central Asian energy complements the Southern Gas Corridor', Euractiv, 24 January 2018

[13] CNPC website, 'Amu Daryan natural gas project' page <https://www.cnpc.com.cn/en/Turkmenistan/country_index.shtml>, viewed 26 November 2019

[14] 'Turkmenistan: an exporter in transition' in Pirani. S. (ed.), *Russian and CIS Gas Markets and their impact on Europe,* Oxford: OUP/OIES, 282, 283 and 294

Dragon Oil, the upstream division of Emirates National Oil Company (ENOC) of Dubai, is working on the Cheleken block in the Caspian under a PSA that expires in 2025. The company states that its priorities are to extend the agreement to 2040; to develop a monetization agreement for gas; and to work with the government on further PSAs for the North Koturdepe area.[15] Other companies including Buried Hill, RWE, Wintershall, Eni and Mitro International have, at various times, signed agreements to work in the Turkmen sector in the Caspian, but none of these have reported that exploration and development work are completed.

A final point to bear in mind about production is the cost of processing. Gas produced in Turkmenistan, as in Uzbekistan and Kazakhstan, has high sulphur content. Turkmenistan's offshore fields generally contain rich gas, that is, with liquids content; sales of these can help to offset processing costs. But the onshore fields contain dry gas.

Domestic market

There is no publicly available information about total volumes of gas consumed on the domestic market. Outside observers, including this author, can only produce estimates by subtracting the volume of exports from total output – although the output figures are themselves estimates. As indicated above in the comments on Table 2, the credibility of the output estimates could be all the more strongly questioned since they did not change substantially between 2014 and 2017 in response to Turkmenistan's loss of the Russian and Iranian export markets. What can be stated with confidence is: first, domestic consumption was estimated at 14-18 Bcm/year in the early 2000s; that 45-50 per cent of these volumes were for electricity and heat production and the energy industry's own use, 25-30 per cent for industry and 10-15 per cent for residential consumers. Second, at the beginning of 2019, household customers began to be charged a nominal fee for gas, which had previously been free, but it seems doubtful that this changed consumption habits.[16] Third, it seems unlikely that consumption rose substantially in 2014–15, as Tables 1 and 2 imply; this is probably a statistical anomaly. Fourth, it seems likely that domestic consumption is now substantially higher than in the early 2000s, due in part to the opening of petrochemicals capacity.

A small corner of the domestic market, in the Balkan province in western Turkmenistan, has become more transparent due to Petronas's activity there. Petronas has reported that it has a contract covering 2.45 Bcm/year of sales to Turkmengaz, and in 2018–19 was selling higher volumes. Petronas stated in 2019 that it sees 'high potential' in the market where the largest consumers of gas it produces are: the Kiyanli petrochemicals complex (see below); Turkmenbashi oil refinery; the Garabogaz carbamide plant; the Balkanabat, Avaza and Turkmenbashi power stations; and outlets to Balkanabat, Gumdag and surrounding villages.[17]

The most significant increment to gas demand in recent years has been the start-up of petrochemicals plants that use gas as feedstock, with a view to adding value to Turkmenistan's gas resources.

In 2018, the country's petrochemicals capacity increased from 160,000 tonnes per annum (tpa) to 600,000 tpa, with the commissioning of the Kiyanli complex in Balkan province. This plant is designed to take 5 Bcm of rich gas, and return 3.7 Bcm of sales gas to the grid. Wood Mackenzie assessed the plant's start-up as 'a step change in Turkmenistan's ability to produce olefins and polyolefins domestically'.[18] The Kiyanli complex includes a gas separation unit, an olefin conversion unit (ethane cracker unit), a high density polyethylene unit producing 386,000 tpa and a polypropylene unit

[15] ENOC *Annual Review 2017*, 45; Turkmenistan Zolotoi Vek, 'TEK Turkmenistana'
[16] Pirani, S. (2012). *Central Asian and Caspian Gas Production and the Constraints on Export,* NG69,63-64, Oxford: OIES; Radio Free Europe, 'Turkmenistan Cuts Last Vestiges Of Program For Free Utilities', 26 September 2018; Radio Free Europe, 'The Gas Man Cometh: In Turkmenistan, Free Energy No More', 11 November 2018
[17] Petronas presentation, 'The role of Petronas in developing gas industry of Turkmenistan', at Turkmenistan Gas Congress, Avaza, 21-22 May 2019
[18] Wood Mackenzie, 'New Turkmengaz gas and chemical complex good news for domestic petrochemicals industry', press release 18 Oct 2018

producing 81,000 tpa. Construction was financed by syndicates of Korean banks (with a $492 million loan and a $215 million Korea Eximbank guarantee), and Japanese banks (with a $730 million loan and $438 million Japanese Bank for International Cooperation (JBIC) guarantee[19]).

In 2018 Turkmenhimiya, the state-owned petrochemicals company, commissioned a fertiliser plant at Garabogaz, on the Caspian coast. It will produce 1.1 million tpa of urea, using natural gas as feedstock, with the intention of exporting most of its output; sales contracts with Indian and Iranian purchasers have been reported. The plant was built by Mitsubishi Corporation (Japan) and Gap Insaat (Turkey), with finance provided by JBIC.[20] A potash plant at Garlyk, constructed by Belarussian companies and opened in 2017, has reportedly so far produced only a small fraction of its 1.4 millon tpa nameplate output, and a dispute with the Belarussian partners has now gone to arbitration.[21]

In June 2019, a gas-to-liquids plant, claimed by the construction consortium to be the first in the world to produce gasoline from natural gas, was opened at Ovan-Depe in Akhalsky province. Haldor Topsoe (Denmark)'s technology, used previously at Oryx (Qatar) and Sasol (South Africa) to produce diesel, has been adapted to produce gasoline. The plant will take 1.78 Bcm/year of gas feedstock and produce from it 600,000 tonnes of gasoline (Eco-93), 12,000 tonnes of diesel fuel and 115,000 tonnes of liquefied petroleum gas. The plant was built by a consortium of Kawasaki Heavy Industries and Ronesans Endustri (Turkey); finance to cover 85 per cent of the $1.7 billion construction costs was arranged by JBIC.[22] Turkmenistan's existing producers of gasoline are the Turkmenbashi and Seidi oil refineries, which cover domestic needs, plus a small amount for export. It has been reported that the component of A-98 high-octane gasoline produced at Ovan-Depe will enable production of A-95, A-92 and A-80 gasoline conforming to Euro-5 standards. Doubt has been cast on the economics of the gas-to-gasoline process, but much more information would be needed to assess this.[23]

Together these projects have the potential to reduce Turkmenistan's dependence on natural gas sales by exporting value-added products. A sense of proportion is needed, though: the two flagship projects, Kiyanli and Ovan-Depe, process 5 Bcm/year and 1.8 Bcm/year respectively of gas – small amounts compared to Turkmenistan's gas export trade. Whether, and to what degree, they are successful will depend on market conditions, and Turkmenistan's ability to compete in them.

The market conditions are uncertain, and will remain so. Petrochemicals markets are not only expanding very rapidly, but are also extremely volatile; factors such as the instability in US-China relations, changing cost profiles and the growth of recycling may enhance volatility; and some observers expect that the large-scale expansion of production facilities, in China in particular, will outpace demand in Asia.[24]

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[19] Newsbase, 'Turkmenistan starts up new petrochemical hub', 26 September 2018; Chemicals-technology.com website, 'Turkmengas Kiyanla petrochemical plant, Turkmenbashi', <https://www.chemicals-technology.com/projects/turkmengas-kiyanla-petrochemical-plant-turkmenbashi/>

[20] Reuters, 'Turkmenistan launches fertiliser plant', 17 September 2018 <https://www.reuters.com/article/turkmenistan-fertilizers/turkmenistan-launches-fertiliser-plant-to-diversify-exports-idUSL5N1W300S>; UK Foreign and Commonwealth Office, *Turkmenistan Energy Newsletter*, October 2018

[21] Reuters, 'Turkmenistan opens potash plant, targets Chinese and Indian markets', 31 March 2017, <https://www.reuters.com/article/us-turkmenistan-potash/turkmenistan-opens-potash-plant-targets-chinese-and-indian-markets-idUSKBN1720RZ>; Turkmen News, 'Turkmenistan impounds Belarusian equipment in potash plant dispute', 27 Feburary 2019, <https://en.turkmen.news/news/turkmenistan-impounds-belarusian-equipment-in-potash-plant-dispute/>

[22] *Argus Caspian Markets*, 'Turkmenistan launches Ovandandepe plant', 21 June 2019; 'Prezident Turkmenistana: neobkhodimo prodolzhit' rabotu', Turkmenpor, 21 June 2019 <https://turkmenportal.com/blog/19918/prezident-turkmenistana-neobhodimo-prodolzhit-rabotu-po-glubokoi-pererabotke-gaza>; Neftegaz.ru, 'Turkmenistan zapustil 1-y v mire GTL-zavod po proizvodstvu benzina', 28 June 2019, <https://neftegaz.ru/news/Gazohimija/456290-turkmenistan-zapustil-1-y-v-mire-gtl-zavod-po-proizvodstvu-benzina-iz-prirodnogo-gaza/?clear_cache=Y>

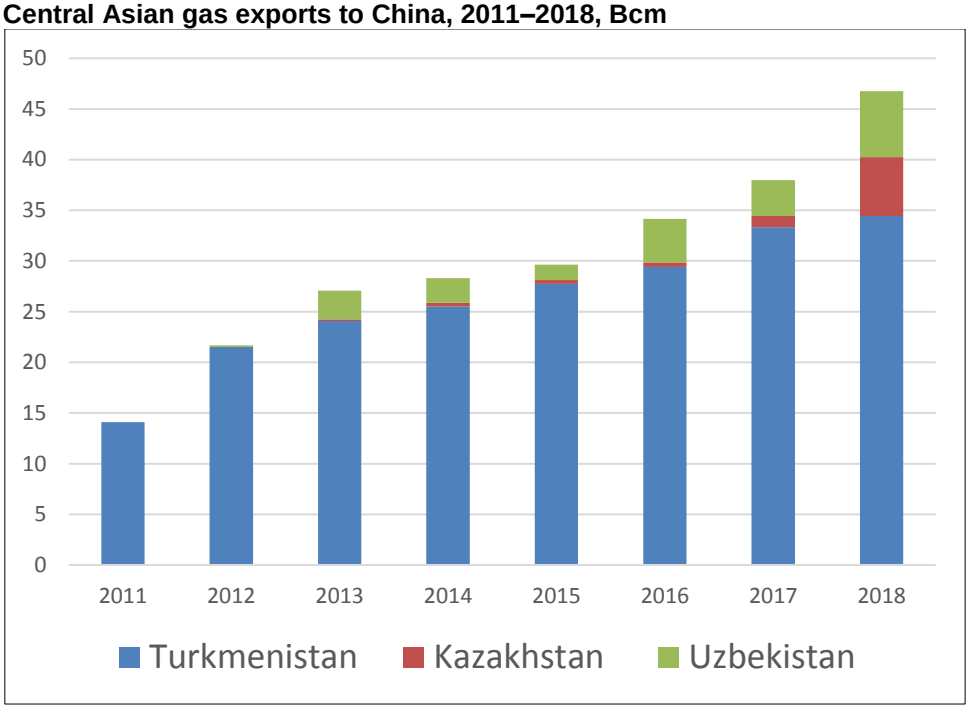
[23] Natural Gas World, 'Turkmenistan starts up GTL plant', 28 June 2019; Eurasianet, 'Turkmenistan: liquid lunch', 2 July 2019; Natural Gas World, 'Kazakhstan ramps up gas-fired power, petchems', 16 August 2019

[24] S&P Global Platts, *Global petrochemical outlook: H2 2019*; S&P Global Platts, *Asia petrochemical outlook H1 2019: Petrochemicals special report*; IEA, *The Future of Petrochemicals,* Paris: IEA, 2018; Hydrocarbon Processing, *Business Trends: Petrochemicals 2025,* March 2019, <https://www.hydrocarbonprocessing.com/magazine/2019/march-2019/trends-resources/business-trends-petrochemicals-2025-three-regions-to-dominate-the-surge-in-petrochemical-capacity-growth>

Exports to China

China became the leading destination for Turkmen gas exports in 2011; exports to China reached 34.5 Bcm in 2018, and they are expected to continue to rise. Russia ceased imports from Turkmenistan in 2015, and restarted them at much lower levels in 2019; Iran ceased imports, probably for the foreseeable future, in 2017. The steady growth of gas exports to China from Turkmenistan, Uzbekistan and Kazakhstan is shown in Figure 2.

Figure 2: Central Asian gas exports to China, 2011–2018, Bcm



Source: Chinese customs data

The Central Asia-China gas pipeline corridor, via which these volumes are transported, is the largest new pipeline route to have been opened up anywhere in the world in recent years. Lines A and B of the corridor, with a capacity of 30 Bcm (13 Bcm from CNPC/Bagtyarlyk and 17 Bcm from Turkmengaz), were commissioned in 2009–10, and Line C, with a capacity of 25 Bcm, in 2014. Turkmen exports to China began in 2010, under an agreement providing for total exports (from CNPC and Turkmengaz) of 30 Bcm for 30 years from 2010 (via lines A and B), with the option of raising the total volume to 40 Bcm.

It was originally reported that supplies for Line C would be provided by Uzbekistan (10 Bcm/year), Kazakhstan (5 Bcm/year) and Turkmenistan (10 Bcm/year, bringing total Turkmen exports to China, via the three lines, to 40 Bcm). More recently, it has been reported that Kazakhstan intends to increase exports to China to 10 Bcm/year, implying that Chinese imports from Turkmenistan would be limited to 35 Bcm/year.[25] By 2018, Lines A-C were being utilised at close to capacity, at peak times. Total annual volumes imported by China in 2018 were 34.4 Bcm from Turkmenistan, 6.5 Bcm from Uzbekistan and 5.8 Bcm from Kazakhstan.[26]

In September 2013, the presidents of China and Turkmenistan signed an agreement providing for the total export volume to rise to 65 Bcm/year by 2020; in return for this China would finance the second

[25] Pirani, S. (2012). *Central Asian and Caspian Gas Production and the Constraints on Export,* NG69,83-84, Oxford: OIES; *Natural Gas Europe*, 'Turkmenistan supplied 125 Bcm of gas to China', 28 September 2015; *Vedomosti*, 'Turkmeniia lishilas' krupnogo pokupatelia gaza v litse Irana', 13 August 2017

[26] Chinese customs data; UK FCO Turkmenistan Energy Newsletter, June 2018; Lelyveld, M., Radio Free Asia, 'China Nears Limit on Central Asian Gas', 25 June 2018

stage of development at Galkynysh. At the same time, it was agreed that Line D of the pipeline corridor would be built, adding a further 30 Bcm/year of capacity, bringing the total capacity to 85 Bcm/year. Line D is planned to cross Uzbekistan, Tajikistan and Kyrgyzstan, rather than following the route of the other three lines across Uzbekistan and Kazakhstan. Construction was originally planned to start in 2015, but was postponed. In 2017 the project was frozen by decision of CNPC, its main sponsor, and talks about restarting it have not yet reached a firm conclusion.[27] See below, *Prospects for exports in the 2020s*.

While it seems likely that China will want to complete Line D eventually, the timing will depend on the evolution of the Chinese gas market – but also on the evolution of China's partnership with Turkmenistan. In contrast to Gazprom, which in the 1990s and early 2000s took possession of Turkmen gas at the border (and for some years used third party traders to do so, avoiding even a commercial relationship with Turkmengaz), CNPC has insisted on active involvement in the Turkmen upstream. In addition to its own PSA at Bagtyarlyk, it has played a significant, and growing, role in developing Galkynysh. Furthermore, the Turkmen investment in the Central Asia-China corridor was largely financed by Chinese institutions, with the loans being repaid from gas export proceeds.[28]

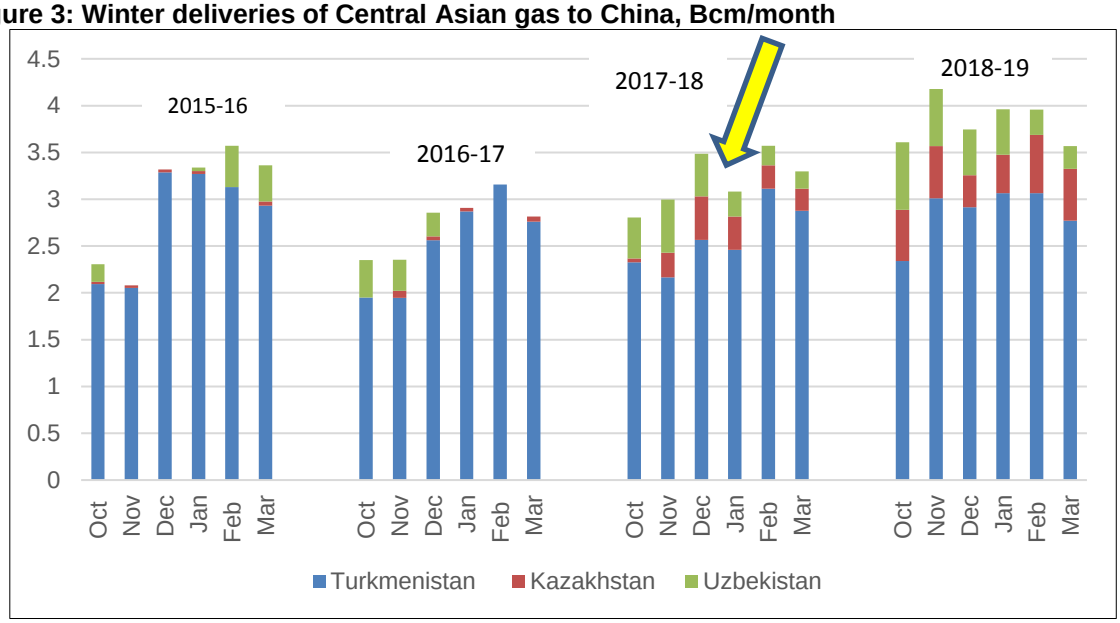
In other words: China has left little to chance in ensuring the security of its gas supplies from Turkmenistan. This caution appeared to have been justified in the winter of 2017**–**18, when upstream technical problems meant that Turkmengaz was unable to meet nominations. In January 2018, a cold spell in China coincided with a directive from the National Development and Reform Commission banning coal-fired heating in 28 northern cities, with a view to avoiding the smog crisis of 2016-17. This put strain on gas transportation and supply capacities. This was exacerbated in late January, when volumes being delivered via the Central Asian Gas Pipeline dropped by half due to what CNPC described in a statement as 'frequent equipment failures' in Turkmenistan.[29] Figure 3 shows Turkmen deliveries to China in the winter months, with the decrease in January 2018 marked by the arrow.

[27] Platts, 'Ashgabat, Beijing sign deals to expand Turkmen gas exports to China', 4 September 2013; CNPC press release, 'CNPC and Turkmengaz ink an agreement', 6 September 2013; Reuters, 'Turkmenistan has started work on a natural gas pipeline', 15 December 2015

[28] Pirani, *Central Asian and Caspian Gas*, 25-26 and 83-86

[29] Lelyveld, M., Radio Free Asia, 'China Nears Limit on Central Asian Gas', 25 June 2018

Figure 3: Winter deliveries of Central Asian gas to China, Bcm/month



Source: China customs data

Exports to Russia

Turkmen gas exports to Russia, previously the main export destination, were cut sharply in 2009. As demand fell in Europe and Russia, Gazprom cut purchases to 10-12 Bcm/year, and demanded a revision of the oil-linked price formula agreed with Turkmengaz in 2008. No agreement was reached, and in 2015 purchases were stopped altogether; Gazprom Export started arbitration proceedings in pursuit of a price revision. In 2018, after political relations between Russia and Turkmenistan improved, and progress was achieved in the long-frozen Caspian Sea delimitation talks, the arbitration claim was set aside. By April 2019, Gazprom and Turkmengaz had agreed to restart exports, under a five-year supply contract for delivery of 5.5 Bcm between 2019 and 2024.[30]

The price of Turkmen gas being sold to Russia has not been made public, but has been reported at $110/mcm at the Turkmen border. This seems plausible, as the average purchase price paid by Gazprom for Central Asian gas in 2018 was around $133/mcm. This suggests that the long-term problem for the Central Asian exporters remains: these purchase prices, plus transport to southern Russia, are higher than Gazprom's cost of production, and higher than Gazprom's domestic sales prices. For comparison, Gazprom's average domestic sale price, net of VAT, in 2018 was about $63.30/mcm.[31] While prices in southern Russia are higher than in other regions, they are not currently high enough for Central Asian gas to compete easily. For Central Asian exports to grow in the 2020s, there would probably need to be a substantial price adjustment.

Given that pipeline capacity is in place, it is probably economically feasible for Turkmen exports to Russia to increase by a few Bcm/year in future – if Turkmenistan finds it worthwhile to do so, making the price adjustment mentioned. Turkmen volumes could replace those from Kazakhstan and Uzbekistan, which have, respectively, exported 11-14 Bcm and 3-6 Bcm annually along this route in recent years, but may have lower volumes available for export in the 2020s (see below).

[30] Argus FSU Energy, 'Gazprom secures Turkmen gas imports', 4 July 2019; *Vedomosti*, 'Gazprom zakliuchil piatiletnyi kontrakts Uzbekistanom', 6 April 2017. On 2008-09, see Pirani, S. (2014). 'Central Asian and Caspian gas for Russia's balance', in Henderson, J. and Pirani, S. (eds.), *The Russian Gas Matrix: how markets are driving change,* Oxford: OUP/OIES. 347-367

[31] Natural Gas World, 'Turkmenistan resumes flows to Russia', 16 April 2019; Gazprom *Annual Report 2017,* average purchase prices extrapolated by the author which gave an average purchase price of $121.55/mcm, 139; Gazprom *Annual Report 2018* which reported a 9.5 per cent year-on-year increase, 121. Gazprom *Annual Report 2018,* for average domestic sales price converted to dollars by the author, 120

Exports to Iran, Azerbaijan and Kazakhstan

Iran, which in the 1990s and 2000s was the second export destination after Russia for Turkmen gas, ceased purchases in 2017. There is no immediate prospect that they will be resumed. Iran had purchased gas from Turkmenistan to supply north eastern parts of the country that had no pipeline connection to its own ample gas resources in the south. Throughout the 2000s and 2010s there were repeated disputes on price, and in January 2017 Turkmenistan halted deliveries, claiming $4.5 billion was outstanding for gas supplied in previous years; the National Iranian Gas Company said that most of this money had been paid; in August 2018 the dispute went to arbitration. Meanwhile, in 2017 the Damgan-Neka pipeline, with a capacity of 14.6 Bcm/year, was completed to bring gas from southern Iran to the northern areas previously supplied by Turkmenistan.[32] There is no obvious reason why Iran should require Turkmen volumes in future.

In 2011-13, small volumes of Turkmen gas were bought by Gazprom and supplied to parts of south-east Kazakhstan that had no access to Kazakhstan's own gas, which is mostly produced in the west of the country.[33] After the completion of Kazakhstan's east-west pipeline link in 2014, this source of demand might have fallen away – but did not, since (i) there were other markets, domestic and export, for the available Kazakh gas, and (ii) Kazakhstan remained anxious to reduce the dependence of its south-east region on Uzbek imports, which have been unreliable. The author has been unable to find statistical records of the volume of Turkmen exports to Kazakhstan, but judging by the available published information, they have been in the range of 1-2 Bcm/year since 2015.[34]

In 2017–2018 Azerbaijan bought about two Bcm of Turkmen gas in total, which it received as swaps from Iran, supplied both to its mainland territory and to the Nakhchivan exclave.[35]

Conclusions

The first decade of Turkmen exports to China, from 2010, has been driven by China's strategic focus on security of supply and diversity of import sources. The question for the second decade, the 2020s, is whether export volumes will increase substantially. This will depend to a large degree on price competition in China between Turkmen and other gas supplies, and on China's strategic approach to gas imports. This issue is dealt with in detail below: see *Prospects for export in the 2020s*. The outlines are as follows: when gas supplies cross the Chinese border, Turkmen pipeline volumes are slightly more expensive than those from Uzbekistan and Kazakhstan, due to additional transport costs and, on average, around $2/MMBtu cheaper than LNG or supplies from Myanmar. But the additional transport cost of moving central Asian gas across China to the major centres of consumption in the east make it uncompetitive with LNG in China's major gas consuming areas on the east coast.

Given the expectations that Chinese gas demand will expand substantially during the 2020s, it is likely that China will choose to increase imports from Turkmenistan. The pace at which it does so will also depend on Turkmenistan's ability to develop the gigantic resources at its disposal – and in particular, its ability to raise output levels at the Galkynysh field. The situation there is unclear, in part because of the lack of reliable information in the public domain. Turkmenistan's ability to supply gas may also be constrained by its autocratic and dysfunctional political system, which has failed to manage the decline in export revenues in recent years and thereby exacerbated a serious economic crisis, and created the potential for a political one.

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[32] *Vedomosti*, 'Turkmeniia lishilas' krupnogo pokupatelia gaza v litse Irana', 13 August 2017; UK FCO *Turkmenistan Energy Newsletter*, August 2018

[33] Gazprom annual reports for 2011 and 2013

[34] LSM.kz, 'Kazakhstan kupil u Turkmenistana gaz', 22 February 2017, <https://www.lsm.kz/kazahstan-kupil-u-turkmenistana-gaz-na-192-mln-infografika>; Evraziia Ekspert, 'Kazakhstan-Turkmenistan: neft', gaz i zheleznaia doroga', <https://eurasia.expert/kazakhstan-turkmenistan-neft-gaz-i-zheleznaya-doroga/>; Kazenergy, *The National Energy Report 2017*, 112

[35] Reuters , 'Azerbaijan, future gas supplier to Europe, faces shortfall at home', 24 February 2017; Jalilvand, D. (2018). *Progress, Challenges, Uncertainty: ambivalent times for Iran's energy sector,* Oxford Energy Insight 34, 3, Oxford: OIES; Pirani, S. (2018). *Let's not exaggerate: Southern Gas corridor prospects to 2030*, OIES NG135, 8

One possible scenario, especially if exports to China increase, is that China will expand its active participation in the upstream. Turkmenistan's successful cooperation with both CNPC and Petronas may pave the way to further international participation, more likely from Asian companies than American or European ones. This would continue the geopolitical and economic trend of the last 25 years in Central Asia, of erosion of Russia's power and influence and the growth of China's.

Given that Russia has plentiful supplies of its own gas, Turkmenistan will probably never return to the pre-2009 levels of export by its northern route, although some deliveries to southern Russia are perfectly economically feasible. Turkmenistan could deliver small volumes to Azerbaijan, via Iran or even across the Caspian Sea. But large-scale deliveries to Europe via a Trans Caspian pipeline, or to Pakistan and India via the TAPI project, look extremely unlikely: the transport costs mean that Turkmen gas simply cannot reach these markets and compete with other supplies. See *Prospects for exports in the 2020s*, below. While the Turkmen government has been vocal in support of these projects, TAPI in particular, it has actually attracted billions of dollars of foreign investment into an alternative: gas processing plants to produce petrochemicals and gasoline. This diversification may prove to be a better way of raising export revenues during the 2020s, although, as indicated above, petrochemical markets, particularly in Asia, are not only expanding but are extremely volatile.

2. Uzbekistan

Introduction

Uzbekistan has produced 53-60 Bcm/year of gas since 2010; its output levels are slightly lower than Turkmenistan's. Unlike Turkmenistan, Uzbekistan consumes more than three-quarters of the gas it produces – 43-46 Bcm/year in recent years. Its gas balance is shown in Table 3. Uzbekistan has the largest population (33 million) in Central Asia, along with the Soviet-era urban infrastructure and energy-intensive industries that are common across the region. It has a large number of small, relatively mature gas fields. Little information has been available about exploration and development potential, although this is now changing; most of the incremental production in recent years has been brought on by Lukoil, the largest foreign company working upstream in Uzbekistan, which in 2018 accounted for 23 per cent of total output (13.4 Bcm).

Uzbekistan exported 6.5 Bcm of gas to China in 2018, and smaller volumes to Russia and Kazakhstan. Raising export levels in the 2020s will depend not only on developing production, but also on domestic market reform, which could reduce demand and free up some volume. Another source of demand could be large petrochemical plants, some of which are completed, and some planned. A tug-of-war is already in progress between export and domestic demand, where prices are regulated at a low level. The PSA covering Lukoil's production allows it to sell all its gas to China, but the company agreed in 2018 to transfer some to Uzbekneftegaz to cover domestic shortages. In June, President Shavkat Mirziyoyev complained in parliament that gas is purchased from Lukoil at $146/mcm and sold to residential sector customers at $40/mcm; as a result, Uzbekneftegaz has accumulated a $600 million debt to Lukoil. Amendments to the PSA law, which would require future PSA licencees to supply the domestic market, are now under discussion.[36] This tension between export demand and domestic demand will continue through the 2020s.

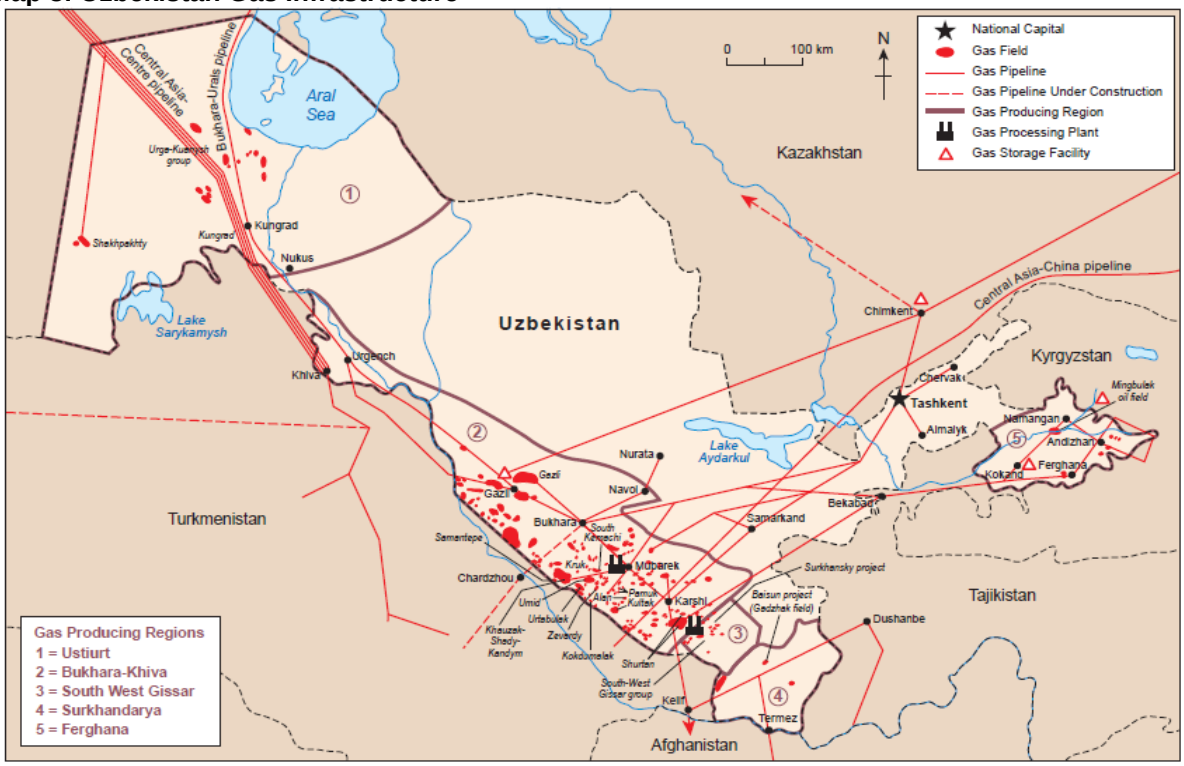
[36]Podrobno.uz, 'V 'Uzbekneftegaze' uvereny, chto ne stoit stavit' pod somnenie proekty s 'Lukoilom'', 28 June 2019; Natural Gas World, 'Uzbekistan to draft new PSA law', 15 July 2019

Table 3: Uzbekistan's gas balance, 2010–2018

Bcm	2010	2011	2012	2013	2014	2015	2016	2017	2018
Production (sales gas)	**59.2**	**56.6**	**56.5**	**55.9**	**56.3**	**53.6**	**53.1**	**53.92**	**57.34**
Total gas balance	**59.2**	**56.6**	**56.5**	**55.9**	**56.3**	**53.6**	**53.1**	**53.92**	**57.34**
Domestic consumption	**45.1**	**46.0**	**44.8**	**43.8**	**46.5**	**45.7**	**42.6**	**43.2**	**44.1**
Export (total)	**14.1**	**10.6**	**11.8**	**12.2**	**9.8**	**8.0**	**10.5**	**10.8**	**13.3**
To/through Russia	11.4	8	8.7	5.6	3.6	3.5	4.3	5.5	3.8
To Kazakhstan	2.5	2.4	2.7	3.7	3.7	2.9	1.9	1.7	2.9
To Kyrgyzstan and Tajikistan	0.2	0.2	0.2	0	0.04	0.02	0.02	0.02	0.02
To China	0	0	0.2	2.9	2.4	1.5	4.3	3.5	6.5

Source: BP Statistical Review, Gazprom, China customs data. For details see Appendix

Map 3: Uzbekistan Gas Infrastructure



Source: OIES

Political and economic context

Uzbekistan, in sharp contrast to Turkmenistan, is going through big economic changes following the accession of President Mirziyoyev in 2016, after the death of his predecessor Islam Karimov. An initial wave of reforms began in 2017–18 aimed at moving away from the autarchic state-led growth model based on capital-intensive production at large state-owned enterprises. The reforms included foreign exchange liberalisation, tax reform and greater openness to international investors. An implicit danger is that Uzbekistan's dependence on revenues from the export of raw materials, including gas, minerals and agricultural products, will increase.

An expansionary credit policy has been adopted; nominal credit to the economy expanded by about 50 per cent in 2018, funding capital goods purchases and infrastructure investment. The labour market is oversupplied, and the rate of formal sector employment fell from 38 per cent in 2000 to 25

per cent in 2018. The IMF and other authorities are urging policies aimed at job creation. Mirziyoyev has prioritised energy sector reform and gas sector reform in particular. Implementation is already underway of his decree, issued in July, to break up Uzbekneftegaz, the state-owned vertically-integrated oil and gas company. Price reforms are also in prospect. Additionally, Mirziyoyev has spoken of the need to bring foreign companies into the energy sector, and campaigned against corruption.[37]

The decree on gas sector reform[38] opens by deploring the 'incomplete provision of energy resources to the economy and the population'; the state companies' declining share of output; and the degradation of the gas reserves base, which has had an average replacement rate of 70 per cent in the last five years. Mirziyoyev points to a 'road map' for sector reform, including modernisation of gas transport infrastructure, an overhaul of accounting and control through the value chain and strengthening of financial discipline. The decree requires (i) the separation-out from Uzbekneftegaz of Uztransgaz, which will purchase gas from upstream producers, transport it in high-pressure pipelines and supply it to major customers; (ii) the formation of Khududgaztaminot, to manage distribution networks and supply residential and public-sector customers; and (iii) the corporate reorganisation of upstream assets, and the abolition of unnecessary administrative sub-divisions. The decree also mandates a production increase for Uzbekneftegaz, energy efficiency measures and development of renewables.

The reform announcements have been accompanied by denunciations of inefficiency (for example, the losses on Lukoil purchases mentioned above) and corruption (for example, the receipt of $80 million in bribes by a manager at the Ustyurt gas processing plant), and dismissals of Uzbekneftegaz managers.[39] Uzbekneftegaz CEO Bahodirjon Sidikov has said that the shake-up of the company will be followed by up to $2 billion of foreign borrowing.[40] The reform proposals will probably play a major part in shaping the Uzbek gas sector over the next few years.

Production

Uzbekistan's statistics agency reported total gas output for the first time in 2018, as 59.84 Bcm. The BP Statistical Review reported output as 57.34 Bcm; the difference may be partly attributable to the different level of energy content assumed for volumes of gas by BP and most former Soviet states, including Uzbekistan. The level of output has been roughly stable over the last decade (see Table 3, gas balance), albeit lower than the reported level of 61-69 Bcm/year in 2006–09.[41] In the last five years Lukoil's reported output has risen rapidly, replacing volumes lost by a decline in output from Uzbekneftegaz and its affiliates. Figure 4 shows estimated production since 2015, as reported in the BP Statistical Review; Lukoil's reported output; and the author's estimate of output by other companies.

[37] IMF (May 2019), Republic of Uzbekistan: 2019 Article IV consultation, Washington: IMF Country Report 19/129, 4-7 and 50; IMF press release on the consultation, 9 May 2019; IMF (17 May 2019), Lagarde, C., 'Uzbekistan's reforms: a new equation for inclusive growth and cooperation' (speech); NefteCompass, 'Uzbekistan adjusts mindset, works to attract investors', 26 September 2019

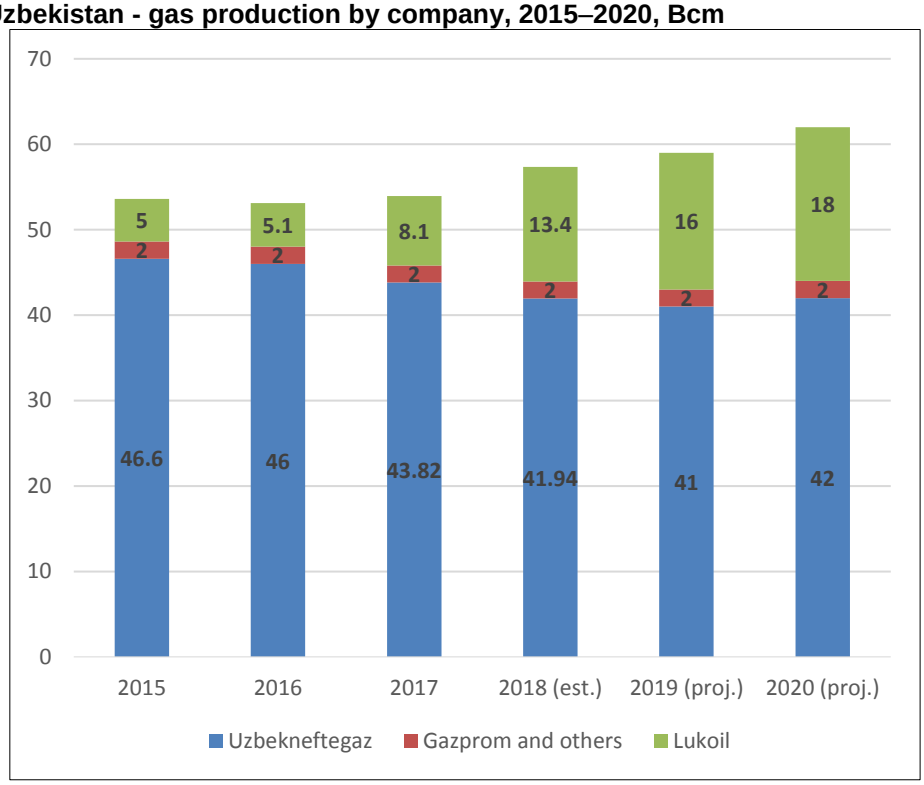
[38] Postanovlenie prezidenta Respubliki Uzbekistan no. PP-4388, 'O merakh go stabil'nomu obespecheniiu ekonomiki i naseleniia energoresursami [...]'. The decree refers repeatedly to the Conception for Development of the Oil and Gas Sector to 2030 [Kontseptsiia razvitiia neftegazovoi otrasli Respubliki Uzbekistan do 2030 goda], to which the author has not had access. See also media reports e.g. Tashkent Times, 'Shavkat Mirziyoyev signs decree reforming oil & gas sector', 10 July 2019, https://tashkenttimes.uz/economy/4113-shavkat-mirziyoyev-signs-decree-reforming-oil-gas-sector; Natural Gas World, 'Uzbekistan to shake up gas sector', 11 July 2019

[39] Tashkent Times, 'Uztransgaz deputy chief sacked due to huge debt to Lukoil', 6 April 2019; Natural Gas World, 'Uzbek president sounds alarm on bribes', 24 June 2019; Sputnik Uzbekistan, 'V dvukh krupnikh neftegazovykh kompaniakh Uzbekistana pomenialos' rukovodstvo', 24 June 2019

[40] Natural Gas World, 'Uzbekneftegaz set to split', 16 May 2019

[41] Pirani, S. (2012). Central Asian and Caspian Gas, p. 14

Figure 4: Uzbekistan - gas production by company, 2015–2020, Bcm



Note on sources. Lukoil: output and projections from the company. Gazprom and others: several small fields in western Uzbekistan are operated by Gazprom, its subsidiaries, and other Russian companies, as joint ventures with Uzbekneftegaz (UNG). From press reports and other information in the public domain, the author estimates the following levels of non-Uzbekneftegaz from these projects, with the total including UNG's share in brackets. Shakhpakhty 0.2 (0.5); Kokdumalak 1 (4), Gissarneftegaz 0.8 (4), Natural Gas Stream 0.5 (1.2), others 0.5. Uzbekneftegaz: calculated by the author, by subtracting non-UNG gas from the total.

Figure 4 suggests that since 2015, Uzbekneftegaz's production has fallen each year, and that Lukoil has been the main source of incremental production. This trend will continue at least until 2020, when Lukoil expects to produce 18 Bcm. Uzbekneftegaz's output is not reported, but is estimated by the author to be currently about 41 Bcm/year. President Mirziyoyev's decree requires Uzbekneftegaz to raise gas output to 42.3 Bcm, and liquefied gas output to 1.5 million tonnes, by 2024: clearly, Mirziyoyev and his advisers do not expect the turnaround to be easy.

One problem the reform drive will have to address is that most of Uzbekneftegaz's output comes from a large number of small fields, mostly in the Bukhara-Khiva region in south-west Uzbekistan, that are in decline. Mirziyoyev's decree calls for an intensification of exploration and development: this is being undertaken in the first place by a range of joint ventures in which Uzbekneftegaz works with international partners. Most of these are working on fields in Karakalpakstan, the westernmost province, including in the Ustyurt region. Efforts are also continuing to enhance production from, and slow the decline of, fields first developed in the 1970s and 1980s. Uzbekneftegaz does not publish reports on its operations, but the media has this year reported some development work in Ustyurt, including the discovery of what may be a very large gas field, and first gas from both the Uchtep and Aralyq fields.[42] More information is available on Uzbekneftegaz's joint activity with foreign partners, as follows.[43]

[42]Sputnik Uzbekistan, 'Uzbekneftegaz poluchil novyi promyshlennyi pritok prirodnogo gaza', 7 April 2019; *Tashkent Times*, 'Gigantic gas field discovered in Ustyurt',28 June 2019

[43]For a more detailed, but now somewhat out of date, survey, see: Pirani, S. (2012). *Central Asian and Caspian Gas Production*, 31-38

Lukoil

Lukoil's highly successful strategy in Uzbekistan has differed from other companies. It entered the country as an upstream investor focused on developing exports to China. This contrasted with Gazprom, which has worked on a series of small fields in which it had interests, in western Uzbekistan, close to the export pipelines to Russia. Unlike Lukoil, Gazprom has limited itself to minority holdings, often through partly-owned subsidiaries.

Lukoil's strategy, of investing heavily in its two PSAs in Uzbekistan – at Kandym and South Gissar – as a means of opening up east Asian markets, is now paying off. In 2017 Lukoil launched a 4.4 Bcm/year gas treatment facility at the Gissar complex, which has six fields, lifting production capacity to its designed 5 Bcm/year. In 2018, six months ahead of schedule, it launched phase two of an 8 Bcm/year gas processing complex at Kandym, which removes sulphur from high-sulphur gas to produce sales gas, stable gas condensate and marketable sulphur.[44]

Lukoil had targeted 15 Bcm of gas output in Uzbekistan by 2020, but will comfortably exceed that: its production shot up to 8.1 Bcm in 2017 and 13.4 Bcm in 2018, with revised projections of 16 Bcm in 2019 and 18 Bcm in 2020. In 2018, Uzbekistan accounted for 39.5 per cent of Lukoil Group's total international gas output, and 84.3 per cent of its gas output outside Russia.[45] In October 2018 Lukoil and Uzbekneftegaz signed an agreement to start joint exploration in early 2020 of three new blocks in Karakalpakstan, covering a 45 sq km area.[46]

Gazprom and other Russian partners

Gazprom entered the Uzbek upstream in 2004, via participation in a PSA with Uzbekneftegaz covering the Shakhpakhty field in the Ustyurt region, and holdings in other smaller projects in that region. The fields in Ustyurt supply the Central Asia-Centre pipeline to Russia, and Gazprom has imported to Russia both its own gas, and gas produced there that it has purchased from Uzbekneftegaz.[47]

After the 2008-09 international economic crisis, Gazprom rationalised its gas portfolio and cut all Central Asian imports. Its gas purchases from Uzbekistan fell from 8-9 Bcm/year in 2010-11, to 3-6 Bcm/year from 2014 onwards. In 2017, after the accession of President Mirziyoyev, Gazprom renewed its strategic partnership agreement with Uzbekneftegaz. Two upstream deals followed. In May 2018, Gazprom and Uzbekneftegaz signed a Supplementary Agreement no. 2 to the Shakhpakhty PSA, providing for follow-up development and for production to continue until 2024.[48] Another 25-year PSA, covering the Djel field in the Shakhpakhty area, was signed between Gazprom EP International and Uzbekistan in October 2018. Gazprom plans to start production at Djel in 2021 with projected output of 0.15 Bcm/year, rising to 0.3 Bcm/year from 2025.[49]

Gazprom is also a partner in Natural Gas Stream, a joint venture that earlier this year announced $700 million of investment in the development of the Urga, Akchalak and Chandir fields in Ustyurt, construction of processing capacity, and exploration of the Sechankul, Oqjar and Chimboy investment blocks. The Urga and Akchalak blocks were previously licenced under PSAs to Petronas of Malaysia,

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[44] Lukoil *2018 Annual Report*, 20-21; *Argus FSU Energy*, 'Uzbekistan lifts gas production', 12 April 2018
[45] Lukoil *2018 Annual Report*, 50; *Argus FSU Energy*, 'Lukoil committed to Uzbek investment', 2 May 2019
[46] *Argus FSU Energy*, 'Lukoil plans exploration in Uzbekistan', 21 March 2019; *Argus FSU Energy*, 'Lukoil committed to Uzbek investment', 2 May 2019. No reserves estimates were given for these blocks
[47] Pirani, S. (2012). *Central Asian and Caspian Gas*, 37 and 119
[48] Gazprom press release, 'Gazprom and Uzbekneftegaz review ongoing development of Shakhpakhty field', 6 July 2018. The field is operated by a consortium of Gazprom International and Gas Project Development Central Asia AG (Switzerland). See Gazprom web site, 'Uzbekistan' page <https://www.gazprom.com/projects/uzbekistan/> and Gazprom International web site, 'Uzbekistan' page <http://www.gazprom-international.com/en/operations/country/uzbekistan>
[49] Gazprom *2018 Annual Report*, 99; *Tashkent Times*, 'Common terms of PSA with Gazprom approved', 4 July 2019

but the company pulled out of these in 2014.[50] The design capacity of Natural Gas Stream's project is annual production of 1.66 Bcm of natural gas, 94,500 tonnes of gas condensate and 80,000 tonnes of liquids (gasoline, kerosene and LPG). Along with Gazprom, the joint venture's owners are Altmax Holding of Switzerland and the Uzbek companies Uzbekneftegaz, Mubarekneftegaz and Ustyurt gas.[51] It is reported that the government has not only approved the investment programme, but also a sales arrangement, presumably to Russia, under which Natural Gas Stream will sell 1.4 Bcm in 2019 for an export-netback price of $185/mcm.[52]

Another Gazprom-related consortium, Surkhan Gas Chemical Operating Company, started exploration drilling in the Surkhandarya province in April 2019 under a PSA, signed in April 2017. The owners are Gas Project Development (GPD) Central Asia (a subsidiary of Gazprom International), Altmax Holding and Uzneftegazdobycha. As well as field development, the project envisages the construction of petrochemicals capacity.[53] GPD Central Asia also retains interests in the Kokdumalak-gaz and Gissarneftegaz joint ventures in Kashkardaryinskoe region: their joint gas output is estimated at 4-8 Bcm/year, with 350,000 tpa of liquids.[54]

Chinese National Oil Development Corporation

China National Oil Development Corporation (CNODC, a subsidiary of CNPC) signed an agreement with Uzbekneftegaz under which CNPC Silk Road Group undertook exploration at five investment blocks in Ustyurt, Bukhara-Khiva and Fergana regions. As a result, three gas condensate fields (Dengizkul, Khojadavlat and Sharky Alat) were discovered on the Karakul block in Bukhara. In 2017, after discussions between President Mirziyoyev's administration and CNPC, financing of development was completed and drilling started both at Dengizkul and at the Mingbulak oil field in the Fergana basin, where the licence is held by a CNPC-Uzbekneftegaz joint venture.[55]

Western partners

This year some western companies have started working in Uzbekistan. Epsilon Development Company of USA is carrying out exploration work at the Kultak-Kamashi, Mubarek, Surkhan, Ashibulak, Koskudyk and West Fergana investment blocks.[56] On the Kultak-Kamashi block, first gas influx from the Talimarjan field was reported, and the company announced it expects to produce 1-1.25 mcm/day.[57] In May, Uzbekneftegaz signed an agreement with BP and Socar of Azerbaijan, providing for the assessment of the exploration potential of three blocks in Ustyurt.[58]

The domestic market

President Mirziyoyev's reform plan for the energy sector included a call for greater efficiency in domestic gas consumption, leading to some minimal price increases for residential consumers. Upgrades in the electricity sector, which is a major consumer, and of transport infrastructure, will probably register much more significant gains in terms of reduced consumption.

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[50] Interfax, 'Petronas completes withdrawal from Uzbek PSAs', 7 May 2014

[51] Rogtec, 'Gazprom, Uzbekneftegaz to invest $700 million', 20 June 2019; Natural Gas World, 'Gazprom JV to invest upstream in Uzbekistan', 20 June 2019

[52] Podrobno.uz, 'Uzbekistan nameren privlech' kredit, 16 May 2019, <https://podrobno.uz/cat/economic/sp-dochki-gazproma-v-uzbekistane-namereno/>

[53] *Tashkent Times*, 'SGCOC commences exploration drilling in Surkhandraya', 9 April 2019

[54] Author's estimate based on of available information. Sputnik News, 'Dochka Gazprombanka realizovala dva proekta', 19 December 2017, <https://tj.sputniknews.ru/asia/20161219/1021336021.html>; Sputnik News, 'Dochernaiaia kompania GPB vypolnit dva neftegazovykh proekta', 11 March 2015; Pirani, S. (2012). *Central Asian and Caspian Gas*, 119

[55] *Tashkent Times*, 'Uzbekistan-China JV New Sil Road Oil and Gas commences drilling', 1 June 2017; *Azernews*, Issues of supply of Uzbek gas to China discussed', 19 Sept 2018

[56] Epsilon Development Company website, <http://www.epsilon-development.com/en/>

[57] *Tashkent Times*, 'Epsilon Development produces first gas from Talimjaran field', 14 March 2019; *Tashkent Times,* 'Epsilon Development increases production to 1.25 million cubic metres daily', 2 April 2019

[58] Uzbekneftegaz press release 19 May 2019, 'Azerbaidzhanskaia Socar i Britanskaia BP vkhodiat na neftegazovyi rynok Uzbekistana'

The president's decree had required 'reduction of losses of gas during its supply to consumers'. It was followed by a government resolution in November last year, increasing prices per cubic metre from 290 soms to 320 soms ($39), to be followed by a further increase to 350 soms ($42.70) in July this year. Electricity prices were also increased, by about 9.6 per cent. There is, however, no indication that Uzbekistan is moving away from controlled energy prices, with the IEA estimating energy subsidies to consumers in 2017 at 12 per cent of GDP ($3.8 billion for gas and $1.3 billion for electricity[59]).

Demand reductions may well result from a modernisation programme in the electricity sector. The 3.2 GW Syrdaryinskaya heat and power plant, the country's largest thermal plant, is being upgraded by Silovye Mashiny of Russia. Mitsubishi Hitachi Power Systems of Japan has signed a memorandum of understanding to carry out maintenance work on three other gas-fired power stations.[60] The presidential decree also calls for energy efficiency measures at household level, including installation of solar panels and supply by state firms of modern appliances (e.g. cookers) to replace old, inefficient ones.

Uzbekistan, like Turkmenistan, has sought to develop petrochemicals capacity using gas as feedstock, to provide another means of obtaining value from gas that is hard to export. In the aftermath of the 2008 financial crisis, this strategy suffered setbacks as foreign investors shied away from large-scale investments that had been under discussion. But in recent years Uzbekistan has registered two major successes, by commissioning the Ustyurt (2015) and Kandym (2018) gas processing complexes, and added further petrochemicals capacity to the older Shurtan and Mubarek gas processing plants. Plans for the gigantic Shurtan gas-to-liquids plant have been revived and a substantial finance package is in place.

The Ustyurt gas chemical complex cost $3.9 billion to build and is operated by an Uzbek-Korean consortium comprising Uzbekneftegaz (50%) and Uz-Kor Gas Chemical (50%); the latter is owned by Korea Gas Corporation (45%), Honam Petrochemical (45%) and STC Energy (10%). The feedstock is supplied from the Surgil field, also operated by the consortium, and Uzbekneftegaz's own East and North Berdakh fields. The complex processes 4.5 Bcm/year of high-sulphur gas; its annual output includes 387,000 tonnes of polyethylene, 83,000 tonnes of polypropylene, 102,000 tonnes of pyrolysis distillate and other byproducts.[61] The Kandym complex, commissioned in April 2018 (see *Production*, above), takes 8.1 Bcm/year of high-sulphur gas as feedstock. Its output includes 7.9 Bcm of purified natural gas, 134,000 tonnes of condensate and 213,000 tonnes of sulphur.[62]

At the Shurtan gas processing plant, which was commissioned in 2001, an expansion programme was launched in 2017, to increase polyethylene output from 125,000 tpa to 200,000 tpa, and to start 100,000 tpa of polypropylene production. Chicago Bridge & Iron Company (CB&I) of the US has been contracted to build an ethylene complex, including a polyproylene unit, using its proprietary technology.[63] The Mubarek plant, built in Soviet times, has three units that produce a propane-butane mixture and 260,000 tonnes/year of LPG capacity, but plans to add petrochemicals production have not borne fruit.[64]

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[59]Natural Gas World, 'Uzbekistan cuts fuel subsidies', 5 November 2018

[60] Nuz.uz, 'K modernizatsii krupneishei elektrostantskii Uzbekistana', 28 June 2019, <https://nuz.uz/ekonomika-i-finansy/41565-k-modernizacii-krupneyshey-elektrostancii-uzbekistana-mogut-privlech-chastnikov.html>; Natural Gas World, 'Mitsubishi to maintain Uzbek power plants', 18 July 2019

[61]Uz-Kor Chemical website, <http://uz-kor.com/index.php/en/activity>; Sultanov, A. Doklad predsedatel'ia pravleniia AO 'Uzbekneftegaz', 1 May 2017

[62] Lukoil *Annual Report 2018*, 20-21; *Argus FSU Energy*, 'Lukoil committed to Uzbek investment', 2 May 2019

[63]World of Chemicals website, 'CB&I bags multi-technology contract in Uzbekistan', 29 June 2017 <https://www.worldofchemicals.com/media/cbi-bags-multi-technology-contract-in-uzbekistan/11736.html>

[64]UNG Muborek GPiZ website, mgpz.uz/; *Tashkent Times*, Government to implement Mubarek GPP modernization project, 11 Dec 2018

In December 2018, Uzbekistan's most ambitious project, for a gas-to-liquids plant near to the gas processing plant at Shurtan, secured $2.3 billion in finance from a consortium of Japanese, Korean and Russian banks. The plant, recently renamed Oltin Yo'l GTL, is expected to process 3.6 Bcm/year of gas; annual output would include 1.5 million tonnes of high-quality fuel at Euro-5 standard, including 743,000 tonnes of diesel, 311,000 tonnes of aviation kerosene, 431,000 tonnes of naptha and 21,000 tonnes of LPG. It is projected to be commissioned in 2020.[65] A consortium, set up in 2008 to undertake the project, of Uzbekneftegaz (44.5%), Sasol of South Africa (44.5%) and Petronas commissioned studies, but work was delayed for the best part of a decade. As of this year, Uzbekneftegaz is the sole shareholder in the project company, and Sasol the licensor of GTL technology.[66] Uzbekistan, despite having some oil fields, remains short of oil and oil products, and the GTL plant is expected to substitute for some imports.[67]

In addition to these projects, in recent years there have been a spate of announcements about other possible petrochemicals plants. Lukoil CEO, Vagit Alekperov, said in 2017 that the company was considering further gas development for petrochemicals production in Uzbekistan. Uzbekneftegaz executives have referred to possibilities including gas-based petrochemical production at Surkhan (see *Production*, above), and a joint venture with the chemicals company Uzkimyosanoat using methanol-to-olefins technology. Uzkimyosanoat has mooted plans for new fertiliser production capacity, including in a joint venture with Samsung.[68]

Whether these substantial petrochemicals investments will bear fruit is unclear. Compared to Turkmenistan, Uzbekistan is short of gas, and during the 2020s will be constantly faced with tension between raising exports, especially to China, and supplying the domestic market. The lack of price reform, and prevalence of inefficient consumption practices, exacerbates this problem – although, if reforms *are* undertaken, domestic consumption may fall, freeing up new resources. In any case, it remains to be seen (i) how sufficient gas volumes will be made available for a large-scale petrochemicals sector, and (ii) whether this use of gas is economically effective for Uzbekistan, given the volatility and potential oversupply of petrochemical markets, mentioned above (under *Turkmenistan: Domestic market*).

Exports

Uzbekistan's gas export strategy, like Turkmenistan's, prioritises growing sales to China. Uzbekistan started exporting small volumes to China in 2014. The volume rose to 4.3 Bcm in 2016, fell to 3.5 Bcm in 2017 and reached 6.5 Bcm in 2018. There is no public information on how the export volumes are split between Uzbekneftegaz and Lukoil.

Agreements with China provide for Uzbekistan to use 10 Bcm/year of capacity in Line C of the Central Asia-China pipeline corridor. From China's point of view, Uzbek supplies help to minimise dependence on Turkmenistan, and, presumably, the constraint on raising exports to this level is on the supply side. Uzbekistan is struggling to arrest the decline of its gas fields and to reduce inefficient domestic consumption, as discussed above. Uzbek exports to Kyrgyzstan apparently ceased in 2013, representing a saving of 0.2 Bcm/year, but the supply gap is larger than that. Exports to south-eastern Kazakhstan, of 1.5-4 Bcm/year in recent years, are likely to be reduced during the 2020s, and

[65] Sultanov, A. Doklad predsedatel'ia pravleniia AO 'Uzbekneftegaz', 1 May 2017 (Uzbekneftegaz website); UzDaily, 'Uzbekistan attracts $2.3 billion', 15 December 2018, <https://www.uzdaily.uz/en/post/46996>; Uzbekneftegaz press release, 'GTL project loan providers held meeting in Tashkent', 31 October 2018; *Tashkent Times*, 'Russian companies to take part in Uzbekistan GTL plant construction', 4 October 2017

[66] Oltin Yo'L GTL website

[67] *Ritm Evrazii*, 'Neftianoe istoshchenie Uzbekistana', 7 April 2019, https://www.ritmeurasia.org/news—2019-04-07—neftjanoe-istoschenie-uzbekistana-npz-est-syrja-nedostaet-42036; Pirani, S. (2012) *Central Asian and Caspian Gas*, 60

[68] *Argus FSU Energy*, 'Lukoil plans exploration in Uzbekistan', 21 March 2019; *Tashkent Times*, 'Air Products, Uzbekneftegaz and Uzkimyosanoat to draft gas chemical complex project', 16 May 2019; *Tashkent Times*, 'Uzkimyosanoat, Samsung Engineering to build carbamide and urea plant', 20 February 2019

Kazakhstan will supply these areas either with its own gas or with Turkmen volumes. (See *Kazakhstan: domestic consumption*, below.)

In the case of exports to Russia, there are demand constraints. Export volumes to Russia fell every year between 2010 and 2015, from 11.4 Bcm in 2010 to 3.5 Bcm in 2015. They then revived, averaging 4.5 Bcm in 2016–2018. In 2017, Gazprom and Uzbekneftegaz signed a contract providing for 4 Bcm/year of purchases by Gazprom in 2018-22, at the same time as agreeing on the upstream projects mentioned above.[69] Uzbekistan faces the same limits as Turkmenistan and Kazakhstan to its gas exports to Russia: they are not competitive, and realistically can only become so in areas of southern Russia that are closer to central Asian supply sources than to the western Siberian gas fields. It is likely, therefore, that they have found a level at which they may remain during the 2020s.

Conclusions

Uzbekistan's gas exports will always be constrained by its unfavourable geographical position. During the 2020s it should be able to raise its exports to China to 10 Bcm/year; its exports to Russia may also be maintained at the level agreed in 2018, of 4 Bcm/year. Exports to Kazakhstan will probably fall to zero. (For estimated projections, see Table 8, in *Prospects for exports in the 2020s*, below.) Uzbekistan's petrochemicals sector could become a source of incremental demand. Apart from this, the domestic economy, which buys gas at steeply subsidised prices and consumes it inefficiently, provides opportunities for efficiency savings that should result in lower consumption. Uzbekistan's large land area and climate makes it suitable for raising wind and solar power output, which could cut into gas consumption by the electricity sector, currently the largest consumer.

3. Kazakhstan

Introduction

The constraints placed on gas exports by domestic uses, described above with regard to Uzbekistan, are even greater for Kazakhstan. In 2018, Kazakhstan's exports reached a record high level of 18.4 Bcm, mainly because it raised deliveries to China to 5.8 Bcm. In the same year, domestic consumption was 22.6 Bcm, up from around 10 Bcm a decade earlier. (Of that 22.6 Bcm, 15.1 Bcm was end-of-pipe consumption, that is, gas that reaches final consumers. The end-of-pipe number excludes gas used by the energy sector, fuel gas for pipelines, net storage increases and other losses, categorised as 'other consumption' in government statistics.) A little under a third of Kazakhstan's domestic consumption (7.7 Bcm in 2018) is imported from Russia, Turkmenistan and Uzbekistan, to supply areas that are distant from, or even unconnected to, Kazakhstan's own gas resources. The gas balance is shown in Table 4.

Despite projecting higher domestic demand in the 2020s – due to ongoing gasification, switching from coal for power generation, and petrochemicals development – the Kazakh government does not expect gas production to rise substantially. This is despite, or rather, because, Kazakhstan is a major oil producer. Most of its gas is associated with oil, and large volumes – 13 Bcm in 2018 – are reinjected into oil reservoirs to raise oil output rates. Reinjection rates, as well as domestic consumption, are expected to increase in the 2020s, leaving lower volumes to export. Net gas exports could fall to around 1 Bcm by 2030. The implications of this are (i) that while Kazakhstan has agreed with China on up to 10 Bcm/year of exports, this arrangement expires in 2023, as sufficient gas is not expected to be available after that; (ii) Kazakhstan's exports to Russia could also be cut substantially; and (iii) given that imports from Uzbekistan will probably fall, Kazakhstan may need to seek Turkmen imports to supplement its gas balance.

[69]Gazprom press release, 'Gazprom and Uzbekneftegaz sign agreement of strategic cooperation', 2 June 2017

Table 4: Kazakhstan's gas balance, 2010–2018

Bcm	2010	2011	2012	2013	2014	2015	2016	2017	2018
*Production (prior to reinjection and flaring) **	*37.3*	*39.5*	*40.1*	*42.4*	*43.2*	*45.3*	*46.4*	*52.9*	*46.3*
*Reinjected & flared**	*18.7*	*21.0*	*18.9*	*19.6*	*21.9*	*12.3*	*11.4*	*13.4*	*13.0*
Production (sales gas)	**18.6**	**18.5**	**21.2**	**22.8**	**21.3**	**21.3**	**28.5**	**31.6**	**33.3**
Import	**4.5**	**3.7**	**3.7**	**4.7**	**6.1**	**5.7**	**6**	**6.3**	**7.7**
From Russia	2.0	1	1	0.7	1.4	1.8	2.8	3.1	3.3
From Turkmenistan	0	0.3	0	0.3	1	1	1.3	1.5	1.5
From Uzbekistan	2.5	2.4	2.7	3.7	3.7	2.9	1.9	1.7	2.9
Total gas balance	**23.1**	**22.2**	**24.9**	**27.5**	**27.4**	**27.0**	**34.5**	**37.9**	**41**
Total domestic consumption	**10.4**	**10.0**	**12.9**	**15.1**	**15.9**	**13.8**	**21.1**	**22.7**	**22.6**
Domestic consumption (end of pipe) **	10.4	10.0	10.5	10.9	12.5	12.1	13.1	13.8	15.1
Other consumption***	0	0	2.4	4.2	3.4	1.7	8.0	8.9	7.5
Export (total)	**12.7**	**12.2**	**12.0**	**12.5**	**11.5**	**13.2**	**13.4**	**15.2**	**18.4**
To/through Russia	12.4	11.9	11.6	11.9	10.9	12.6	12.7	13.8	12.3
To Kyrgyzstan****	0.30	0.33	0.43	0.40	0.23	0.23	0.27	0.30	0.30
To China	0	0	0	0.2	0.4	0.4	0.4	1.1	5.8

* Most gas is associated with oil, and large volumes are reinjected for oil production purposes. These rows are included to illustrate the importance of this factor for Kazakh gas production

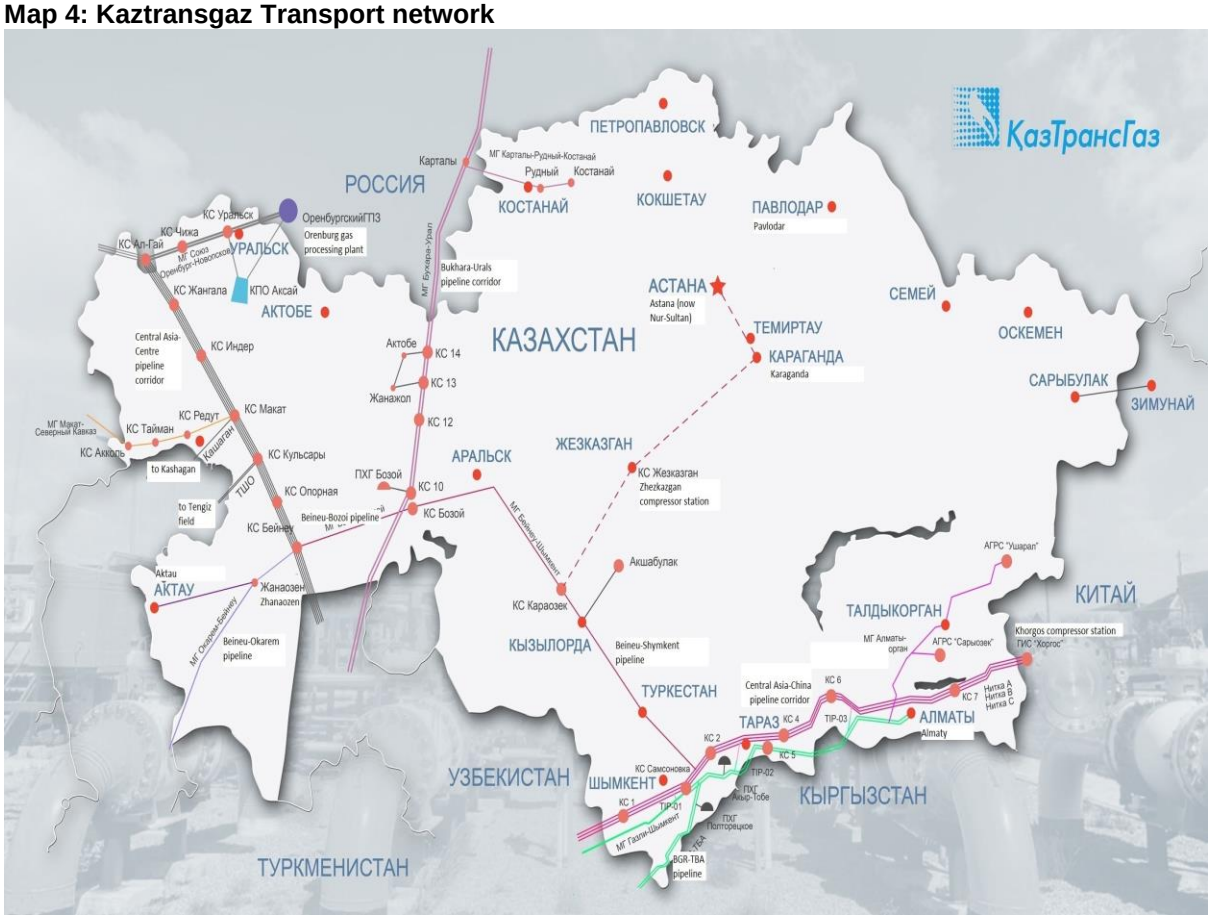
** End-of-pipe consumption is the total volumes that reach consumers, as reported by Kaztransgaz and Kazmunaigaz

*** The row "other consumption" is described by Kazenergy as "domestic disappearance, including field use (including for on-site power generation) and processing losses, pipeline use, changes in stocks, etc" (see Kazenergy, the National Energy Report 2017, p. 111). I have arrived at my estimates for this by subtracting end-of-pipe consumption from total domestic consumption

**** The exports to Kyrgyzstan include Kazakh gas bought by Gazprom and supplied to Kyrgyzstan, plus small residual volumes (all less than 0.2 bcm in any year) that are on Kyrgyzstan's gas balance and are presumed to be imported from Kazakhstan

Sources: Kazakh statistical agency, energy ministry, Kaztransgaz, Kazenergy, author's estimates. For details see appendix

Map 4: Kaztransgaz Transport network



Source: Kaztransgaz. English labels of key items added by author

Political and economic context

Kazakhstan is fundamentally an oil-exporting economy, whose government has developed a strong working relationship with the international oil companies. In both these respects it differs from Turkmenistan and Uzbekistan. The government's economic strategy is centred on raising oil exports further, although this will probably make economic development still more one-sided, as well as contradicting internationally agreed climate targets. The importance of oil means that gas has a secondary position in the energy sector, also in contrast to Turkmenistan and Uzbekistan. Most gas is produced at the three giant oil production projects (Tengiz, Karachaganak and Kashagan), and gas production is constrained by the large-scale reinjection of gas into oil reservoirs to enhance output. The operators of Kazakhstan's three big oil projects, which produce most of its gas, intend to increase reinjection rates in the 2020s. Barring a dramatic change in the ratio of oil and gas prices, and the comparative costs, this will continue to be economically logical.

The role of gas in Kazakhstan's economy has grown over the past decade, and will probably continue to grow through the 2020s, due to government policy favouring gasification, switching some coal-fired electricity generation to gas, and petrochemicals development. A key strategic success was the completion in 2015 of the Beineu-Bozoi-Shymkent (BBS) pipeline, which carries gas from Kazakhstan's producing fields in the west into the Central Asia-China pipeline for export. It also links western supply with the largest centre of population, in the south-east, which previously depended on Uzbek supplies that have become increasingly unreliable in recent years. The Saryarka pipeline, to bring gas to Nur-Sultan (formerly Astana), the Kazakh capital, is nearly completed, after years of delay and hesitation, due largely to its significant cost. This will be the first step to gasification of northern Kazakhstan.

Table 5 shows the projections made in the government's Conception for the Development of the Gas Sector in 2014.[70] It is striking that sales gas production is projected to rise to 24.6 Bcm in 2020, and then *fall* to 22.2 Bcm in 2025 and 21 Bcm in 2030. There is a caveat: actual sales gas volumes in 2016-18 were reported at a much higher level than these projections (in the range of 28-34 Bcm/year), although some of that increase may reflect changes in statistical methods.[71] Nevertheless, it is unlikely that the government of Kazakhstan, like that of any other hydrocarbons-producing country, would publish projections of falling output unless it was very sure that that was the most likely outcome of its policies.

The projections in Table 5 are from the government's 'pragmatic' scenario. The Conception document explains that, in contrast to its 'forced development' scenario, the 'pragmatic' scenario assumes that oil fields will be produced 'without accelerated exhaustion'. The 'pragmatic' scenario suggests that 'together with the expected significant increase in the [gross] volumes of gas produced, up to 2030 the volumes reinjected into the reservoirs will also increase', so that while gross production rises by half, the sales gas volume remains in the range of 21-25 Bcm/year.[72]

Table 5 includes the government's projections of end-of-pipe consumption under its 'realistic' scenario. The author has added his own estimates of the possible level of 'other consumption', which was recorded in 2016-18 at 7.5 Bcm or higher. (See Table 4 above.) 'Other consumption' is described by Kazenergy as 'domestic disappearance, including field use (including for on-site power generation) and processing losses, pipeline use, changes in stocks, and so on'.[73] I have assumed that 'other consumption' will fall steeply, to 2 Bcm/year, that is, that the volumes consumed under this category, recently introduced into the statistics in order to focus on potential savings, can and should be reduced quite substantially. Even making this assumption, though, *net* exports (total exports, minus the volume of imports from Russia, Turkmenistan and Uzbekistan, which were in the range of 6-8 Bcm in recent years), during the 2020s will fall from more than 6 Bcm/year to less than 1 Bcm/year.

Table 5: Kazakhstan government projections of gas output, 2015–2040

Bcm		**2015 (actual)**	**2020**	**2025**	**2030**	**2035**	**2040**
Gross gas production ("pragmatic" scenario)		**44.2**	**62**	**61**	**59.8**	**80.3**	**87.9**
	Reinjection	24	37.4	38.8	38.8	51.9	51.5
	Sales gas	20.2	24.6	22.2	21	28.4	36.4
End-of-pipe consumption ("realistic" scenario)		12.1	16.3	17.6	18.1	21.4	25.6
Other consumption (author's estimate)		*1.7*	*2*	*2*	*2*	*2*	*2*
Net export (author's estimate)		*6.4*	*6.3*	*2.6*	*0.9*	*5*	*8.8*
Note. End-of-pipe consumption = "domestic disappearance, including field use (including for on-site power generation) and processing losses, pipeline use, changes in stocks, etc"							

Source: 'Ob utverzhdenii Kontseptsii razvitiia gazovogo sektora RK do 2030 goda' p 8 and p17

[70]Government of Kazakhstan, 'Kontseptsiia razvitiia gazovogo sektora RK do 2030 goda' (downloadable at <http://energo.gov.kz/index.php?id=1745>), 7-8 and 16-18

[71] In 2016-18, sales gas production as recorded by Kaztransgaz and the energy ministry were in a much higher range of 28-34 Bcm, on average around 9 Bcm higher than in 2012-15. In 2016-18, volumes of 'other consumption', which includes on-field power generation and processing losses, were also in a higher range, on average around 5 Bcm higher than in 2012-15. So at least half the increase in sales gas volumes may only be due to a change in the way that the energy industry's own gas use is treated in the statistics. The numbers used are in Table 4, Kazakhstan's gas balance. A further problem is that no consistent set of statistics is available, and the author compiled Table 4 from a range of sources – the energy ministry, Kaztransgaz, and Kazenergy – and their numbers do not always agree with each other

[72]'Kontseptsiia', p. 8

[73] Kazenergy, *The National Energy Report 2019*, 89-90

The next section on Production refers to some, limited, possibilities of higher output, and the following section on the domestic market reiterates the potential for demand to rise in the 2020s.

Production

The production of sales gas has risen in recent years, mainly due to higher output from the Kashagan project in the Caspian Sea. In 2018 sales gas output was reported of 5.46 Bcm from Kashagan, 9.2 Bcm from Tengiz and 10.3 Bcm from Karachaganak.[74] These three big oil projects accounted for 76 per cent of output; the bulk of the remainder was associated gas from oil fields in western Kazakhstan. Most of these are joint ventures operated by Kazmunaygaz, and output levels are shown in Table 6.

Table 6: Kazakhstan gas production, 2018

	Sales gas output, Bcm	KMG share of asset, %
The three large oil projects		
Tengiz	9.18	20
Karachaganak	10.3	10
Kashagan (North Caspian Operating Company)	5.46	8.44
Other fields		
Ozenmunaigaz + KazGPZ	1.12	50
Mangistaumunaigaz	0.41	50
Kazgermunai	0.41	50
Amangeldy gas	0.34	100
Kazakhoil Aktobe	0.35	50
Embamunaygas	0.15	100
Kazakhturkmunay	0.14	100
PetroKazakhstan	0.21	33
Karazhanbasmunai	0	50
Other (author's estimate)	5.23	
Total	**33.3**	

Source: Kazenergy, *The National Energy Report* 2019, pp 85-86; Kazmunaygaz annual report 2018, p53; author's calculation

The outlook for increased commercial gas production from the big three projects is limited due to the comparative costs of reinjection and gas processing. The associated gas has a high sulphur content, 18-19 per cent at Tengiz and Kashagan:[75] reinjection not only supports higher oil output, but is also cheaper than processing the gas and storing and utilising the sulphur.

[74]Kazenergy, *The National Energy Report 2019*, 85. These figures do not correspond exactly with those in Table 7, extrapolated by the author from Kazmunaygaz's annual report

[75]Kazenergy, *The National Energy Report 2019*, 86-87

Almost all of the incremental gas production from the big three projects is expected at Kashagan. The Kazenergy *National Energy Report* projects gas output there to increase to 9 Bcm in 2035 and 10.5 Bcm in 2040, providing that the project's phase two development goes ahead, and that additional gas processing capacity is installed at the Bolashak plant at which Kashagan gas is processed.[76]

At Tengiz, gross gas extraction will increase under the next stage of development, the Future Growth Project-Wellhead Pressure Management Project (FGP-WPMP), but most of the incremental volumes will be reinjected.[77] At Karachaganak, the Karachaganak Petroleum Operating consortium (KPO) states that the field is using the limit of its gas processing capacity, due to the recent increase in the gas-oil ratio. Between now and the expiry of the PSA in 2037, additional capacity will be added; a segregated gas reinjection compression station is also planned. In October 2018, a long-running dispute between the consortium and the government was settled, with an agreement adjusting the revenue split; this should allow field development to continue as planned.[78]

In the longer term, a series of agreements signed in 2018–19 for exploration in the Kazakh sector of the Caspian Sea could give rise to new gas production. These include agreements between Kazmunaygaz and Lukoil, signed in 2018 for the I-P-2 block and in 2019 for the shallow-water Zhenis block; and an agreement with Eni for the offshore Abay block. The North Caspian Operating Company, the operator of Kashagan, has been in talks with the government about a joint development project for the Kalamkas-More and Khazar fields, and has spent $900 million on exploration work, but in October 2019 relinquished its stake in the consortium; Kazakhstan's deputy energy minister, Murat Zhurebekov, attributed the decision to the 'high capital investment needs and low cost-effectiveness' of the project.[79]

A further possible source of incremental gas production may be the reduction of flaring. Estimates of volumes flared have fallen, thanks to the 2005 subsoil law, which prohibited new projects from flaring gas, and further legislative restrictions passed in 2010. But flaring levels are still high. The World Bank Global Gas Flaring (GGFR) initiative estimates Kazakhstan's total at 3.9 Bcm in 2014, 3.7 Bcm in 2015, 3.2 Bcm in 2016, 2.8 Bcm in 2017 and 2.0 Bcm in 2018. The Kazakh Oil and Gas Information-Analytical Centre's published estimate for 2016, of just over 1 Bcm, is about one third of the World Bank's: this underlines the need for unified methodology and stronger reporting requirements.[80]

Domestic market

For Kazakhstan, in contrast to Turkmenistan and Uzbekistan, gas plays a secondary role to coal in the energy balance. Coal accounted for 43.3 per cent of total primary energy supply in 2016 (the most recent year for which statistics are available); gas for 35.1 per cent; and oil for 22.8 per cent.[81] In the north and east of the country, coal dominates both electricity generation and industrial consumption, and will continue to do so. In the west, where oil and gas production is based, and in the south-east, the energy balance is mixed. Gas consumption is rising: in the last decade, total consumption has more than doubled, to 22.6 Bcm in 2018. (See Table 4 above.) Of this, 15.1 Bcm was end-of-pipe consumption, that went to power generation (50%), residential and commercial users (36%) and industry (14%); 7.5 Bcm was 'other consumption'.[82]

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[76] Kazenergy, *The National Energy Report 2019*, 88

[77] Chevron website, chevron.com, Kazenergy, *The National Energy Report 2017*, 100

[78] KPO website, <http://www.kpo.kz/en/operations/future-development.html>; Interfax, 'Kazakhstan, Karachaganak operator sign agreement on terms of dispute settlement, <http://www.interfax.com/newsinf.asp?id=860821>

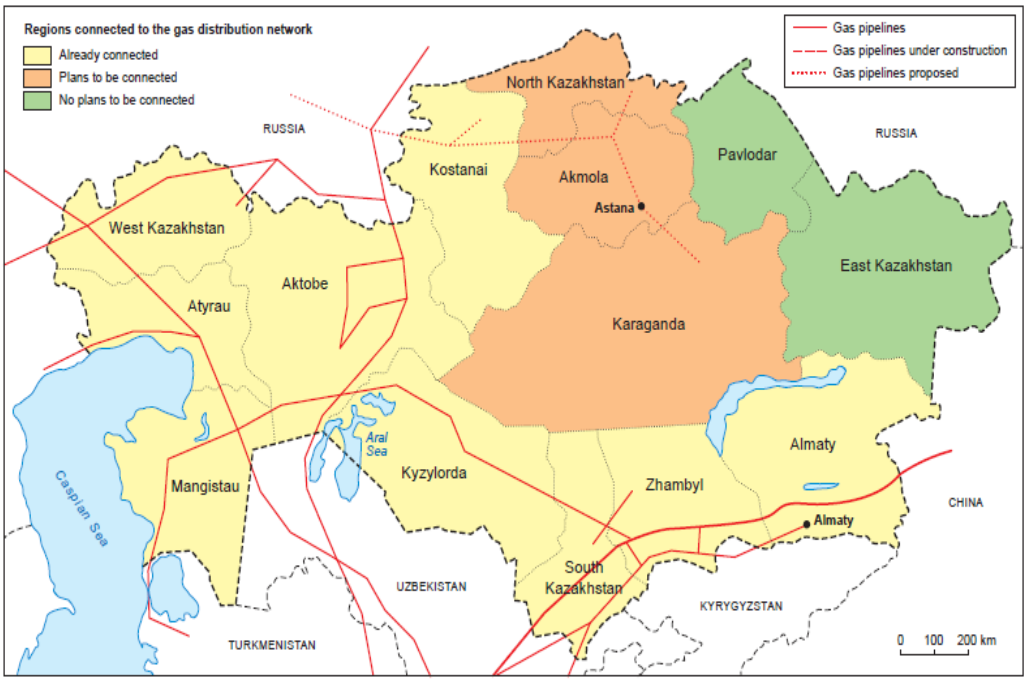
[79] Kazenergy, *The National Energy Report 2019*, 88; *Argus FSU Energy*, 'Lukoil tragets new Kazakh offshore project', 21 March 2019; *Gazette of Central Asia*, 'Investment in Kalamkas project may reach $70 bln', 25 July 2018; *Argus FSU Energy*, 'Second Kashagan' shelved', 17 October 2019

[80] World Bank Global Gas Flaring Reduction initiative web site; Kazenergy, *The National Energy Report 2017*, 133. The GGFR monitors flaring globally using satellite data

[81] IEA, *World Energy Balances* 2018 II.271

[82] Kazenergy, *The National Energy Report 2019*, 89-90 (on sectoral breakdown)

Map 5: Kazakhstan regions and gas pipelines



Source: OIES

Kazakhstan's long-standing programme of gasification has taken significant steps forward in the last five years, with the completion of projects that have reinforced the pipeline network and extended it to new areas. Out of Kazakhstan's 14 regions (oblasts), nine have historically had access to pipeline gas; East Kazakhstan became the tenth in 2015. The Saryarka pipeline, now under construction to the capital Nur-Sultan (Astana), will add an 11th and 12th (Karaganda and Akmola) within the next two years, and a 13th (North Kazakhstan) by the mid-2020s.[83] The notable new pipelines are:

- The Beineu-Bozoi-Shymkent (BBS) line, which brings gas from the western producing regions both to the Central Asia-China line and to consuming regions in the south-east of the country. It will also provide for gasification of previously unconnected regions in eastern Kazakhstan by 2021. The line was commissioned in 2015; in 2016 compressor stations at Bozoy (Aktobe) and Karaozek (Kyzylorda) were added, bringing throughput capacity to 10 Bcm/year; in 2018, the Aral compressor station was commissioned, together with compressor stations numbers 5 and 7 on the Central Asia-China line, bringing capacity in the whole system to 15 Bcm/year.[84]
- The upgrading of pipeline infrastructure in south-east Kazakhstan reduced dependence on Uzbek gas supplies and on transit through Kyrgyzstan. In 2016 Kaztransgaz completed a booster compressor station designed to link the Bukhara-Tashkent-Bishkek-Almaty (BGR-TBA) line, on which south-east Kazakhstan has long relied, to the Central Asia-China line. By 2018 three interconnections between the BGR-TBA line and the Central Asia-China line were completed, which allowed volumes from western Kazakhstan to be delivered to southern regions of Kazakhstan and increased security of supply in the heating season. There has also been substantial investment in distribution networks.[85]

[83]For more detailed information on the regional markets, see Pirani, S. (2012). *Central Asian and Caspian Gas*, 64-70; Kazenergy, *The National Energy Report 2015*, 165-167 and 175-179

[84] Kazenergy, *The National Energy Report 2017*, 109; *Ritm Evrazii*, Transaziatskaia gazovaia 'perezagruzka' Kazakhstana, 15 Dec 2018

[85]Kazenergy, *The National Energy Report 2017*, 109; *Ritm Evrazii*, 'Transaziatskaia gazovaia 'perezagruzka' Kazakhstana', 15 Dec 2018

- Upgrades to pipelines in western Kazakhstan were completed in 2016 to increase flexibility, and specifically a small bypass line between the Orenburg-Novopskov and Central Asia Centre-4 pipelines, which allowed Karachaganak gas coming from Orenburg after processing to flow south on the CAC system without leaving Kazakh territory.
- The 1076 kilometre Saryarka pipeline from the Karaozek compressor station on the BBS line to Nur-Sultan, approved by the government in 2018 is now three-quarters complete. This project effectively replaced an earlier one designed to bring gas from Chelyabinsk in southern Russia to the capital; although the gas would ultimately have been sourced from Karachaganak, this line would have increased dependence on gas transit through Russia. The first phase of construction of the Saryarka line is due to be completed next year; a second phase, to extend the pipeline to Kokshetau, north of Nur-Sultan, by 2023; a third phase will extend it to Petropavlovsk in North Kazakhstan oblast; and a fourth phase in 2028-31 will add compressor stations at Zhezkazgan and Temirtau, raising capacity to 3 Bcm.[86]

Considering Kazakhstan's gas consumption by sector, the largest consumer, and the one with considerable growth potential, is electricity generation. Half of the 'end of pipe' gas consumption goes to electricity generation, but gas accounts for only 19 per cent of electricity generation. Gas dominates thermal power generation in western regions, and coal in the north, while in the south both are used. In 2018, the fuel used by thermal stations was 60.6 per cent coal, 36.9 per cent gas and 2.5 per cent mazut.[87] Given the abundance of cheap coal, and a pricing and regulatory environment that provides no stimulus for switching, the shift from coal to gas may take time, but it is supported by government policy, particularly on environmental grounds. In Nur-Sultan, the municipal authorities plan to switch three power stations to gas when it becomes available via the new pipeline.[88]

Another area of future incremental consumption is the petrochemicals sector. Earlier this year, against a background of improved conditions on world markets for petrochemical products, the government revived a long-standing plan to build a major gas-chemicals complex at Atyrau on the Caspian coast. United Chemical Company, which is wholly owned by Samruk Kazyna, the national sovereign wealth fund, took over the project from Kazmunaygaz in 2018 and started Phase 1 of construction. CB&I of the US have been contracted to project-manage construction of a propane dehydrogenation unit, a polypropylene plant, a 207 kilometre propane pipeline and auxiliary infrastructure. China National Chemical Engineering Co is the contractor for the gas processing and chemicals segment, and the China Development Bank has allocated a $2 billion loan to the project. The gas processing and chemical phases are expected to be operating by May 2021. A 310-MW gas fired power plant is also part of this contract. The complex will be supplied with associated gas from Tengiz.[89] A second phase, planned for completion in 2023, will add 0.5 metric tonnes per annum (MTPA) of polypropylene and 1.25 MTPA of polyethylene production capacity.[90]

The caveats mentioned with respect to petrochemicals capacity in Turkmenistan and Uzbekistan apply to Kazakhstan as well – all the more so, since it will evidently require net imports for much of the 2020s. The economics of constructing petrochemical capacity requiring imported gas feedstock must be questionable.

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[86] *Ritm Evrazii,* 'Dolgie versty 'Saryarky'', 19 August 2019; Oilcapital.ru, 'Uzhe postroeno 796.6 km gazoprovoda', 20 August 2019; Kazenergy, *The National Energy Report 2017*, 113-4

[87] Kazenergy, *The National Energy Report* 2019, 90

[88] *Interfax Natural Gas daily*, 'Astana to switch three power plants', 6 April 2018

[89] http://www.kpi.kz/ru, 'Kazakhstan revives Atyrau integrated petchem complex'; *Natural Gas World*, 'Kazakhstan ramps up gas-fired power, petchems' 5 August 2019; *Oil & Gas Journal*, Kazakhstan revives Atyrau integrated petchem complex', 11 Dec 2017

[90] *Natural Gas World*, 'Kazakhstan ramps up gas-fired power, petchems', 5 August 2019

Exports

Volumes exported to China rose, after the completion of the Beineu-Shymkent pipeline, from 0.4 Bcm/year in 2014-16, to 1.1 Bcm in 2017 and up sharply to 5.8 Bcm in 2018. In October 2018, Kaztransgaz and PetroChina International signed a contract providing for up to 10 Bcm/year of exports in the five-year period 2019-23. This appears to be in recognition of the fact that after that date, exports to China will fall again.[91] Kazakhstan's other main export trade, to Russia, has been consistent since Soviet times. About 12 Bcm/year is supplied from the Karachaganak field to the Orenburg processing plant in Russia.

The government forecast that total sales gas output will fall during the 2020s has been discussed above. With domestic consumption rising, albeit slowly, less volume will therefore be available for export. As Table 5 shows, the government's projections for sales gas volumes, and the level of end-of-pipe consumption, in 2025 and 2030, suggest that – even if 'other consumption' is reduced to below half of its current level to around 2 Bcm/year – *net* exports will fall during the 2020s to less than 1 Bcm/year. The implications are that: (i) exports to China will fall quite sharply after 2023; (ii) exports to Russia, which have long been in the range of 10-12 Bcm/year, will also fall; and (iii) Kazakhstan may negotiate its gas shortfall during the 2020s more effectively by increasing its imports from Turkmenistan.[92] Imports along the eastern route, which have increasingly been substituting those from Uzbekistan in recent years, may continue to rise; gas could also be imported from Turkmenistan to western Kazakhstan, using existing infrastructure.

Attention is drawn to the projections in Table 8, below. These assume that exports to Russia will fall to 4 Bcm/year, about one-third of their current level, by the late 2020s; even in this case, some additional volumes from Turkmenistan would be required for Kazakhstan's gas balance. Whether such integration of the Central Asian market is possible will depend on how the commercial and political relationships between its states evolve during the 2020s.

4. Kyrgyzstan and Tajikistan

Kyrgyzstan, whose energy balance is dominated by coal, imports pipeline gas from Kazakhstan and this trade is growing. Kyrgyzstan's national gas company has been acquired by Gazprom; it is investing in gasification and seeking to grow its market at coal's expense. Tajikistan, where the energy balance is dominated by hydro, with some coal, consumes very small quantities of gas that it produces itself, and is now reported to be importing small volumes from Uzbekistan. Through the 2010s, a major factor hindering the gas sector in both Kyrgyzstan and Tajikistan has been the difficulty of sourcing Uzbek imports. Both countries had imported Uzbek gas since Soviet times, but these became increasingly unreliable during the 2000s, and stopped all together in the early 2010s. The upgrading of a pipeline connection from Kazakhstan provided an alternative source of gas for Kyrgyzstan. For the 2020s, the governments of both countries see opportunities for expanding their domestic gas sectors in the planned Line D of the Central Asia-China pipeline corridor, which would give them access to Turkmen volumes. The available information about their gas balances is in Table 7.

[91] Kaztransgaz press release, 'Kaztransgaz narashchivaet eksport', 12 October 2018 http://kaztransgas.kz/index.php/ru/press-tsentr/novosti-kompanii/1469-kaztransgaz-narashchivaet-eksport-gaza-v-kitaj; Kazenergy, *The National Energy Report 2019*, 95-96

[92] The author's projections are in the same range as those of IHS Markit, which assumes that total exports will shrink to about 7 Bcm in 2025, and rise again to 15 Bcm in 2040; Kazenergy, *The National Energy Report 2017*, 115

Table 7: Kyrgyzstan and Tajikistan gas balances, 2010–2018

		2010	2011	2012	2013	2014	2015	2016	2017	2018
Kyrgyzstan gas balance, Bcm										
Production		**0.023**	**0.027**	**0.029**	**0.033**	**0.032**	**0.032**	**0.029**	**0.03**	**0.03**
Imports		**0.272**	**0.305**	**0.396**	**0.293**	**0.237**	**0.244**	**0.259**	**0.3**	**0.3**
	From Kazakhstan*	0.3	0.33	0.425	0.4	*0.23*	*0.226*	*0.268*	*0.3*	*0.3*
	From Uzbekistan	0	0	0	0	*0.04*	*0.02*	*0.02*	*0.02*	*0.02*
Total gas balance		**0.295**	**0.332**	**0.425**	**0.326**	**0.269**	**0.276**	**0.288**	**0.33**	**0.33**
Consumption		**0.295**	**0.332**	**0.425**	**0.326**	**0.269**	**0.276**	**0.288**	**0.33**	**0.33**
Tajikistan gas balance, Bcm										
Production		**0.023**	**0.019**	**0.011**	**0.004**	**0.003**	**0.004**	**0.003**	**0.003**	**0.003**
Imports (from Uzbekistan)		**0.174**	**0.18**	**0.133**	**0**	**0**	**0**	**0**	**0**	**0**
Total gas balance		**0.197**	**0.199**	**0.144**	**0.004**	**0.003**	**0.004**	**0.003**	**0.003**	**0.003**
Consumption		**0.197**	**0.199**	**0.144**	**0.004**	**0.003**	**0.004**	**0.003**	**0.003**	**0.003**

* The exports to Kyrgyzstan include Kazakh gas bought by Gazprom and supplied to Kyrgyzstan, plus small residual volumes (all less than 0.2 bcm in any year) that are on Kyrgyzstan's gas balance and are presumed to be imported from Kazakhstan

Sources: IEA energy balances, Gazprom, news sources, author's estimates

For Kyrgyzstan, Kazakhstan replaced Uzbekistan as the main source of gas in the late 2000s, with Gazprom Export acting as supplier. Due to unfavourable economic and social conditions, Kyrgyzstan's networks were dilapidated. In 2014, Gazprom agreed with the Kyrgyz government to acquire the national gas company, Kyrgyzgaz, which was renamed Gazprom Kyrgyzstan. An infrastructure investment programme was undertaken, including the upgrading of the BGR-TBA pipeline, and the renovation of branch pipelines and gas distribution points to supply Bishkek and Sokuluk. A further link to Kant and Tokmok is now under construction. The south of the country, which relies on a pipeline from the Ferghana valley region of Uzbekistan, continues to experience supply interruptions in winter; Gazprom Kyrgyzstan says it is working on plans to connect southern regions with the northern pipeline.[93]

Demand will be determined in the large part by fuel competition between gas, coal and mazut. In the 2000s, when Kyrgyzstan faced gas supply difficulties, it switched some gas-fired electricity generation capacity to coal; gas industry managers are lobbying for these to be switched back again. A high level of air pollution in some towns may add to the political pressure. Gasification of households is also underway, accompanied by a scheme to subsidise purchase of gas boilers.[94]

In Tajikistan, the energy system is based on hydropower. The Nurik dam supplies 70 per cent of Tajikistan's electricity; the recently completed Rogun dam supplies electricity both to the domestic market and for export to Uzbekistan. Liquefied petroleum gas is used for home heating and transport, but since the cessation of imports from Uzbekistan in the early 2010s hardly any pipeline gas has been available. With the accession of President Mirziyoyev in Uzbekistan, political relations between the two countries improved, and in April 2018 it was reported, during Mirziyoyev's visit to Tajikistan,

[93]Gazprom Kyrgyzstan website, Gazprom vlozhil v Kyrgyzstan 25 mlrd somov', 18 February 2019
[94]Gazprom Kyrgyzstan, 'Gazprom vlozhil v Kyrgyzstan'; *Vechernii Bishkek*, 'Cherez 5 let respublika budet gazifitsirovana na 60-70%', 14 July 2016

that an agreement had been signed for Tajikistan to purchase 0.126 Bcm of Uzbek gas, for $15.1 million, (implying a price of about $120/mcm). The gas is supplied through the Muzrabad-Dushanbe pipeline to the Tursunzade district where Tajikistan's largest industrial plant, the Tajik Aluminium Company (Talco), is based.[95]

For Kyrgyzstan and Tajikistan, construction of Line D of the Central Asia-China pipeline corridor would transform the gas sector, not only by bringing in transit revenue, but by potentially giving them access to plentiful supplies from Turkmenistan. Since being announced in 2013, the project has been postponed several times. At the time of writing there is no clear indication that construction has begun, and the project may be pushed back to the mid-2020s on account of Chinese import policy (see *Prospects for exports in the 2020s*, below).

Despite this both the Kyrgyz and Tajik governments have made repeated statements looking forward to the project and its impact on their gas sectors. In January 2018, Tajikistan's deputy energy and water resources minister, Jamshed Shoimzoda, announced that work had resumed on the pipeline. In August 2018, the Tajik government decreed that 9500 hectares of land be leased to the Trans-Tajik Gas Pipeline Company, for the project. A dispute between Tajikistan and China on the route of the pipeline, with Tajikistan proposing a route through particularly mountainous territory, has been reported.[96] In May 2019, Zhyrgalbek Sagynbaev, Deputy President of the Kyrgyz state industry committee, said that discussions had been held with China on arrangements for Kyrgyz offtake from the pipeline, financing for construction and the route through Kyrgyzstan.[97]

5. Prospects for exports in the 2020s

During the 2020s, Turkmenistan could, potentially, produce considerable additional volumes of gas for export, as has been shown in the foregoing sections. Turkmenistan has very large resources, although much will depend on the ability of Turkmengaz and its international partners to develop these and bring the gas to market. Uzbekistan may also have additional gas available for export to China – but in the early 2020s this is unlikely to exceed 10 Bcm/year. Kazakhstan has committed to deliver the 10 Bcm/year to China until 2023, but its exports both to China and to Russia are likely to decline thereafter, in line with the decline in net export volumes throughout the 2020s discussed above. While, overall, Central Asian exports to China will most likely increase during the 2020s, exports to Russia may well decline further. If political factors allow, some small volumes could be exported from Turkmenistan westwards. The opening of large-volume export corridors to Europe and south Asia remains highly unlikely. Table 8 presents some possible scenarios for volumes of export during the 2020s.

[95] *Tashkent Times*, 'Uzbekistan resumes gas supplies to Tajikistan', 8 April 2018
[96] Radio Ozodi, 'Tadzhikistan otvel pod stroitel'stvo gazoprovoda do Kitaiia 9,5 tys gektarov zemli', 21 August 2018; *The Diplomat*, 'Tajikistan Resumes Building Turkmenistan-China Pipeline', 31 January 2018
[97] K-News, 'Kyrgyzstan khochet brat' goluboe toplivo iz gazoprovoda 'Turkmenistan-Kitai'', 1 May 2019

Table 8: Possible levels of gas exports from Central Asia in the 2020s

Bcm							
From	**To**	**Actual**		**Projected**			**Comments/assumptions**
		2017	**2018**	**2020**	**2025**	**2030**	
Turkmenistan	**China**	33.3	34.5	35	45	60	Assumes Line D is built by 2025, and that Chinese upstream activity increases. Assumes deliveries to Russia under contract, but that it is not renewed. Assumes substantial new export trade to Kazakhstan
	Russia	0	0	1	0	0	
	Azerbaijan	1	1	1	0	0	
	Kazakhstan	1.5	1.5	6	7.9	9.6	
Uzbekistan	**China**	3.5	6.5	8	10	12	Assumes that Uzbekistan prioritises export to China, that Lukoil and others raise output, and that China prefers to offer some Line D capacity to Uzbekistan
	Russia	5.5	3.8	4	4	4	
	Kazakhstan	1.7	2.9	1	0	0	
Kazakhstan	**China**	1.1	5.8	7	4	4	Assumes (i) that oil producers prioritise reinjection to maintain oil output, and that gas output falls, and (ii) that imports from Turkmenistan are used to cover the short. An alternative scenario would see a sharp reduction of Kazakh exports to Russia
	Russia	13.8	12.3	8	4	6	
	Kyrgyzstan	0.3	0.3	0.3	0.5	0.5	
Note. Assumed Kazakh imports							*Assumes (i) that Turkmen exports to Kazakhstan rise to a substantial level in the 2020s, (ii) that sales gas volumes are according to government projections, and that "other consumption" falls to 2 bcm/year (see Table 5)*
	From Russia	*3.1*	*3.3*	*4*	*4*	*4*	
	From Turkmenistan	*1.5*	*1.5*	*4*	*1.9*	*5.6*	
	From Uzbekistan	*1.7*	*2.9*	*1*	*0*	*0*	
Note. Assumed Kazakh net exports		*8.9*	*10.7*	*6.3*	*2.6*	*0.9*	*See also Table 5.*
Note. Assumed Kazakh total exports		*15.2*	*18.4*	*15.3*	*8.5*	*10.5*	

Source: author's research, presented in this paper

China and the Central Asia-China pipeline

There is no doubt among observers of China's energy sector that gas demand will grow substantially during the 2020s. China's gas consumption was 283 Bcm in 2018; by 2024, CNPC expects it to rise by a further 130 Bcm, the IEA estimates by a further 160 Bcm. Both CNPC and BP forecast Chinese demand in 2035 of 610 Bcm. China's production potential is limited, and the consensus among observers is that its dependence on imported gas will grow. A major new source of imported gas, the Power of Siberia pipeline from Russia to north-east China, is expected to come on stream by the end of this year, and to ramp up to its 38 Bcm/year plateau volume by 2025. Liquefied natural gas is a second source of incremental imports: an additional 49 Bcm/year could be needed by 2025 according to a recent analysis by my colleague Stephen O'Sullivan. China would then have three other significant pipeline options, each projected to bring an extra 30 Bcm/year: either a western route from Russia (i.e. via Altai into western China), or a new export corridor from the Russian Far East, or Line D of the Central Asia-China corridor.[98]

At present, it seems clear that the Chinese authorities, and the companies working in the gas sector, will not proceed to a final investment decision on Line D. First, because economic growth is slowing down in China; a softening of gas demand growth in 2019 may also continue; under these conditions, it would seem logical to delay construction of a pipeline that will increase dependence on existing suppliers, rather than sourcing gas from a new one. Second, because of uncertainty around the establishment of a national gas transport company, which has been proposed by the energy ministry

[98] BP Statistical Review of Energy 2019; Meidan, M. (2019). *Glimpses of China's Energy Future,* OIES/Oxford Energy Comment; O'Sullivan, S. (2019), *China: growing import volumes of LNG highlight China's rising energy import dependency,* OIES/Oxford Energy Comment

but questioned by CNPC and others. Clearly, while this strategic decision is pending, the launching of a major infrastructure project is unlikely. Third, because domestic market regulation and pricing structures are also being reviewed, and this may also have an effect on companies' financing plans.

China signed memoranda of understanding with all the parties along the route of Line D – Turkmenistan, Tajikistan, Kyrgyzstan and Uzbekistan – in September 2013, at the same time as a preliminary agreement was reached on raising Chinese imports of Turkmen gas to 85 Bcm/year. A ground-breaking ceremony was held in Tajikistan in 2014, and a joint venture established between CNPC and Uzbekneftegaz to build the Uzbek section. Construction work was reported to be starting in 2015 and 2016, but in March 2017 a range of media outlets, citing Chinese official sources, said the project had been postponed.[99] During 2018 and 2019, Kyrgyz and Tajik officials repeatedly suggested that construction was moving forward (see above), but there was no confirmation of this from either China or Uzbekistan. In June 2018 Tajik President Sooronbai Jeenbekov met with Chinese President Xi Jinping and signed a protocol with amendments to the intergovernmental agreement to the project, but no announcement on construction followed; a CNPC representative at an industry conference in Turkmenistan in April 2019 identified the project as 'delayed'.[100]

There is no serious doubt that, through the 2020s, Chinese gas demand will continue to rise, and therefore demand for imported gas will continue to rise. While Chinese policy will continue to aim at the maximum possible diversification of sources, additional supplies of 30 Bcm/year from Central Asia, and Line D of the pipeline corridor, will be needed. However, this major investment will probably be postponed, not only until the corporate reform of gas transmission has been completed, but also until such time as both pipeline and LNG supplies from Russia have been added to the gas balance, and the speed of demand growth becomes clearer.

Russia

Russia is, and will remain for the foreseeable future, the second largest destination for Central Asian gas exports after China. In 2018, Russia imported 12.3 Bcm of gas from Kazakhstan and 3.8 Bcm from Uzbekistan. There are contracts providing for imports from Kazakhstan to continue at around that level; for 4 Bcm/year from Uzbekistan until 2022; and for 5.5 Bcm in total from Turkmenistan between 2019 and 2024. The Central Asia-Centre pipeline corridor, although no doubt in need of maintenance work, has the capacity to carry much larger volumes.

Russian demand for Central Asian gas is limited to areas that can be reached more easily via this pipeline corridor than from Russia's own centres of gas production. Pipelines linked to the Orenburg processing plant, at which gas from Karachaganak is processed, traverse the Orenburg, Bashkortostan and Chelyabinsk regions, with respectively around 9 Bcm, 16 Bcm and 16 Bcm of annual demand. The Soiuz pipeline, which enters Russia from Kazakhstan and exits it at the Ukrainian border, goes through the Volgograd and Rostov regions, with 6-7 Bcm each of annual demand. More distant are the Saratov, Penza and Riazan regions, which lie on the line from Aleksandrov Gai to Moscow, with 6, 3 and 5 Bcm respectively of annual demand. To supply this 60+ Bcm of demand there is 40+ Bcm of gas produced in southern Russia annually, in the Volga and Southern federal districts.[101] So in principle this demand could be met by Central Asian gas.

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[99]Eurasia net, 'Central Asia-China Gas Pipeline Expansion Delayed Again', 3 March 2017, https://eurasianet.org/central-asia-china-gas-pipeline-expansion-delayed-again; *Vedomosti*, 'Turkmeniia lishilas' krupnogo pokupatelia gaza v litse Irana', 13 August 2017

[100]Radio Free Asia, Lelvyeld, M., 'China Nears Limit on Central Asian Gas', 25 June 2018; Radio Ozodi, 'Tadzhikistan otvel pod stroitel'stvo gazoprovoda do Kitaiia 9,5 tys gektarov zemli', 21 August 2018; CNPC Economics and Technology Research Institute, presentation 'Status and Outlook of China Natural Gas Market', at Turkmenistan Gas Congress, Avaza, 21-22 May 2019

[101] Pirani, S. (2014). 'Central Asian and Caspian gas for Russia's balance', in Henderson, J. and Pirani, S. (eds.), *The Russian Gas Matrix: how markets are driving change,* Oxford: OUP/OIES

In the 2000s, Central Asian gas was imported by Russia for this purpose, at European netback prices: this trade was substantially curtailed by a change in Russian import policy, and the contraction of markets following the 2008–09 financial crisis. As explained above (*Turkmenistan: exports*) Gazprom's Central Asian purchase prices still appear to be at a premium to its domestic sales prices. Nevertheless, the export of Kazakh and Uzbek volumes continued, and the recent conclusion of new contracts suggests that this trade is beneficial both for Gazprom and for the Central Asian producing companies. Whether there are opportunities to increase it will depend on the evolution of transport costs and of demand. Another issue is that during the 2020s Kazakhstan will itself be short of gas. Depending on Turkmen export prices, it might make sense to increase its own imports from Turkmenistan, which could free up additional volumes for export to Russia.

South Asia and the Turkmenistan-Afghanistan-Pakistan-India pipeline

Among other sources of possible demand for Central Asian gas are the south Asian markets – Pakistan, India and Bangladesh. Turkmenistan's policy is to access these markets by means of the Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipeline. This project has been under discussion in political and diplomatic circles for at least 15 years, has been approved by memoranda of understanding between the governments, and has received backing from the Asian Development Bank (ADB) and other financial institutions. Nevertheless, even assuming that the considerable logistical and strategic challenges of building TAPI could be overcome, there are no plausible scenarios under which gas could be supplied at a price competitive with other imports to south Asia. It is therefore very unlikely to be completed.

Gas demand in India, Pakistan and Bangladesh is expected to rise steadily through the 2020s. The world gas market model used by OIES forecasts demand in India (55.2 Bcm in 2018) rising to 61.9 Bcm in 2020 and 90.1 Bcm by 2030; in Pakistan (42.1 Bcm in 2018) to 44.3 Bcm in 2020 and 54.9 Bcm by 2030; and in Bangladesh (28.7 Bcm in 2018) to 30.3 Bcm in 2020 and 39.6 Bcm by 2030.[102] However, all this demand may be met by indigenous production, and LNG imports, at price levels well under those projected for Turkmen pipeline gas.

The TAPI project first gained governmental approval in very different market circumstances, in 2010, when the Turkmen, Afghan, Pakistani and Indian governments signed an intergovernmental memorandum, and heads of agreement on gas sales. Since then, a protracted series of discussions on the price formula have been reported.

Originally, Pakistan pressed for import prices linked to 70 per cent of the prevailing crude oil price. In 2013, a further agreement was signed, reportedly linked to 55 per cent of crude oil prices. Roughly, this would imply a gas price of $6/MMBtu at the Turkmen border when oil prices are at $60/barrel, and $7.5/MMBtu when oil prices are at $75/barrel. Analysis conducted by the *Hindu* newspaper showed that transit fees and transportation charges would add a further $3/MMBtu to prices at the Indian border. These prices are roughly in line with the peak achieved by Indian LNG import prices, around $10/MMBtu in 2013, but substantially above both the 2015–16 level of around $6/MMBtu and the current 2019 prices of both LNG (around $6/MMBtu) and long-term contract gas (around $8/MMBtu). The 55 per cent oil link has thus been judged unacceptably high by the Pakistani and Indian governments, who were reported in 2017 and 2018 respectively to be seeking to renegotiate the heads of agreement. In June 2019, reports that work on the pipeline would soon be started by Pakistan were accompanied by fresh calls from Pakistani officials for a renegotiation of prices.[103]

[102] OIES uses the Nexant World Gas Model. With thanks to Mike Fulwood, Senior Research Fellow, OIES

[103] Pirani, S. (2012). *Central Asian and Caspian Gas*, 102-103; *The Express Tribune*, 'TAPI pipeline: Pakistan to press for reducing gas import price', 16 November 2017; *The Hindu*, 'India seeks revision in gas price from TAPI pipeline', 22 August 2018; FCO *Turkmenistan Energy Newsletter*, June 2019. On 2019 LNG prices, see, e.g. Reuters, 'Indian LNG customers choosing spot buys', 29 October 2019, <https://www.reuters.com/article/petronet-lng-results/indian-lng-customers-choosing-spot-buys-over-long-term-deals-petronet-lng-exec-idUSFWN27E0FA>

The fact that the cost of delivery is far above the range of likely gas prices in India and Pakistan is the main obstruction to TAPI being completed. In the unlikely event that this obstruction is somehow removed, for example, by a further downward revision of Turkmen export prices, there are still considerable logistical challenges to building the pipeline, and security challenges to the route across Afghanistan.

Turkmenistan, Afghanistan, Pakistan and India have incorporated the TAPI Pipeline Company Ltd (TPCL) in the Isle of Man to build, own and operate the pipeline; Turkmengaz is consortium leader. The initial plan was for a 1680 kilometre, 56-inch line, with a capacity of 32 Bcm/year, including 735 kilometres in Afghanistan and nearly 800 kilometres in Pakistan. The possibility of a link to western China has also been mooted by Pakistani officials. In February 2018, a ceremony was held at the Turkmen-Afghan border to mark the 'completion' of the Turkmen section of TAPI. It is reliably reported that, in fact, 7-23 kilometres of the 217 kilometre section has been completed. Financial close on a $1 billion package of loans for the project, from the ADB and the Islamic Development Bank, was due in September 2018, but has been delayed.[104] During this year, it has been reported that the project could be split between a first phase, providing for supplies of 11 Bcm/year (5 Bcm each for India and Pakistan, 1 Bcm for Afghanistan), and a second stage in which 22 Bcm/year of capacity would be added by means of the construction of six compressors. Financial close is now reported to be planned for early 2020.

While Turkmenistan remains firmly committed to TAPI, it is unlikely to make progress. In the absence of economic logic, it seemed possible in the past that it might go ahead as a strategic and political project. In the early 2010s, it was strongly backed by the USA as a 'peace project' for Afghanistan. This driver has been weakened, though, with the erosion of US foreign policy under the Trump presidency.

Possible Turkmen exports westward

The European Commission has, for many years, championed plans for a Trans Caspian pipeline that would bring Turkmen volumes westward to Azerbaijan, to enter an expanded southern gas corridor to Europe. No agreement was reached on this with Turkmenistan prior to the final investment decision to expand production at the Shah Deniz 2 field (Azerbaijan) and complete the southern corridor through Azerbaijan, Georgia and Turkey. The project went ahead without Turkmen gas, on the basis of 16 Bcm/year of gas exports from Azerbaijan: 10 Bcm for European markets, 6 Bcm for Turkey.

The underlying problem, as with the aspirations to build TAPI, was one of price. The cost of production, of building a Trans Caspian pipeline, and of transporting the gas across Georgia and Turkey, could not be covered on the basis of any reasonable assumptions about future European gas prices. Turkmen gas could not be delivered to Europe at a price competitive with other importers. Political opposition to a Trans Caspian pipeline from Russia and Iran, which as Caspian littoral states could not be ignored, was a further complicating factor, particularly as, until 2018, the legal status of the Caspian Sea had been unclear since the dissolution of the Soviet Union in 1992 and no legal framework existed for building pipelines across it.[105]

In August 2018, all five Caspian littoral states (Russia, Iran, Azerbaijan, Kazakhstan and Turkmenistan) signed a Convention on the Legal Status of the Caspian Sea. This clarified the legal status of the sea; emphasised that the littoral states were jointly responsible for the sea's security and that no forces other than those of the littoral states could use it; and demarcated the five states' territorial waters. The Convention did not, however, clarify how the sea floor and the subsoil is to be delimited; nor did it resolve border disputes between Azerbaijan and Turkmenistan (with respect to the border across the Serdar-Kapaz oil field) or between Azerbaijan and Iran (with respect to their dispute on the Sardar-e Jangal gas field). The Convention provided for any of the littoral states to lay

[104]FCO *Turkmenistan Energy Newsletter*, August 2018

[105]For a detailed discussion, see Pirani, S. (2018). *Let's not exaggerate: Southern Gas Corridor Prospects to 2030,* Oxford, OIES, NG135

pipelines on the sea floor, but specified that this would have to be agreed bilaterally, and that consent on environmental grounds would have to be given by all littoral states. Russia ratified the Convention in October 2019, but Iran continues to delay ratification.[106]

The signing of the Convention clearly moves a possible Trans Caspian pipeline one step closer. Nevertheless, there are hurdles to overcome. First, in practice, Russian and Iranian consent still needs to be secured, on environmental grounds, and as long as those countries have strategic reasons to deter substantial westward exports of Turkmen gas, it may not be forthcoming. Second, and more important, this political shift does not change the unfavourable economics of westward Turkmen exports.

One possibility that may have come closer is the construction of a small-scale link between the westernmost Turkmen fields in the Caspian, and the easternmost Azerbaijani fields. Such a pipeline could provide an outlet for 3-5 Bcm/year of gas produced in the Turkmen section of the Caspian, to relieve the shortage of gas in the Azerbaijani market.[107] Petronas of Malaysia, which produces gas in the Turkmen sector of the Caspian, has studied the feasibility of this project and, in a recent presentation, stated that it would support 'Turkmenistan's wise policy of diversification of energy exports'.[108]

The construction of a Trans Caspian pipeline to transport larger volumes to Europe remains unlikely. The author has argued in the past that it may be more likely, and is certainly more economically feasible, for Turkmen gas volumes to reach Europe via Russia – through an existing pipeline system that has been used for this purpose in the past – than via a Trans-Caspian route. In 2017, this possibility was mooted by Myrchat Archaev, acting President of Turkmengaz.[109]

Yet another possibility, dependent on a fundamental change in geopolitical relationships, is that gas could be exported from Turkmenistan to Turkey via existing pipelines through Iran (along Turkmenistan's Caspian coast line from Korpedzhe to Kurt Kui, and thence to northern Iran, a link that was demonstrated to be working in December 2006, during an interruption of Iranian supplies to Turkey). Depending on economic and gas market circumstances, it is not inconceivable that Iran could itself import Turkmen volumes in future, but there appears to be no call for this at present.[110]

6. Conclusions

China has become the main export destination for Central Asian gas, and will remain so through the 2020s. The 55 Bcm/year capacity of the Central Asia-China pipeline corridor has in recent years been used ever closer to capacity, with exports from Uzbekistan and Kazakhstan slightly higher than expected. But both those countries remain constrained by the requirements of their domestic markets; Kazakhstan aims to export up to 10 Bcm/year to China up until 2023, but after that, its exports will fall; Uzbekistan should be able to raise exports to 10 Bcm/year, but it is not clear that it will be able to go further. Turkmenistan, on the other hand, has sufficient resources to be able to increase its exports to China substantially.

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[106]FCO *Turkmenistan Energy Newsletter*, August 2018; RIA Novosti, 'Putin ratifitsiroval konventsiiu', 1 October 2019; FCO *Turkmenistan Energy Newsletter*, June 2019. For background on Russia's position, see: Pritchin, S. A. (2018). *Rossiia na Kaspii: poiski optimal'noi strategii*, Moscow: Aspek Press especially 57-89

[107] Also discussed in Pirani, S. (2018). *Let's not exaggerate: Southern Gas Corridor Prospects to 2030* ,Oxford: OIES, NG135

[108]'The role of Petronas in developing gas industry of Turkmenistan', presentation at Turkmenistan Gas Congress, Avaza, 21-22 May 2019, slide 9

[109] *Vedomosti*, 'Turkmeniia khochet postavliat' gaz v Evropu po trubam Gazproma', 3 November 2017; *Chronicles of Turkmenistan,* 'Turkmenistan is ready to supply gas to eastern Europe via Russia', 3 November 2017; Pirani, S. (2018). *Let's not exaggerate*, OIES NG135

[110]IEA *World Energy Outlook 2010,* Paris: IEA, 540-541

To increase the volume of Turkmen exports, China would have to decide, along with its partners, to go ahead with the expansion of the Central Asia-China pipeline corridor from its current capacity of 55 Bcm/year to 85 Bcm/year, by constructing Line D from Turkmenistan via Kyrgyzstan, Tajikistan and Uzbekistan. In the short term, this is unlikely. China's gas transportation sector may be facing a corporate shake-up; its gas market is expanding but projections of the pace of that expansion are being revised downwards; and its strategy of import diversification is currently focused on ramping up volumes from Russia. Line D is likely to go ahead at some point in the 2020s, with the timing dependent, ultimately, on the evolution of China's gas market.

There are no doubts that, especially now that the Galkynysh field is under development, Turkmenistan's resources are more than adequate to supply a larger volume of exports. There are, however, questions about Turkmenistan's capacity for developing that field and the supporting infrastructure. The supply interruptions in the winter of 2017-18, which CNPC took the unusual step of complaining about publicly, underlined these capacity issues. Part of the solution to these may be the participation in the Turkmen upstream of foreign oil companies: the two now working there, CNPC and Petronas, had by 2018 increased their share of gas output to 28 per cent.

A further reason for caution with regard to Turkmenistan is the political situation. Some observers believed in 2018-19 that the government could be facing a systemic, and perhaps terminal, crisis. This turned out not to be the case. This was, at least in part, because Turkmenistan's economy is heavily reliant on gas exports and vulnerable to price shocks – and has suffered as a result of low prices in recent years – but does not appear to be at the point of collapse.

Uzbekistan, in contrast to Turkmenistan, has begun substantial political and economic reforms since the accession of President Mirziyoyev in 2016. It is moving towards a more open economy and corporate reform of the gas sector has begun. This could mean more foreign investment in future; together with energy efficiency measures in the domestic market, this could increase Uzbekistan's export potential by the mid-to late-2020s.

Kazakhstan, in contrast to Turkmenistan and Uzbekistan, is primarily an oil-producing nation, with strong links to the international oil companies. This is unlikely to change during the 2020s, meaning that gas production will continue to take second place to oil, even while domestic consumption rises.

Apart from China, the only other significant market for Central Asian gas exports is Russia, and this will almost certainly remain the case through the 2020s. Exports to Russia could grow, albeit not substantially, depending on demand in the southern regions near to the Kazakh border, and pricing issues. However, it is also possible that they could fall, due to supply constraints. Other routes – Europe via a Trans Caspian pipeline, or south Asia via a Turkmenistan-Afghanistan-Pakistan-India pipeline – are unlikely to develop. Even if political obstacles to these routes are overcome, geographical and, above all, economic obstacles remain. In a world of a growing LNG business, there are simply no grounds for believing that there will be a long-term sea-change in the level of gas prices, sufficient to make TAPI or the Trans Caspian pipeline into attractive investment propositions.

With these limitations, caused largely by their geographical position, a solution now being more actively worked on by the Central Asian states is to use their gas resources as feedstock for petrochemicals production. The launch of the Shurtan complex in Uzbekistan, and Kiyanli in Turkmenistan – both with generous financial and engineering support from Japanese and other east Asian companies – may mark a significant turning point in this respect. But Central Asian countries' ability to export and sell petrochemicals products into expanding, but very volatile, markets has yet to be demonstrated.

The domestic gas markets in Uzbekistan, Kazakhstan and Kyrgyzstan are going through significant changes. In Uzbekistan, market reform is likely, over time, to yield welcome, and potentially substantial, efficiency savings. This could result in lower domestic consumption, and perhaps some extra volumes for export. In Kazakhstan, an energy policy aimed at expanding gasification, and taking measures to substitute coal with gas, is in place. The construction of pipelines is underway, enabling Kazakhstan, first, to link its oil and gas fields to the export pipeline to China; second, to supply

consumers in the south-east with its own gas; and third, to expand the gas grid to northern and eastern regions. Over time this should help move towards a more rational domestic energy policy. Kyrgyzstan is also moving towards substituting gas for coal.

From the standpoint of national development, Kazakhstan's policy of maximising oil output, and Turkmenistan's near-total reliance on gas export revenues, carry the danger of one-sided economic development and versions of the 'resource curse'. There are many arguments too, in terms of economic development strategies, against Uzbekistan's combination of smaller exports with a capital-intensive – and also energy-intensive and gas-intensive – economy. The changes now being made, to open up the economy to international investors, may move Uzbekistan to a more heavily export-oriented model. Moreover, hydrocarbon-export-oriented policies will inevitably leave these countries at odds with internationally recognised guidelines for minimising the danger of climate change. As yet, these issues of development and environment take second place in policy discussions in the region. During the 2020s this will hopefully change.

Appendix. Sources for gas balances

The gas balances in the paper have been compiled by the author based on primary sources where available. The sources of information used are as follows:

Turkmenistan.

Production: BP Statistical Review.

Domestic consumption: author's estimates based on production minus exports.

Exports: Gazprom (for Russia and Kazakhstan); Kazenergy (for Kazakhstan); news sources/ Energy Economist (for Iran); customs data compiled by Energy Aspects (for China).

Uzbekistan.

Production: 2010, author's estimate; 2011–16, BP Statistical Review; 2017–18, Uzbekistan statistical agency, adjusted to account for field use.

Domestic consumption: author's estimates based on production minus exports.

Exports: Gazprom (for Russia, Kazakhstan and Kyrgyzstan), news sources (for Tajikistan and Kyrgyzstan), customs data compiled by Energy Aspects (for China).

Kazakhstan.

Production: companies, Kazenergy, BP Statistical Review.

Domestic consumption and imports: Kaztransgaz, Kazenergy, author's estimates.

Exports: Gazprom (for Russia), Gazprom and author's estimates (for Kyrgyzstan); customs data compiled by Energy Aspects (for China). Some volumes of gas are exported from the Karachaganak field in Kazakhstan to the Orenburg processing plant in Russia for processing, and returned to Kazakhstan: these volumes are included in customs statistics, but have been omitted from the gas balance in this paper; the volumes stated for export are net of these trades.

Kyrgyzstan and Tajikistan.

Production, total gas balance and consumption: 2010–16, IEA gas balances; 2017–18, author's estimates.

Imports: Gazprom, news sources.