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MAIN GAS PIPELINES OF KAZAKHSTAN AND THEIR CHARACTERISTICS

In 2017, Kazakhstan occupied the 19th place in terms of natural gas reserves – 1.9 trillion m³. Most of the natural gas reserves are concentrated in the western part of Kazakhstan at the three largest fields: gas condensate Karachaganak, oil Kashagan and Tengiz. More than half of this volume is in the Karachaganak oil and gas field. Kazakhstan was in the TOP-30 countries in gas production, occupying 30th place: 22.9 billion m³. In 2018, the volume of international gas transit amounted to 90 billion m³. Schemes and technical specifications of existing and under construction gas pipelines passing through the territory of Kazakhstan: Bukhara-Ural, Central Asia Center (CAC), Kazakhstan-China (AS), Central Asia-China (CAC), Tobol-Kokshetau-Astana, MG Saryarka.

Keywords: gas mains, route diagrams, technical characteristics of gas pipelines, Kazakhstan.

INTRODUCTION

In terms of natural gas reserves, according to OPEC, the world leader in 2017 is Russia: 50.6 trillion m³ (with a share of 25.4 %). BP (British Petroleum – a multinational oil and gas company TNK) estimates Russia's reserves at 35 trillion m³ (18.1 %). In second place is Iran: 33.8 trillion m³ (17 %), according to OPEC, and 33.2 trillion m³ (17.2 %), according to BP. Qatar closes the top three: 23.9 trillion m³ (12 %), according to OPEC, and 24.9 trillion m³ (12.9 %) by BP [1].

According to OPEC, Kazakhstan ranked 19th in world gas reserves in 2017: 1.9 trillion m³ (1 %). According to BP, Kazakhstan took the 25th place:

1.1 trillion m³ (0.6 %). Most of the natural gas reserves are concentrated in the western part of Kazakhstan at the three largest fields: gas condensate Karachaganak, oil Kashagan and Tengiz. Moreover, more than half of this volume is accounted for by the Karachaganak oil and gas field, the proven reserves of which are, according to available data, 1.36 trillion m³. Half of the total gas production is associated petroleum gas (APG).

According to OPEC estimates, the world leader in natural gas production in 2017 is the United States: 762.3 billion m³ (with a share of 20.4 % of world gas production); in second place Russia: 649.6 billion m³ (17.4 %); the third is Iran: 238 billion m³ (6.4 %). The share of OPEC countries was 21.3 %, the share of OECD countries was 36.4 %. Kazakhstan was in the TOP-30 countries in gas production, occupying 30th place: 22.9 billion m³ (with a share of 0.6 %).

According to the data of the CC MNE of the Republic of Kazakhstan, natural gas production in the liquid and gaseous state amounted to 52.9 billion m³ in 2017, of which 22.9 billion m³ natural gas in the gaseous state. Natural gas production for 11 months of 2018 in physical terms amounted to 50.6 billion m³. Of these, 42.5 % (21.5 billion m³) were in the Atyrau region, 36 % (18.2 billion m³) in the WKO, 12.4 % (6.3 billion m³) in the Aktobe region, 2.8 billion m³ in the Mangystau region [2]. Gas production in 2018 increased by 5 % compared to 2017 and amounted to 55.5 billion m³ [3].

MAIN PART

Kazakhstan is mainly a transit country (transit is about 90 %.) For the transportation of natural gas from Uzbekistan and Turkmenistan to Russia and China. In 2009, exports for the first time exceeded imports by 3.8 billion m³, reaching 8.8 billion m³ in 2012, which made Kazakhstan one of the gas exporters. In 2018, the volume of international gas transit increased to 90 billion m³.

There are two unrelated natural gas distribution systems in Kazakhstan: one in the west, which discusses production fields and used to export gas, and the second in the south, which provides gas imports to South Kazakhstan from Uzbekistan. The total length of the system of gas pipelines in Kazakhstan in single-thread terms (the product of the length of one string to the number of threads) exceeds 14 000 km (for comparison, the total length of the Russian main gas pipeline (MGP) is 150 thousand kilometer); the throughput is about 190 billion m³ [4].

The western gas transmission system is based on trunk pipelines stretching across Kazakhstan (Figures 1 and 2) in a submeridional direction from Turkmenistan and Uzbekistan to Russia: the Central Asia-Center system (CAC) and the Bukhara-Ural gas pipeline. The CAC system is connected by additional pipelines to the Caucasus (Makat-North Caucasus 371 km, 1987 year) and the

western regions of Turkmenistan «Okarem-Beineu» in 1975 (the Kazakhstan section of Begdaesh-Beineu has a length of 473 km [5].

In the northwest, the Orenburg-Novoposkovsk gas pipelines (sections 319 km and 63 km along the territory of the West Kazakhstan region) and Soyuz with looping (424 km) and a separate branch linking Orenburg with the Karachaganak field (see figure 2). The Orenburg-Novoposkov and Soyuz gas pipelines were built in 1975 and 1976 years, respectively, with a total throughput of 42.5 billion m³/year. In 1965, the Kartaly-Rudny-Kostanay gas pipeline was commissioned (154 km from Kartaly gas station to the «Bukhara-Ural» gas pipeline) with gas supplied from the Russian Federation in exchange for its own gas produced at the Karachaganak field, and in 1988 – «Zhanazhol-Oktyabrsk-Aktobe» with a length of 270 km (see Figure 1) [5].

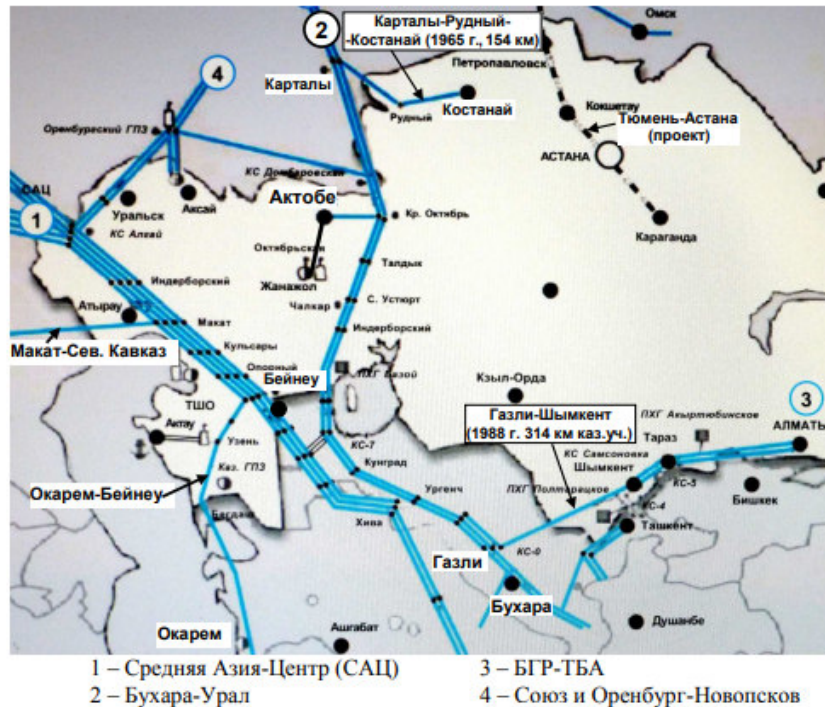


Figure 1 – Gas pipelines – built in Kazakhstan before 1991 [4]

There are also three underground gas storage facilities (UGS) in the country: Bozoyskoye UGS with an active storage capacity of 4 billion m³ in Aktobe Oblast, Poltoratskoye UGS (0.35–0.4 billion m³) in South Kazakhstan Oblast

and Aktyrtobinskoye (0.3 billion m³) gas in Zhambyl Oblast (see figure 2) [6]. Underground gas storages are designed to provide consumers with natural gas during the winter seasons, as well as during periods of decreasing gas supplies.

The main gas pipelines. The main characteristics of MGP of Kazakhstan are shown in table 1.

Table 1 – The main gas pipelines of Kazakhstan

Initial, intermediate and final points	Year entered in operation	Track length *, km; number of lines	Bandwidth ability billion m ³ / year; diameter mm
Bukhara-Ural (border of Uzbekistan – Russian border)	1963, 1964	639 (578) / 2 lines	14-20 /1015
The Kartaly-Rudnyi-Kostanay	1965	154/1 line	3,8 /820
Zhanazhol-Oktyabrsk-Aktobe	1988	270/1 line	0,9 /520
The Orenburg-Novoposkov	1975	382/1 line	11,5 /1220
Union (with looping 42 km)	1976	424/1 line	31 /1420
CAC (Central Asia-Center): Beineu-Al. Guy (border. RK-border RF)	1967, 1986	823 /5 lines	50-80 /1420, 1220, 1015
Makat-North Caucasus	1987	371/1 line	25,5-31 /1420
Okarem-Beineu (Begdash-Beineu)	1975	461 (473) / 1-2 lines	5-12 /1220, 1015
Caspian (Begdash-Beineu-Al. Guy)	2012-2013	1285/1 line	30-40 /1420
BGR-TBA (Bukhara gas-bearing district-Tashkent-Bishkek-Almaty)	1971, 1999	813/2 lines	21,6 /720, 1015
Gazli-Shymkent (to KS-Samsonovka)	1988	314/ line	11,5-13,3 /1220
1st section MGP Kazakhstan-China (Kazakhstan part MGP of the Turkmenistan-Uzbekistan-Kazakhstan-China)	1st, 2nd, 3rd stage: 2009, 2010, 2015	1293/3 lines	30-55 /1420, 1020
2nd section of the Kazakhstan-China MGP (Beineu-Bozoy-Shymkent)	2011-2013	1475/2 lines	10 /1067

* The length of the route (one line) within the borders of Kazakhstan

MG «Bukhara-Ural». The history of the main gas pipelines of the Republic of Kazakhstan dates back to 1961, when the construction of the «Bukhara-Ural» gas pipeline began on the territory of 4th republics, including Kazakhstan. In fact, this event should be considered the beginning of the creation of a domestic gas transportation system, since before the construction of this facility the republic did not have its own network of gas pipelines. The gas pipeline route has become the longest and most modern in the country – the total length of two lines is 4464 km, including the total length of two gas lines of 1175 km across Kazakhstan [5].

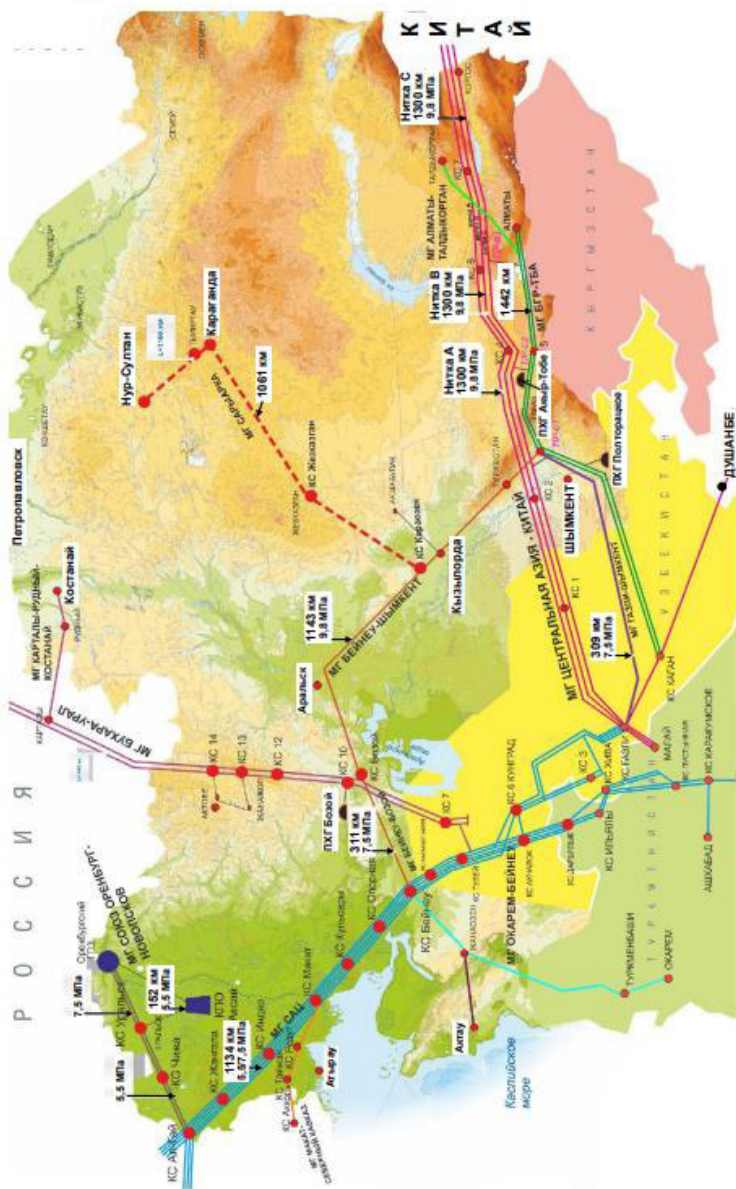


Figure 2 – Map of the gas pipelines of Central Asia [5] (modified)

Bukhara-Ural was built «by the whole world.» The pipeline crossed 625 natural and man-made barriers, including 14 rivers, 19 railways and 650 highways. A total of 17 compressor stations, 138 gas pumping units and 22 gas distribution stations were built. MG throughput reached 14–20 billion m³/year. The reserves of the Gazlinskoye field were only enough for 20 years. Currently, the Bukhara-Ural transit pipeline, designed to transport gas from Uzbekistan and Turkmenistan to the industrial regions of Russia, is practically not used for transit, but is used more to supply gas to the Aktope region.

MGP «Central Asia Center» (CAC). In October 1965, construction began on the Central Asia-Center multi-pipeline system of gas pipelines. The new gas pipeline was supposed to absorb gas from Uzbekistan and Turkmenistan and transported through Kazakhstan to the central regions of Russia. At the time the construction of the first phase was completed in 1967, the CAC was the largest gas pipeline in the world – its length was 3,180 km with a throughput of 10.5 billion m³/year. By 1985, the CAC had become a multi-line system of gas pipelines and branches with a throughput of 80 billion m³/year. Currently, the five-strand Central Asia-Center gas pipeline is a complex, branched transnational network of pipelines with a total length of 5215 km in single-thread calculation [4], according to other sources 4892 km [7]. Now the CAC with a length of 2750 km takes 6th place in the world [8].

Two branches of the CAC gas pipeline are connected in the south-west of Kazakhstan near the village of Beineu, before crossing the border with Russia in the vicinity of the village of Aleksandrov Gai and connecting to the Russian gas transmission network. The eastern branch, with a throughput of 59.5 billion m³/year starts from the southeast gas fields in Turkmenistan. The western Okarem-Beineu branch with a throughput of 5 billion m³/year starts from the Caspian coast of Turkmenistan. The length of the Kazakhstan site («Bezhevshsh-Beineu») is 473 km [5].

MGP «Bukhara gas-bearing region-Tashkent-Bishkek-Altay» (BGR-TBA). The construction of the BGR-TBA gas pipeline began in 1961 from the Gazli field [7]. In 1968, gas came to the regional center – the city of Dzhambul (Taraz). In January 1971, the BGR-TBA gas pipeline was completed to the city of Alma-Ata. MGP BGR-TBA also provides gas supply to the north of Kyrgyzstan – more than 700 million m³/year and the southern regions of Kazakhstan – about 2 billion m³/year. This gas pipeline has a length of two lines 1585 km with a throughput of 12 billion m³/year [5].

In 1988, the construction of the Gazli-Shymkent gas pipeline was completed (see Figures 1 and 2). The Gazli-Shymkent gas pipeline connects the BGR-TBA pipeline with the Bukhara-Ural trunk pipeline and has a length of 314 km across Kazakhstan [5]. On the section between Shymkent and Almaty, the pipeline crosses the territory of Kyrgyzstan, feeding its capital Bishkek.

The Kazakhstan-China gas pipeline (KAC). China for Kazakhstan is the second most important trading partner after Russia. The trade turnover between the countries in 2018 amounted to \$12 billion. At the heart of Kazakhstan's exports to China, accounting for more than half of the turnover: oil, gas, metals and grain. About 20 billion dollars out of \$ 330 billion of foreign direct investment came from China over the years of Kazakhstan's independence. In April 2019, at the «One Belt, One Way» Forum, countries signed an agreement on the implementation of 55 projects in Kazakhstan for an additional \$27.6 billion in energy, industry and infrastructure. According to unofficial estimates, China has invested in Kazakhstan up to \$80 billion, and the share of Chinese companies is about a quarter of the country's oil and gas industry. The official debt of RK to China is about \$12 billion, however, in the debt list, China is inferior to the Netherlands (about 50 billion), Britain and the United States [11].

In early sources, the Kazakhstan-China MGP was understood to mean various pipelines: 1) the Beineu-Shymkent gas pipeline as the second stage of the Central Asia Gas Pipeline project [12];

2) the Kazakhstan part of the Turkmenistan-China gas pipeline [13];

3) at the same time, the Kazakhstan section of the Turkmenistan-China gas pipeline and the Beineu-Shymkent gas pipeline [14]. All this contributed to the appearance in the media of conflicting information about this gas pipeline.

The Kazakhstan-China gas pipeline is part of a large-scale transcontinental project of the Central Asia-China gas pipeline, which includes gas pipelines passing through Turkmenistan (188 km), Uzbekistan (525 km), and Kazakhstan (1293 km); total to China: 188 + 525 + 1293 = 2006 km and in China to Guangzhou – more than 4860 km. The Central Asia-China gas pipeline is the longest pipeline in the world (about 7,000 km). It gives Asian gas an alternative sales route bypassing Russia. Construction began in 2007, and commissioning began in December 2009. The total cost of the pipeline in 2012 reached over \$ 8.5 billion [14].

As already noted, the «Kazakhstan-China» MGP was originally understood to mean the part of the MGP «Central Asia-China», which starts from the Uzbek-Kazakh border near the town of Saryagash (15 km from Tashkent) and ends on the Kazakh-Chinese border in the vicinity of the Khorgos border post. MGP consists of three lines (see Figure 2). diameter 1067 mm, pipe wall thickness 11.9 /15.9 mm; steel grade X70.

In October 2009, the Beineu-Shymkent gas pipeline began to be considered as the second section of the Kazakhstan-China gas pipeline. Thus, starting from 2009, the Kazakhstan-China MGP began to consist of two sections: the 1st section (launched on September 7, 2013) – the Kazakhstan part of the Turkmenistan-Uzbekistan-Kazakhstan-China gas pipeline (Ugralli-Khorgos) with a length of 1293 km and with a transit capacity of Turkmen gas of 40 billion m³/year and the

2nd – northern section (launched in November 2015) – the Kazakhstani Beineu-Bozoy-Kyzylorda-Shymkent gas pipeline with a length of 1475 km and a capacity of 10 billion m³/year. The total length of two sections of the Kazakhstan-China MGP is 2768 km.

Projects of gas pipelines to the capital of Kazakhstan. The first talk about the gasification of the current capital was still in 1963. And during independence, at least three unrealized projects were developed. Kaztransgaz's proposals for the supply of gas to the north and north-east of Kazakhstan were considered: from Tyumen through Petropavlovsk to Kokshetau and Astana (see Figure 1) or through the Kostanay region directly to Astana, as well as through Kostanay to Kokshetau and Astana. Another option is to join the Beineu-Bozoy gas pipeline. Of all the options, the construction of the West-North-Center gas pipeline (Tobol-Kokshetau-Astana), the continuation of the Kartaly-Rudny-Kostanay gas pipeline from Russia, was considered more or less acceptable for economic reasons (Figure 3) [16].

It was planned to start the construction of the MGP from the point of insertion into the existing Kartaly-Rudny-Kostanay gas pipeline for 131.8 km, towards Kokshetau, with a branch to the Shchuchinsko-Borovsk resort zone, then to Astana, route length 829.5 km Bandwidth 1.5 billion m³/year. Further, the design throughput was brought to 5.3 billion m³/year. The project cost taxpayers 5 billion tenge. That is how much «Samruk-Kazyna» JSC spent on its development.



Figure 3 – The Tobol-Kokshetau-Astana gas pipeline [16]

It was supposed to transport Uzbek gas from the MGP «Bukhara-Ural», which became Russian when reversed. And official Astana would have to regularly make certain concessions to Moscow. The difficult negotiations finally convinced the Government that it was better to go to our own raw materials and not to depend on anyone.

The Saryarka gas pipeline project (Kyzylorda-Zhezkazgan-Karaganda-Temirtau-Astana). The new project [17] provides for the maximum loading of the existing «Beineu-Shymkent» MGP, inside of which is precisely Kazakhstan gas from fields in the west of the republic. That is, the project removes the issue of dependence on other people's raw materials. The construction of the linear part of the pipeline was started in March and completed on October 9, 2019. The total length of the pipeline was 1061.3 kilometers. Coverage – 171 settlements. The project cost is 267.3 billion tenge. It took the builders only 8 months to stretch the gas pipeline along the route Kyzylorda-Zhezkazgan-Karaganda-Temirtau-Nur-Sultan (see Figure 2) [18].

CONCLUSIONS

The total length of the system of gas pipelines in Kazakhstan in single-thread terms exceeds 14 thousand km; bandwidth is about 190 billion m³/year. In 2018, gas export from the Republic of Kazakhstan amounted to 26.5 billion m³/year – 3.5 % more than in 2017. In money, exports reached \$2.2 billion per year. The volume of gas transit increased by 7 %, to 90.6 billion m³/year.

In 2015, the «Beineu-Bozoy-Shymkent» MG was launched, which became the northern part of the «Kazakhstan-China» gas pipeline, connecting with the C line of the «Central Asia-China» MG. Kazakhstan began exporting gas to China in October 2017. During the year, the supply volume amounted to 5 billion m³. In October 2019, the «Saryarka» MG (Kyzylorda-Zhezkazgan-Karaganda-Nur-Sultan) was built, supplying gas from the «Beineu-Bozoy-Shymkent» MG to the capital, which will realize the 60-year-old need for gasification of this city (Akmolinsk, Tselinograd, Akmola, Astana, Nur-Sultan).

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