Regional Analysis Brief: Caspian Sea

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Overview

- This report analyzes energy in the Caspian Sea region, focusing both on energy production and resources offshore in the Caspian Sea itself. It also provides an energy overview of several littoral (coastal) countries of the Caspian Sea (Azerbaijan, Kazakhstan, and Turkmenistan). We also include a discussion of Uzbekistan because a considerable amount of Uzbekistan's territory, along with its energy resources, lies in the geological Caspian basins (Figure 1). Separate reports are available for the two other littoral countries, Iran and Russia.
- The Caspian Sea region is one of the oldest oil-producing areas in the world, and historical records reveal primitive oil extraction on the Apsheron peninsula near Baku dating back hundreds of years. Significant oil and natural gas reserves exist from both offshore deposits in the Caspian Sea and onshore fields in the Caspian basins. Traditionally an oil-producing area, the Caspian area has more recently grown as a natural gas producer.
- The Caspian Sea region became a significant source of oil production for the Russian Empire, and subsequently the Soviet Union. The region's share of world supply fell in the second half of the 20th century because its stagnated growth and a shift toward new oil-rich areas such as West Siberia. Aside from Azerbaijan's oil production, the Caspian Sea largely was untapped until the collapse of the Soviet Union.
- The Caspian Sea and its surrounding area regained the world's attention after a consortium of international oil companies led by bp signed an agreement with Azerbaijan's government to develop the country's offshore reserves and discovered the giant Azeri-Chirag-Guneshli (ACG) field. Since then, Caspian fields have seen an influx of investment into major projects such as Kazakhstan's Kashagan field.

Territorial disputes

- The Caspian Sea is the world's largest inland water body and contains more than 40% of the world's inland waters, according to the United Nations Global International Waters Assessment (GIWA). The dissolution of the Soviet Union led to different interpretations of existing legal treaties between the Soviet Union and Iran related to the ownership of the Caspian Sea and use of resources in its waters, seabed, and subsoil. Given the lack of an agreement on whether the Caspian was a *lake* or a *sea*, two sets of public international law could have applied. This lack of clarity created uncertainties for investments in exploration and development activities in the Caspian Sea.[1]
- During the Fifth Caspian Summit on August 12, 2018, the Presidents of Kazakhstan, Azerbaijan, Iran, Russia, and Turkmenistan signed the Convention on the Legal Status of the Caspian Sea (Convention).
- According to the Convention:
    - The parties established the extent of their territorial waters up to a limit not exceeding 15 nautical miles.
    - The parties also established 10 nautical miles-wide fishery zones adjacent to the territorial waters where each state has the exclusive right to harvest aquatic biological resources. Outside the fishery zones, the parties preserved a common water area. Outside the maritime state borders, ships flying the flags of coastal countries enjoy freedom of navigation.

- The states with adjacent and opposite coasts could delimit the seabed and subsoil into sectors by agreement to enable those states to exercise their sovereign rights to subsoil exploitation and other legitimate economic activities related to developing the seabed and subsoil resources.
- Undersea pipelines and cables can also be laid on the bed of the Caspian Sea, on the condition that the projects complied with environmental requirements.

Table 1. Caspian offshore oil and natural gas reserves and production

		2023 2P reserves (percentage of total country 2P reserves)	2022 offshore production per day (percentage of total country production)
Azerbaijan	Oil (million barrels)	3,196 (89%)	0.650 (96%)
	Natural gas (Bcf)	23,067 (95%)	3.307 (100%)
Kazakhstan	Oil (million barrels)	4,206 (28%)	0.277 (15%)
	Natural gas (Bcf)	1,948 (10%)	0.345 (13%)
Turkmenistan	Oil (million barrels)	526 (52%)	0.122 (55%)
	Natural gas (Bcf)	2,234 (4%)	0.552 (7%)
Uzbekistan	Oil (million barrels)	0 (0%)	0 (0%)
	Natural gas (Bcf)	0 (0%)	0 (0%)

Data source: U.S. Energy Information Administration, *International Energy Statistics*, Rystad
Note: Excludes refinery gains. 2P reserves are the total of proven and probable reserves. Bcf= billion cubic feet

Energy Overview of Caspian Regional Countries

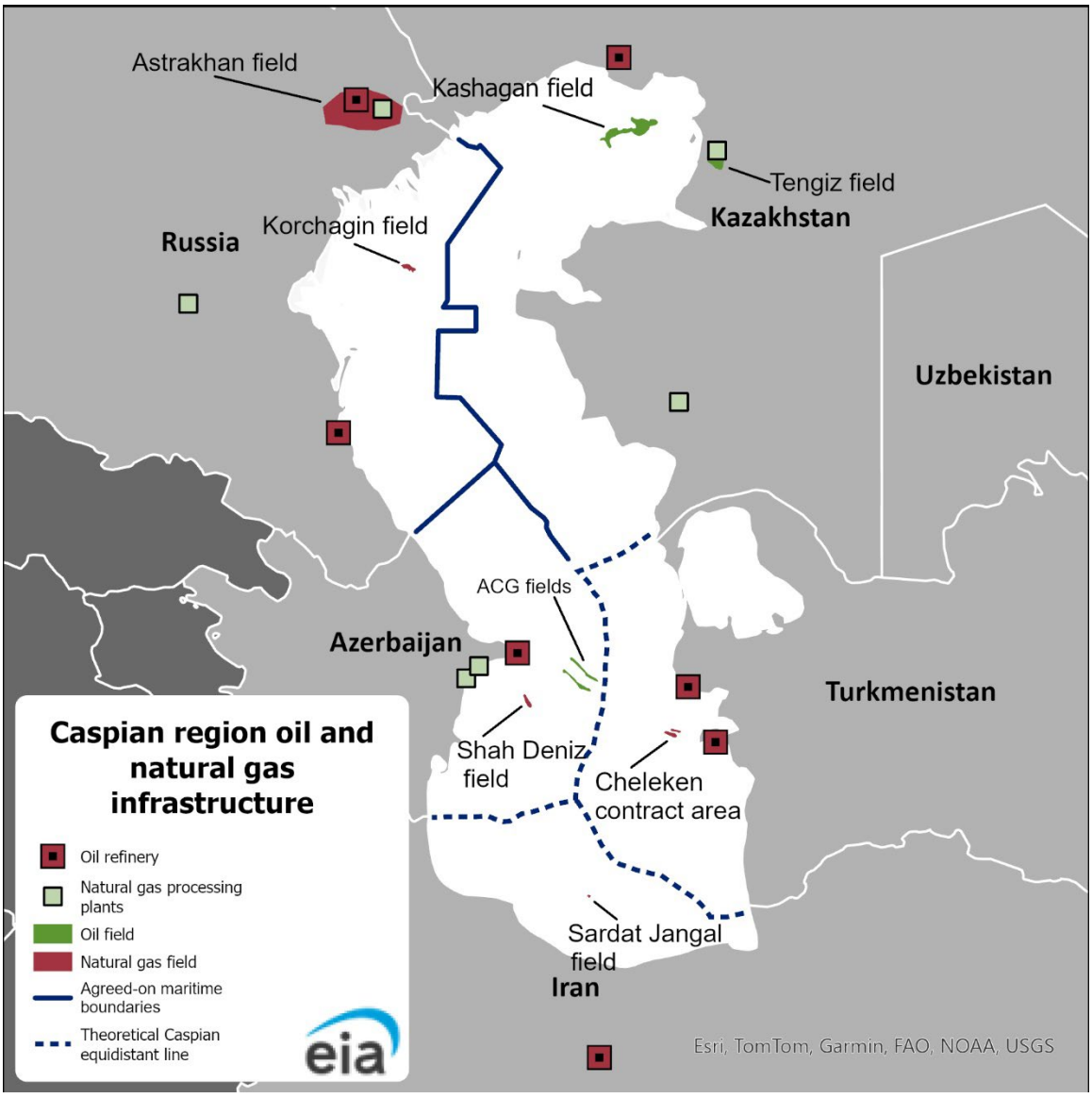
- Petroleum and natural gas production in the four Caspian regional countries (Azerbaijan, Kazakhstan, Turkmenistan, and Uzbekistan) were considered an alternative to Russia after the breakup of the Soviet Union. Petroleum production in the offshore Caspian accounted for 1% of global petroleum supplies [over 1 million barrels per day (b/d)] and almost 3% [over 4 trillion cubic feet (Tcf)] of global natural gas supplies in 2022.
- OPEC+ member Azerbaijan was the top producer of oil and natural gas from offshore Caspian Sea fields, and almost all of its petroleum and natural gas production in 2022 came from offshore in the Caspian Sea (Table 1).
- Kazakhstan, also an OPEC+ member, was the second-highest petroleum producer from offshore fields in the Caspian Sea, with 15% (0.28 million b/d) of its total production produced offshore.
- Kazakhstan, Turkmenistan, and Uzbekistan also have considerable energy resources and production located onshore that are not included as part of their Caspian Sea totals. Large fields such as the Tengiz field in Kazakhstan, often associated with the Caspian, are located onshore and are not included in Kazakhstan's Caspian Sea totals.
- In 2023, the four Caspian countries covered in this brief accounted for 3% of global energy production [16.0 quadrillion British thermal units (quads)] and 1% of global energy consumption (8.1 quads). Kazakhstan accounted for almost one-half of the region's energy production and consumption (Table 2).

- Turkmenistan was the world's 11th-highest natural gas producer, and Uzbekistan was the 17th-highest natural gas producer in 2023; almost all of their reserves and production were onshore.

Figure 1. Caspian basins

Source: U.S. Energy Information Administration

Figure 2. Caspian region oil and natural gas infrastructure



Source: U.S. Energy Information Administration

Table 2. Caspian Sea countries' energy overview, 2023

		Crude oil and other petroleum liquids	Natural gas	Coal	Nuclear	Hydro	Other renewables	Total
Azerbaijan	Primary energy production (quads)	1.33	1.32	0.00	0.00		0.01[a]	2.66
	Primary energy production (percentage)	49.9%	49.8%	0.0%	0.0%		0.3%	100.0%
Azerbaijan	Primary energy consumption (quads)	0.22	0.47	0.00	0.00		0.00[a]	0.69
	Primary energy consumption (percentage)	32.0%	68.5%	0.0%	0.0%		-0.5%	100.0%
Azerbaijan	Electricity generation (TWh)	0.11	27.08	0.00	0.00	1.64	0.26	29.09
	Electricity generation (percentage)	0.4%	93.1%	0.0%	0.0%	5.6%	0.9%	100.0%
Kazakhstan	Primary energy production (quads)	4.13	1.16	2.62	0.00		0.05[a]	7.96
	Primary energy production (percentage)	51.9%	14.6%	32.9%	0.0%		0.6%	100.0%
Kazakhstan	Primary energy consumption (quads)	0.76	0.82	1.88	0.00		0.05[a]	3.52
	Primary energy consumption (percentage)	21.7%	23.4%	53.4%	0.0%		1.5%	100.0%
Kazakhstan	Electricity generation (TWh)	1.42	28.22	70.50	0.00	9.36	4.70	114.19
	Electricity generation (percentage)	1.2%	24.7%	61.7%	0.0%	8.2%	4.1%	100.0%

Table 2. Caspian Sea countries' energy overview, 2023 continued

		Crude oil and other petroleum liquids	Natural gas	Coal	Nuclear	Hydro	Other renewables	Total
Turkmenistan	Primary energy production (quads)	0.48	3.12	0.00	0.00		0.0 [a]	3.59
	Primary energy production (percentage)	13.3%	86.7%	0.0%	0.0%		0.0%	100.0%
Turkmenistan	Primary energy consumption (quads)	0.29	1.66	0.00	0.00		-0.03[a]	1.92
	Primary energy consumption (percentage)	15.2%	86.4%	0.0%	0.0%		-1.6%	100.0%
Turkmenistan	Electricity generation (TWh)	0.00	33.78	0.00	0.00	0.01	0.00	33.78
	Electricity generation (percentage)	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Uzbekistan	Primary energy production (quads)	0.07	1.55	0.09	0.00		0.02 [a]	1.74
	Primary energy production (percentage)	4.0%	89.3%	5.3%	0.0%		1.4%	100.0%
Uzbekistan	Primary energy consumption (quads)	0.21	1.60	0.13	0.00		0.03 [a]	1.97
	Primary energy consumption (percentage)	10.6%	81.0%	6.7%	0.0%		1.8%	100.0%
Uzbekistan	Electricity generation (TWh)	1.50	62.0	5.70	0.00	6.60	0.45	76.25
	Electricity generation (percentage)	2.0%	81.3%	7.5%	0.0%	8.7%	0.6%	100.0%

Data source: U.S. Energy Information Administration, International Energy Statistics

Note: Table shows country totals. We aggregate hydroelectricity, hydro pump storage, and renewables as *other renewables* for primary energy production and consumption. Totals may not equal sum of component due to independent rounding. Quads=quadrillion British thermal units, TWh=terawatthours

[a] Includes hydroelectricity. Negative numbers can occur when energy is put into pumped storage and then released, resulting in net energy losses.

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Petroleum and Other Liquids

Azerbaijan

- Azerbaijan's proved oil reserves totaled 7 billion barrels as of January 1, 2025. [2]
- Crude oil production (excluding condensate) in Azerbaijan has been declining since peaking at almost 1.0 million barrels per day (b/d) in 2009–2010. We project total petroleum liquids production to average a little over 600,000 b/d from 2024 to 2026 (Figure 3).[3]
- The State Oil Company of the Republic of Azerbaijan (SOCAR) is the state-owned company responsible for 282,000 b/d of Azerbaijan's oil production in 2021, primarily through minority stakes in fields.[4] bp is the largest foreign investor in Azerbaijan and operates much of the country's oil and natural gas production and infrastructure, including pipelines and terminals, with SOCAR.
- The deepwater field Azeri Chirag Gunashli (ACG) is the primary source of petroleum liquids production in Azerbaijan, but it peaked in 2010 at 823,100 b/d before falling to 664,400 b/d in 2012.[5] In the first half of 2023, the field produced 375,000 b/d of Azeri Light crude oil (34.9° API and 0.55% sulfur). This crude oil and the condensate from the Shah Deniz natural gas field are the primary petroleum liquids produced and exported by Azerbaijan.[6,7] The newest addition to the ACG field, the $6 billion Azeri Central East platform (ACE), began production in April 2024 as part of an effort to slow the decline of the ACG field production.[8,9]

Kazakhstan

- Kazakhstan's proved oil reserves totaled 30 billion barrels as of January 1, 2025.[10]
- In Kazakhstan, also an OPEC+ member, petroleum and other liquid fuels production totaled an estimated 1.9 million b/d in 2024 (Figure 3). Petroleum liquid fuels consumption was an estimated 0.4 million b/d in 2024 (Figure 4).
- Crude oil production (excluding condensate) was 1.5 million b/d in 2024. Kazakhstan has missed its OPEC+ production targets for multiple months.[11]
- The Tengiz oil field, Kashagan offshore oil field, and Karachaganak natural gas condensate field are the primary sources of oil production in Kazakhstan. KazMunayGas, formerly KazakhOil, maintains a relatively small stake in most fields, and international firms such as Shell, Chevron, Eni, Lukoil, and ExxonMobil oversee most of the operations.
- The three top-producing petroleum liquids fields in 2022 were Karachagank (227,000 b/d of condensate), Tengiz (610,000 b/d of condensate), and Kashagan (255,000 b/d of crude oil).[12]
- Chevron completed an expansion project for the Tengiz oil field that plans to increase production to 960,000 b/d. [13]
- The Tengiz oil field expansion could lead to more production, but seasonal power outages continue to hamper oil production in Kazakhstan.[14]
- Kazakh CPC blend is a very light (45.3° API), sweet crude oil (0.56% sulfur) that is valued for its high yield of gasoline and light distillates, and it is the main export blend of Kazakhstan.

Turkmenistan

- Turkmenistan's proved oil reserves totaled 600 million barrels as of January 1, 2025. [15]

- Crude oil and liquid petroleum fuels production in Turkmenistan totaled an estimated 275,000 b/d in 2024, and we estimate that consumption was 154,000 b/d in 2024 (Figures 3 and 4).

Uzbekistan

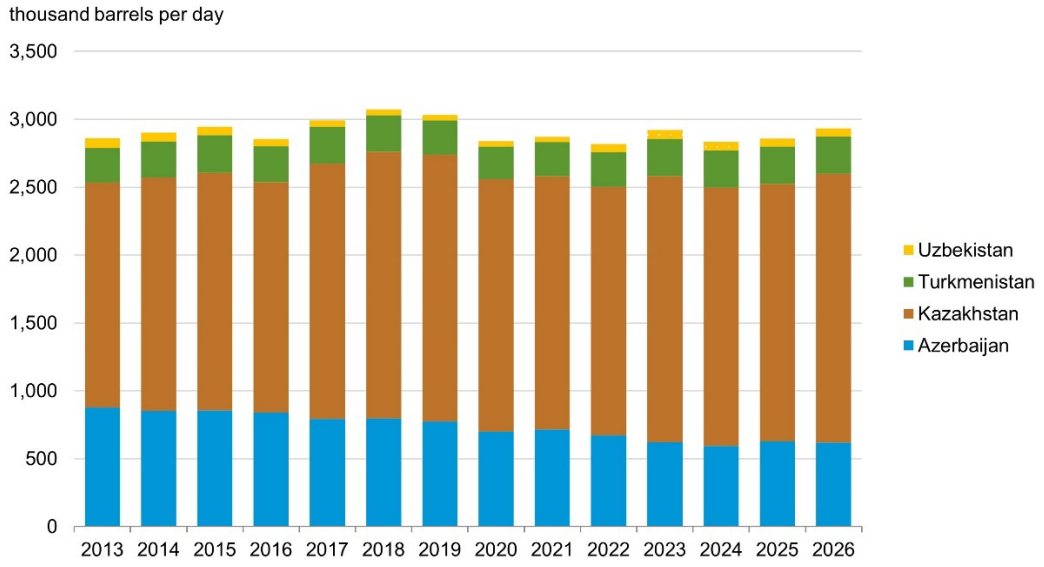
- Uzbekistan's proved oil reserves totaled 594 million barrels as of January 1, 2025. [16]
- Uzbekistan has relatively small production totals, with an estimated 63,000 b/d of crude oil and liquid fuels production in 2024 (Figure 3). In 2024, an estimated 112,000 b/d of liquid fuels were consumed in Uzbekistan (Figure 4). Notably, total petroleum liquids production in Uzbekistan peaked decades earlier with production as high as 189,000 b/d in 1999.

Table 3. Caspian region refineries, 2023

Refineries	Ownership	Location	Initial operations	Crude oil capacity (b/cd)	Vacuum distillation capacity (b/cd)	Note
New Baku	SOCAR	Baku, Azerbaijan	1953	120,493	71,043	Scheduled to undergo construction and modernization until 2026; scheduled to produce lower-emitting and lower-sulfur EURO-5 diesel starting in 2022 and EURO-5 gasoline this year[17]
Atyrau	KazakOil	Atyrau, Kazakhstan	1945	100,000	27,064	Uses only domestic crude oil from northwestern Kazakhstan
Pavlodar	KazakOil	Pavlodar, Kazakhstan	1978	120,000	93,973	In north-central Kazakhstan and supplied mainly by a crude oil pipeline from western Siberia because Russia's supplies are well-placed geographically to serve it
Shymkent	Petro-Kazakhstan	Shymkent, Kazakhstan	1985	120,000	0	Uses crude oil from the oil fields at Kumkol and the nearby area in central Kazakhstan
Turkmenbashi Complex		Turkmenbashi/Seydi, Turkmenistan	1943	200,820	40,900	Many plans to expand refining have been reported but details are scarce.[18]
Fergana	Sanoat Energetika Guruhi LLC	Fergana, Uzbekistan	1959	110,452	45,671	$400 million modernization effort replaces 30% of the refinery's existing obsolete units and equipment and enables production of Euro 5-quality gasoline, diesel, and jet fuel. A new hydrogen production unit for hydroprocessing also added.[19]
Bukhara	Uzbekneftegaz	Bukhara, Uzbekistan	1997	50,000	0	In 2022, added installation for loading liquefied hydrocarbon gas into tankers and enabled production of Euro-6 class diesel fuel.[20]
Total				**821,765**	**278,651**	

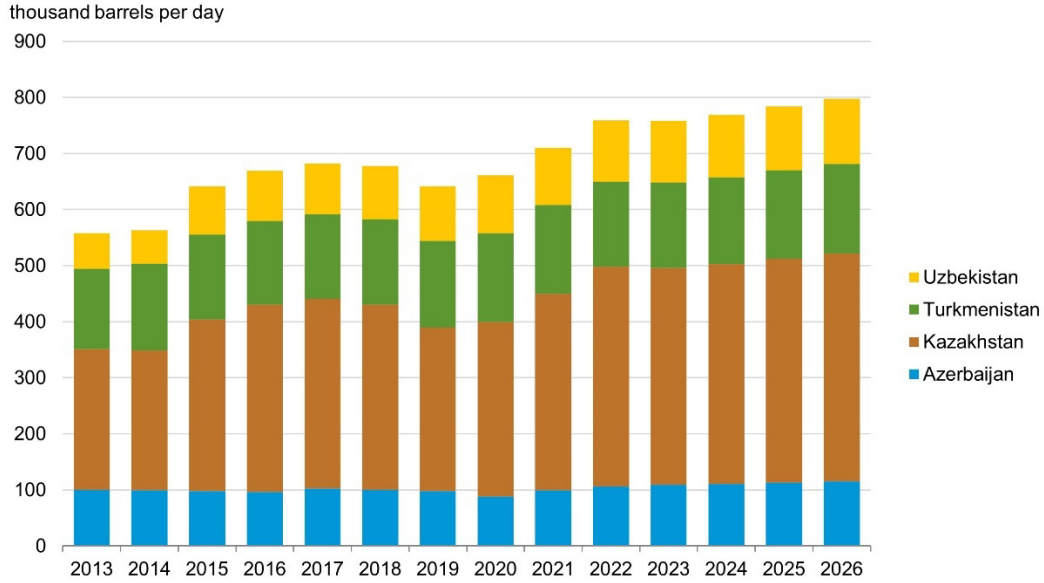
Data source: Oil & Gas Journal, *2023 Worldwide Refining Survey*
Note: Excludes production in Iran and Russia. b/cd=barrels per calendar day

Figure 3. Caspian region petroleum and other liquid fuels production, 2013–2026



Data source: U.S. Energy Information Administration, *International Energy Statistics and Short-Term Energy Outlook*
Note: Data for 2025 and 2026 are forecast in the *Short-Term Energy Outlook*. Excludes production in Iran and Russia.

Figure 4. Caspian region petroleum and other liquid fuels consumption, 2013–2026



Data source: U.S. Energy Information Administration, *International Energy Statistics and Short-Term Energy Outlook*
Note: Data for 2025 and 2026 are forecast in the *Short-Term Energy Outlook*. Excludes consumption in Iran and Russia.

Natural Gas

Azerbaijan

- Azerbaijan's proved natural gas reserves totaled 60 trillion cubic feet (Tcf) as of January 1, 2025.[21]
- Production reached a record-high 1.3 Tcf of natural gas in 2023, and consumption was 0.4 Tcf (Figures 5 and 6).
- The Shah Deniz field and the ACG oil and natural gas fields are the top sources of natural gas in Azerbaijan. The Shah Deniz field accounted for 0.7 Tcf and the ACG field accounted for 0.3 Tcf of the 1.3 Tcf of natural gas produced from January to September 2023 in Azerbaijan. bp, the operator of the field, expects the second phase of the Shah Deniz field to increase Shah Deniz's production to 0.9 Tcf of natural gas and 100,000 b/d of condensate when production plateaus.

Kazakhstan

- Kazakhstan's proved natural gas reserves totaled 85 Tcf as of January 1, 2025.[22] Most of Kazakhstan's natural gas reserves are associated reserves with crude oil.
- In Kazakhstan, natural gas production was 1.0 Tcf, and consumption was 0.8 Tcf in 2023 (Figures 5 and 6).
- In 2022, more than 35% of gross natural gas production in Kazakhstan was reinjected to increase oil production.[23] Natural gas produced at Tengiz and Kashagan generally is high in sulfur and so, requires special handling and additional expense to process. Unlike the Tengiz project, which includes a natural gas processing plant, the Karachaganak project has insufficient natural gas processing capacity to produce pipeline-quality dry natural gas. Most of the raw marketed natural gas production from the Karachaganak field must be exported via a Soviet-era dedicated pipeline to Russia to be processed at a natural gas processing plant in Orenberg, owned by Gazprom.

Turkmenistan

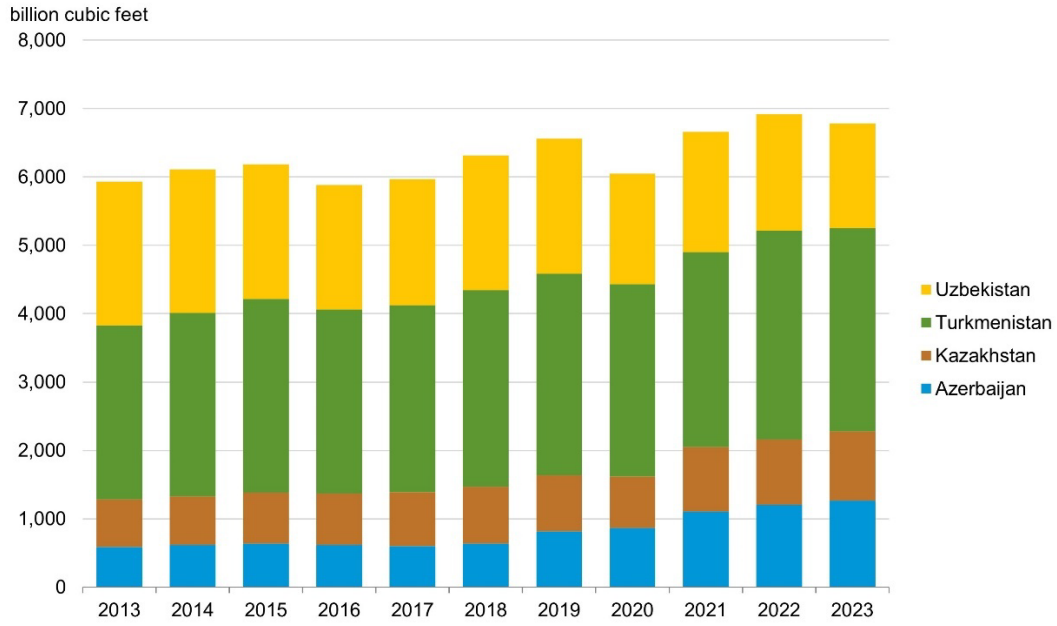
- Turkmenistan's proved natural gas reserves totaled 400 Tcf as of January 1, 2025, which are the fifth-highest in the world.[24]
- In Turkmenistan, dry natural gas production was 3.0 Tcf, and consumption was 1.6 Tcf in 2023, which were record highs dating back to when our data keeping began in 1992 (Figures 5 and 6). In 2009, production in Turkmenistan fell nearly 50% to 1.2 Tcf when a dispute with Russia led to decreased exports via the Central Asian Center Export Pipeline 4.[25]
- In response, Turkmenistan built the East-West Gas Pipeline and established additional pipeline paths to export natural gas to Europe and Asia. Turkmenistan also plans to complete the Turkmenistan-Afghanistan-Pakistan-India Gas Pipeline (TAPI) and begin the Trans Caspian Pipeline extension of the East-West Pipeline to Europe through Azerbaijan and Türkiye.[26]
- Turkmenistan's national gas company, Türkmengaz, operates the Galkynysh Gas Field, the world's second-largest natural gas field based on reserve volume. The Galkynysh has an estimated 953.5 Tcf in reserves, which includes unproven reserves, and an estimated 3.2 Bcf/d of production from 45 wells.

- Development of the Galkynysh field cost Turkemenistan $10 billion and was partially financed by an $8 billion targeted loan from China. Galkynysh is still in its first production stage, so production likely will increase in the future with additional drilling.[27,28]
- The Galkynysh produces a sour natural gas containing hydrocarbon gas liquids. It has two sour natural gas and condensate processing complexes that have a total processing capacity of 1.0 Tcf per year. The field also has at least three natural gas treatment and sulfur handling facilities, and each has production capacity of 0.4 Tcf per year.[29]
- High methane emissions from its oil and natural gas fields threaten Turkmenistan's prospects to enter the European natural gas market via a potential Trans Caspian Pipeline, but Turkmenistan has additional export prospects in Asia via the proposed TAPI Gas Pipeline and via Line D of the Center Asia Gas Pipeline (CAGP).[30,31]

Uzbekistan

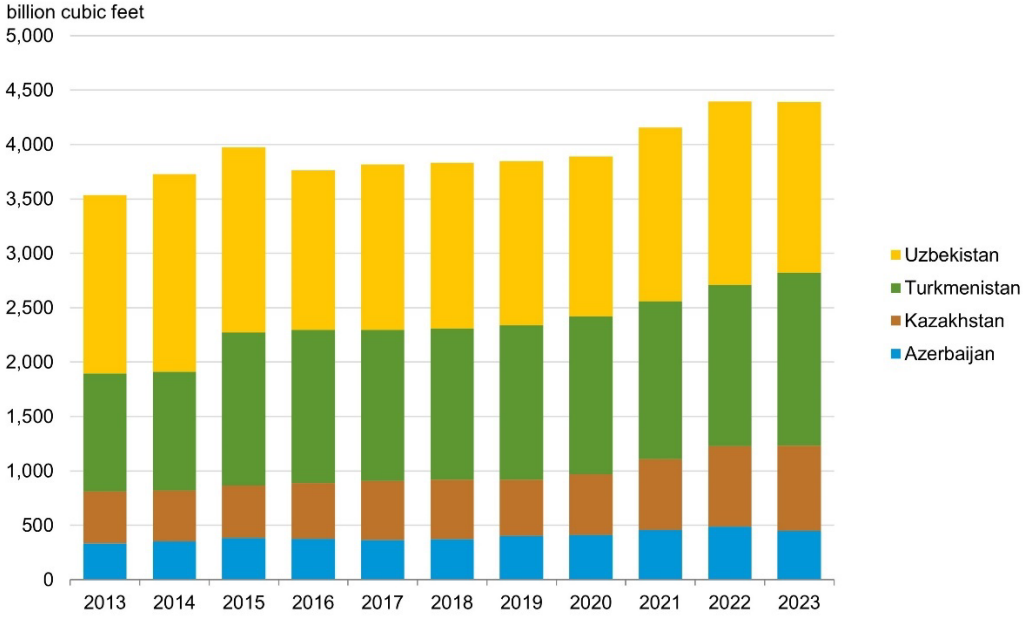
- Uzbekistan's proved natural gas reserves totaled 65 Tcf as of January 1, 2025.[32,33] Uzbekneftegaz, Ubekistan's state-owned energy firm, owns about one-half (33.0 Tcf) of the proved reserves in Uzbekistan.[34]
- In Uzbekistan, in 2023, dry natural gas production was 1.5 Tcf, and consumption was 1.6 Tcf (Figures 5 and 6). Production in Uzbekistan has been declining since peaking at 2.4 Tcf in 2008. Natural gas production in the country declined by 4% from 2021 to 2022, and this decline is on pace to continue in 2023.[35]
- In 2018, Uzbekneftegaz and Russia's Lukoil commissioned the Kandym Gas Processing Complex (KGPC) in the Bukhara Province of southwestern Uzbekistan. The plant can process more than 280 Bcf of natural gas per year, making it one of the largest natural gas treatment facilities in Central Asia.[36]
- Natural gas shortages have intensified Uzbekistan's energy shortages and power outages, but a proposed natural gas union with Russia could provide some relief in the form of additional Russian natural gas imports.[37,38]

Figure 5. Caspian region dry natural gas production, 2013–2023



Data source: U.S. Energy Information Administration, *International Energy Statistics*
Note: Excludes production in Iran and Russia.

Figure 6. Caspian region dry natural gas consumption, 2013–2023

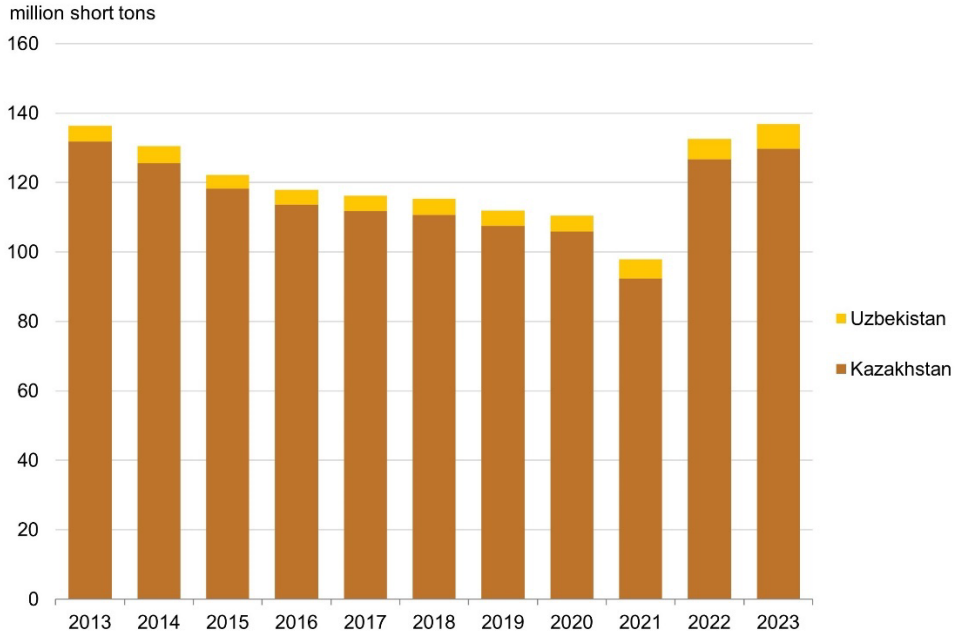


Data source: U.S. Energy Information Administration, *International Energy Statistics*
Note: Excludes consumption in Iran and Russia.

Coal

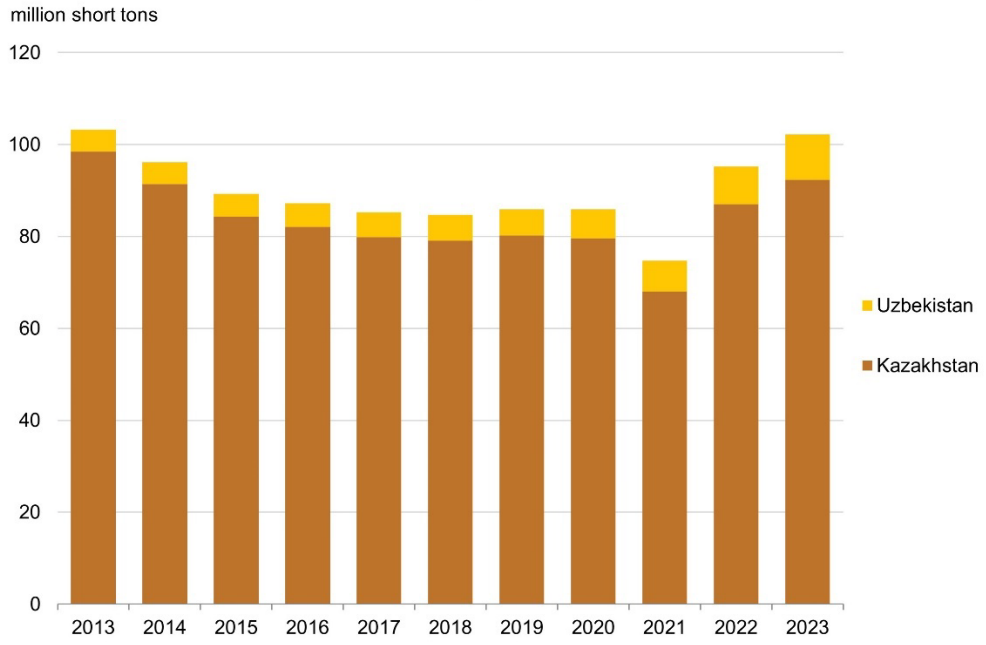
- Kazakhstan is the only significant coal producer and consumer of the four Caspian-region countries in this brief, and it was the eighth-highest coal producer in the world in 2023.
- Coal production in Kazakhstan in 2023 was 130 million short tons, and consumption was 92 million short tons (Figures 7 and 8). Coal production and consumption remain a significant part of Kazakhstan's energy sector despite a general decline in both since peaking in 2012.
- Most coal production (85% in 2023) and exports (81% in 2023) in Kazakhstan consist of steam coal (also known as bituminous coal), which is suitable for burning in electric power plants or in other applications to generate steam and heat. Smaller quantities of metallurgical coal are also produced in Kazakhstan that are consumed domestically. In addition to coal, Kazakhstan is rich in a variety of minerals, and those deposits are concentrated in the north and center of the country. Coal is a major energy source for the mining and smelting industries and for the electric power sector in Kazakhstan.
- Uzbekistan produces and consumes a relatively small amount of coal compared with other Caspian region countries, but Azerbaijan and Turkmenistan do not have any significant coal consumption or production (Figures 7 and 8).

Figure 7. Caspian region coal production, 2013–2023



Data source: U.S. Energy Information Administration, International Energy Statistics
Note: Excludes production in Iran and Russia.

Figure 8. Caspian region coal consumption, 2013–2023



Data source: U.S. Energy Information Administration, International Energy Statistics
Note: Excludes consumption in Iran and Russia.

Electricity

Azerbaijan

- In 2023, electricity generation in Azerbaijan totaled 29.1 terawatthours (TWh), and the country had 8.4 gigawatts (GW) of installed generation capacity, of which 6.7 GW was fossil fuel capacity (primarily natural gas).
- Azerenerji—Azerbaijan's state-owned power utility—is responsible for generating, dispatching, and transmitting electric power. Azerenerji, along with the Nakhchivan Energy Authority, operates most of the country's power stations.[39] The State Agency for Alternative and Renewable Sources and independent power producers operate much less generation capacity.
- Azerbaijan's electric power sector has no wholesale competition among its power producers. Electricity prices are regulated, and power producers are required to supply their power to the central dispatch system for transmission and distribution.
- In December 2023, Azerbaijan's energy minister announced a 230-MW solar plant was completed, the largest in the Caspian Sea region, with near-term plans for eight more solar and wind plants totaling 1.6 GW of capacity. The minister conveyed further plans to use foreign investment to add 8.0 GW of carbon-free power capacity by 2030 and 19.0 GW of power capacity by 2037, including hydrogen and green-ammonia production and export projects.[40]

Kazakhstan

- In 2023, electric power generation in Kazakhstan totaled 114.2 TWh, and the country had 28.0 GW of installed generation capacity. Kazakhstan had 22.0 GW of installed fossil fuel capacity,

primarily coal in 2023. Kazakhstan generates the most electricity among the four Caspian countries (Figure 9).

- Kazakhstan has some of the world's largest uranium deposits and is the top uranium producer, accounting for 43% of the world's uranium production from mines (21.2 thousand metric tons) in 2022.[41,42] Kazakhstan's sole nuclear power plant retired in 1999, but in 2023, the government announced plans for a referendum on building another nuclear power plant at an indefinite date.[43]
- Kazakhstan's Electricity Grid Operating Company, a state-owned company, operates Kazakhstan's national grid and is responsible for electricity transmission and network management. Several medium and small regional electricity companies handle distribution, some of which are privately owned. The electricity transmission and distribution sectors are considered natural monopolies and are regulated by the government. However, wholesale power generation is a competitive market, and most generation assets are owned by private enterprises.[44]
- Kazakhstan faced a series of power outages in 2023 that affected its oil production, refining, and transmission via the Caspian Pipeline Consortium (CPC) pipeline, highlighting the need for investment in its power infrastructure.[45]

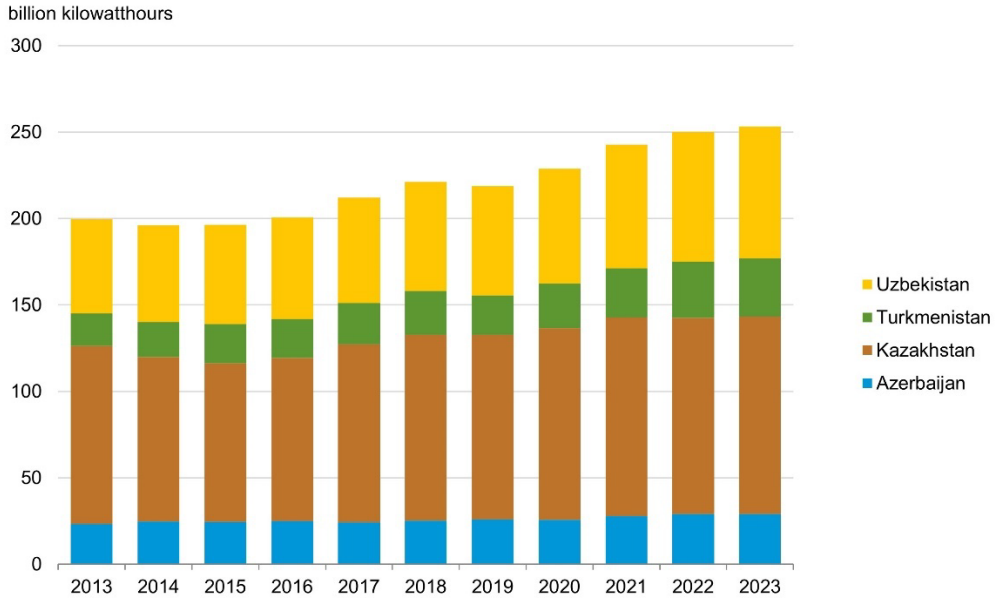
Turkmenistan

- In 2023, electric power generation in Turkmenistan was 33.8 TWh, and the country had 6.5 GW of installed generation capacity, all of which was from natural gas.
- The Ministry of Energy and Industry controls the electric power sector in Turkmenistan.
- Turkmenistan expanded electricity generation at the Turkmenbashi Oil Processing Complex. It already supplies some electric power to neighboring Iran, Afghanistan, Uzbekistan, and Kyrgyzstan.[46]

Uzbekistan

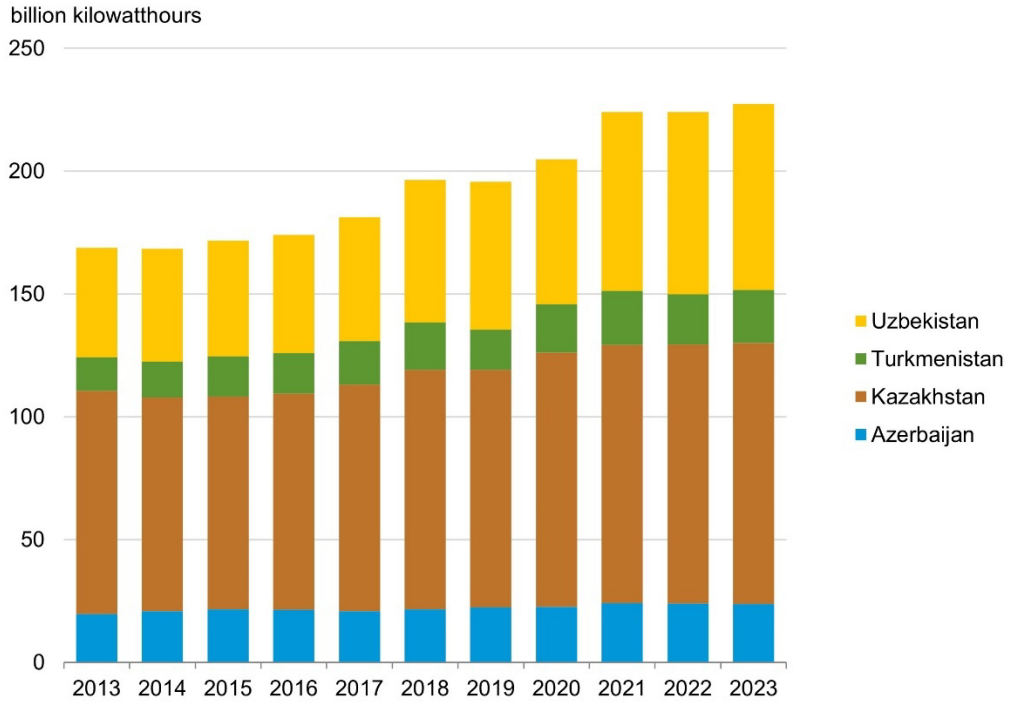
- In 2023, electric power generation in Uzbekistan was 76.3 TWh, and the country had 18.0 GW of installed generation capacity, of which 15.0 GW was from fossil fuel, primarily natural gas.
- Natural gas-fired thermal plants are the country's primary source of power generation, supplying approximately 86% of the country's total power; the remaining electricity is supplied by hydropower plants (Table 1). Uzbekistan's power system contributes significantly to the power-generating capacity of the Central Asia Power System (CAPS), an integrated power transmission network linking several Central Asian nations. Uzbekistan is also the primary electricity supplier to neighboring Afghanistan with fellow supplier Tajikistan.[47]
- Uzbekistan has an electrification rate of nearly 100%, but because of the country's aging Soviet-era infrastructure as well as increasing electricity demand, natural gas supply shortages, and extreme weather, regular power shortages and blackouts occur in some areas.[48,49] Shortages also limit electricity exports (Figure 16).[50]

Figure 9. Caspian region electricity net generation, 2013–2023



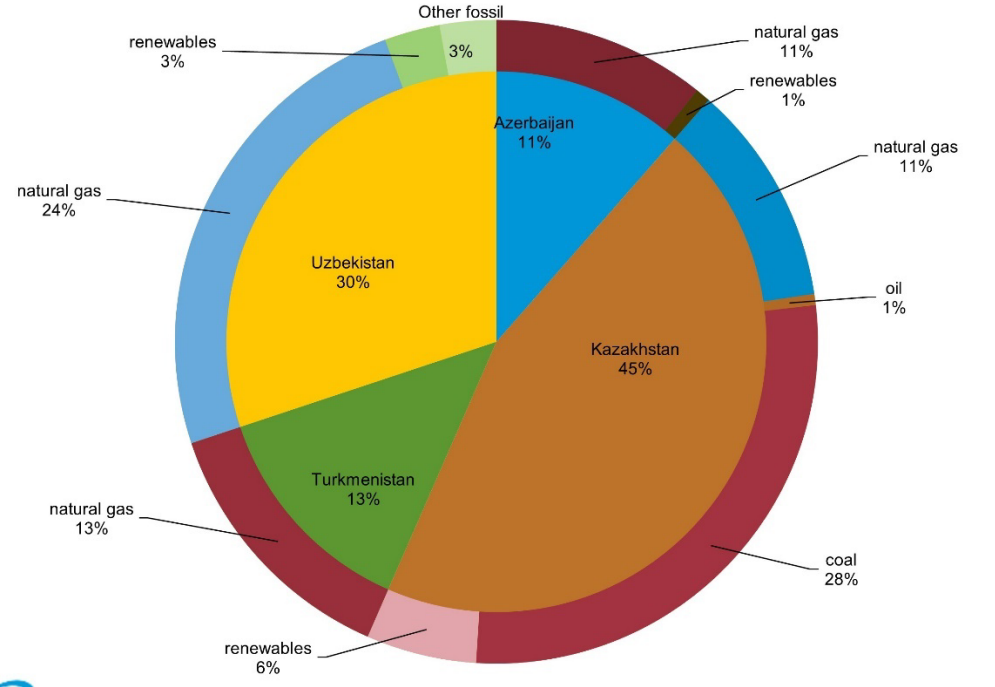
Data source: U.S. Energy Information Administration, International Energy Statistics
Note: Excludes production in Iran and Russia.

Figure 10. Caspian region electricity consumption, 2013–2023



Data source: U.S. Energy Information Administration, International Energy Statistics
Note: Excludes consumption in Iran and Russia.

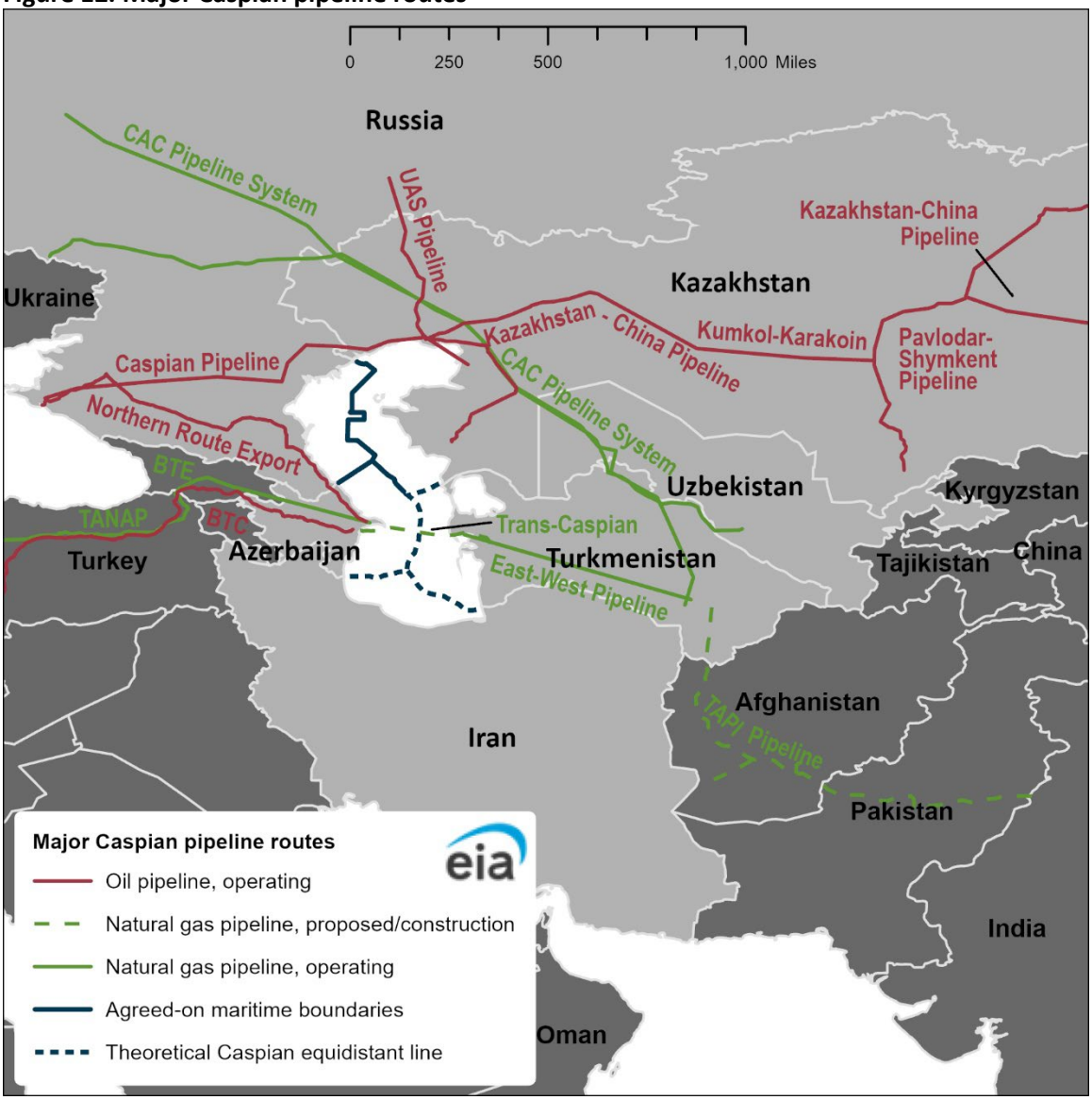
Figure 11. Caspian region electricity generation by fuel, 2023



Data source: U.S. Energy Information Administration, International Energy Statistics
Note: Excludes generation in Iran and Russia. Also excludes Turkmenistan hydropower which is less than 1% of generation.

Energy Trade

Figure 12. Major Caspian pipeline routes



Source: U.S. Energy Information Administration

Azerbaijan

Petroleum

- Azerbaijan's crude oil exports remained steady at about 620,000 b/d in 2022 and 2023. (Figure 13).
- Since it began operating in 1994, over 90% of ACG-produced oil (3.3 billion barrels of 3.6 billion barrels) has been exported to Ceyhan, Türkiye, via the Baku-Tbilisi-Ceyhan pipeline (BTC) as the

BTC blend (36.6° API gravity, 0.15% sulfur).[51,52] Small volumes of heavier crude oil are exported through the northern export pipeline to Russia. This oil is blended in Russia and marketed as the Urals blend. The quality of Urals blend can vary, but the oil is generally a medium, sour crude oil.

- About 83% of Azerbaijan's oil exports go through the BTC pipeline. Azerbaijan's and some of Kazakhstan's oil exports via the BTC were stopped for about six days following the earthquake in Türkiye that disrupted the Ceyhan port terminals in February 2023.[53]
- Russia and Azerbaijan may reverse the flow of the Baku-Tikhoretsk oil pipeline to supply up to 80,000 b/d to Baku because Kazakhstan is diverting flows to other pipelines and away from Russia's pipeline infrastructure.[54]

Natural Gas

- Natural gas exports grew from 0.7 Tcf in 2021 to 0.8 Tcf in 2022 and 2023 (Figure 14).
- In 2023, natural gas and oil exports briefly paused as a result of an earthquake that primarily damaged Turkish infrastructure. Since then, Azerbaijan's Nagorno-Karabakh conflict with Armenia has limited Azerbaijan's natural gas trade with Europe. However, production prospects in Azerbaijan got a boost from the Azeri Central East oil field (ACE) and Absheron natural gas and condensate fields, which should provide large production increases in Azerbaijan.[55]
- Given its connections to the Turkish pipeline system, including the TANAP pipelines, Azerbaijan can export both its own domestic natural gas production and the production from other Central Asian countries to Europe (Table 4).
- Azerbaijan's natural gas exports to Europe rose 4% to 0.3 Tcf for January to September 2023 relative to the prior year.[56]
- In September 2023, Azerbaijan and Türkiye began constructing the Türkiye-Nakhchivan (Igdir-Nakhchivan) Gas Pipeline, which was completed at the end of 2024. This pipeline will provide the Nakchivan Autonomous Region of Azerbaijan with an alternative to Gazprom, which currently controls the region's pipeline access to natural gas from both Russia and Iran. The pipeline capacity will be 53.0 Bcf per year (Bcf/y). The pipeline will travel through Armenia, which also could benefit by providing the country with new sources of natural gas as an alternative to Russia's Gazprom.[57]

Kazakhstan

Petroleum

- Kazakhstan's crude oil exports were 1.30 million b/d in 2022 (Figure 13) and increased to 1.41 million b/d in 2023.[58] In 2023, Kazakhstan worked to diversify trade routes, given its high use of the CPC pipeline. The CPC carries about 80% of Kazakhstan's crude oil export, which is loaded at Novorossiysk Port in Russia. Since Russia's full-scale invasion of Ukraine and the disruption to CPC loadings, Kazakhstan has been increasingly using vessels to ship oil and natural gas across the Caspian and Black Sea in addition to using the BTC oil pipeline; exports through the BTC increased 54% between January and August 2023 compared with the same time in 2022.[59,60,61]

Coal

- Kazakhstan's coal exports in 2023 totaled 37.5 million short tons (Figure 15).

Turkmenistan

Natural Gas

- Turkmenistan is the Caspian region's top natural gas exporter (1.5 Tcf in 2023) (Figure 14).
- Turkmenistan increased its trade with China when its natural gas exports to China via pipelines (such as the Central Asia-China pipeline) increased to 1.2 Tcf in 2022 (Table 4). Some analysts expect natural gas exports to reach 2.3 Tcf after a fourth pipeline, Line D, is built in 2028. These projects appear to be an alternative to the proposed West Siberia 2, also known as Power of Siberia 2, a proposed 1.8 Tcf link with China via Mongolia that is now pushed to the early 2030s.
- Turkmenistan is seeking to further diversify its natural gas exports to Afghanistan, Pakistan, and India via the planned Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipeline project, in which Turkmengaz is the primary shareholder. All other parties from Afghanistan, Pakistan, and India have a 5% share each in the $10 billion project. The TAPI has an expected transport capacity of 1.2 Tcf/y.[62,63]
- Turkmenistan also supplies 0.9 Bcf/d of natural gas to Iraq via a natural gas swap with Iran. This swap is one of many expansions on the initial 2021 three-way agreement between Turkmenistan, Iran, and Azerbaijan.[64,65]
- Turkmenistan aspires to ship natural gas to Europe via the proposed TransCaspian pipeline, but high methane emissions from its oil and natural gas fields may prevent its exports from complying with the EU's 2030 import emission limits.[66] Satellites have recorded 849 super-emitting events from leaks, wells, tanks, or pipes from 2019 to 2022, and an estimated 2.6 metric tons of methane leaked in 2022 from Turkmenistan's western fields on the Caspian coast.[67,68,69]

Uzbekistan

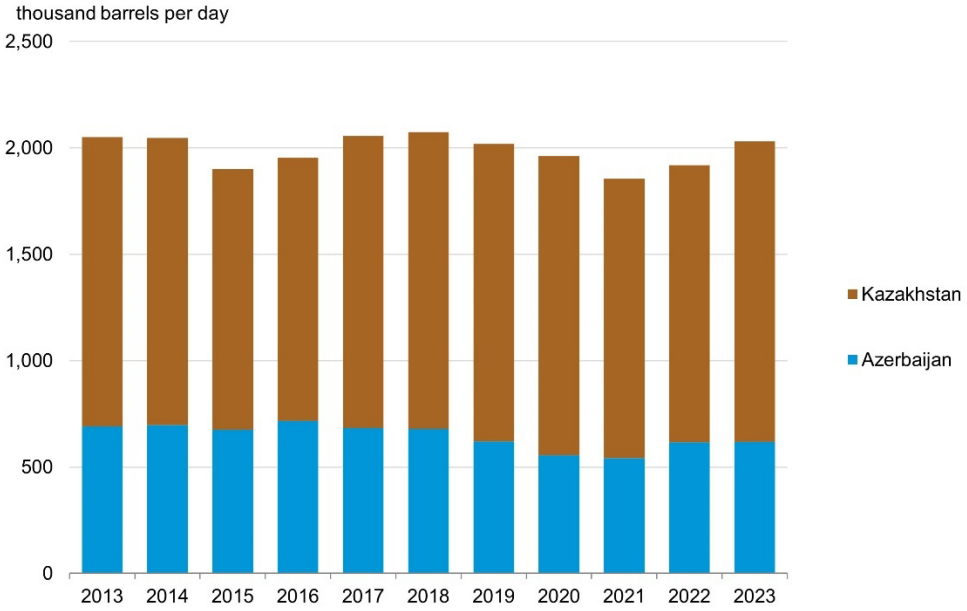
Natural Gas

- Uzbekistan is a transit country for natural gas flowing from Turkmenistan and Russia to China via the CAC oil pipeline and pipelines associated with the Kazakhstan-China natural gas pipeline (Tables 4 and 5).

Electricity

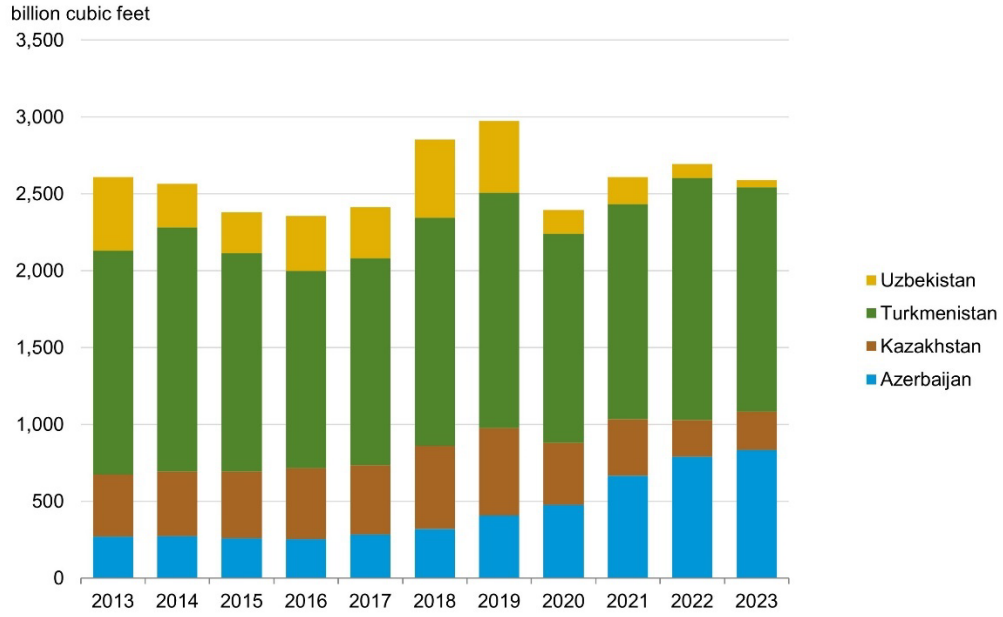
- Uzbekistan's power shortages have resulted in electricity exports falling from 8.1 billion kWh in 2013 to 2.0 billion kWh in 2023 (Figure 16).

Figure 13. Caspian region major crude oil exporters, 2013–2023



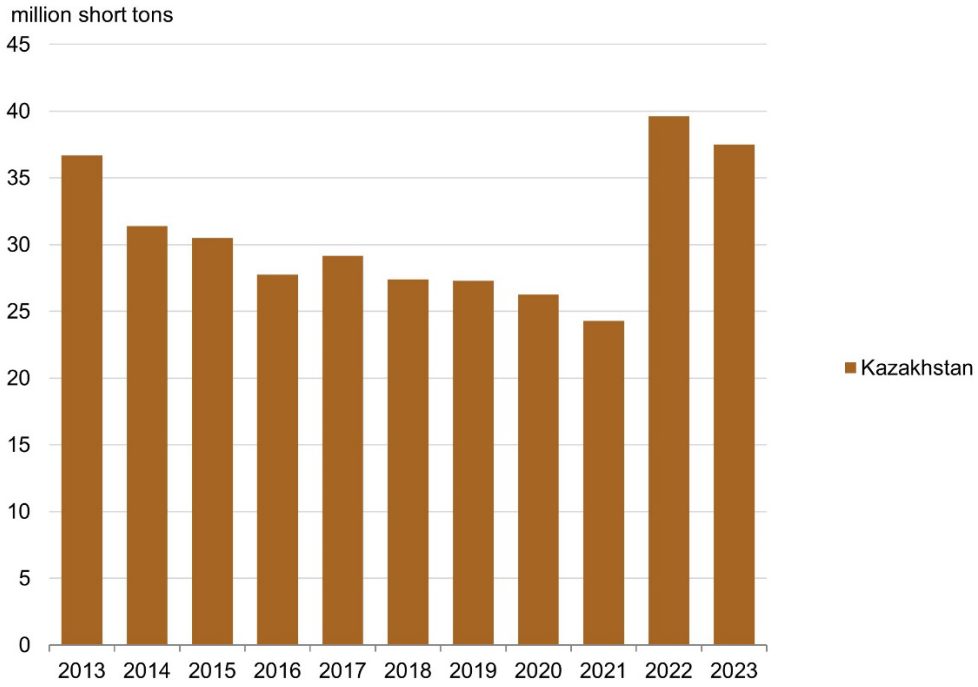
Data source: Azerbaijan: EIA International Energy Statistics and Vortexa. Kazakhstan: Global Trade Tracker
Note: Excludes Iran and Russian exports

Figure 14. Caspian region natural gas exports, 2013–2023



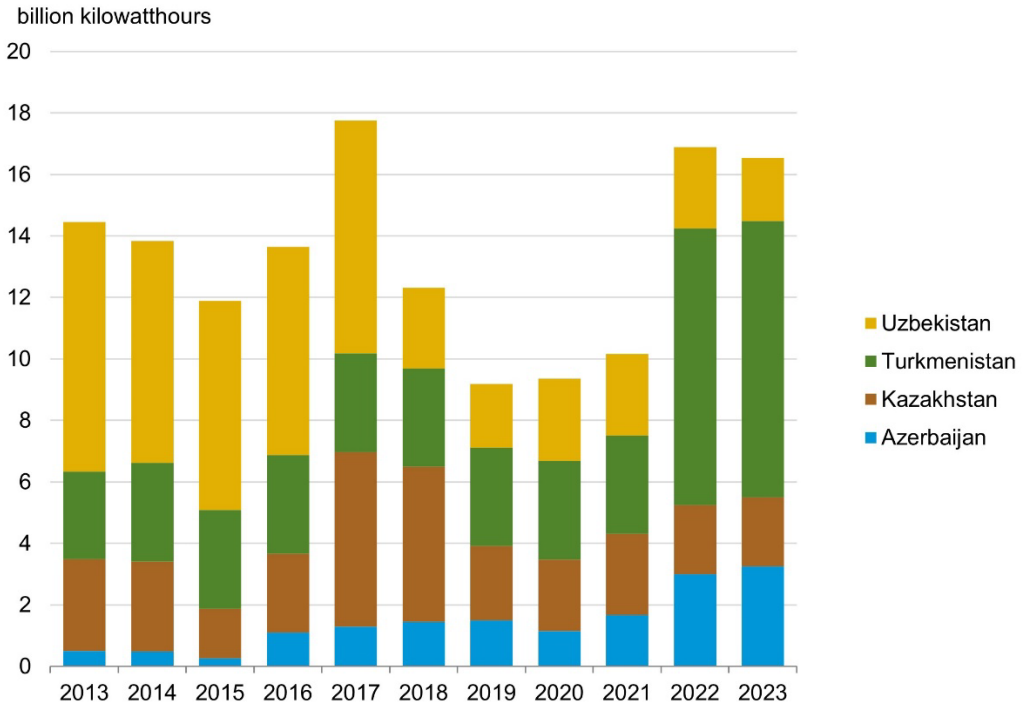
Data source: U.S. Energy Information Administration, International Energy Statistics
Note: Excludes Iran and Russian exports

Figure 15. Caspian region coal exports, 2013–2023



Data source: U.S. Energy Information Administration, International Energy Statistics
Note: Excludes Iran and Russian exports

Figure 16. Caspian region electricity exports, 2013–2023



Data source: U.S. Energy Information Administration, International Energy Statistics
Note: Excludes Iran and Russian exports

Table 4. Caspian Sea region's major natural gas pipelines

Facility (status)	Capacity (Tcf/y)	Total length (miles)	Supply regions	Destination	Details
Central Asia-Center/China Pipeline (CAC)-2,4,5, and 3 (Operating since 1969; CAC-1 retired)	2: 2.1 3: 0.2 4: 2.1 5: 2.1	2: 1,650 3: 2,240 4: 2,300 5: N/A	Russia	Kazakhstan and China via Uzbekistan and Turkmenistan	Originally used to connect Turkmenistan to Russia. Now, relatively important in supplying China with natural gas. Notably, CAC flow reversed on two lines in October 2023 to supply Russia's natural gas to Uzbekistan from Kazakhstan.[70]
Center Asia Gas Pipeline (CAGP) Line A–C (Operating since 2009; Line D planned)	A and B: 0.5 C: 0.9 D: 1.1	1,140 each	Turkmenistan	China via Kazakhstan, Tajikistan, Kyrgyzstan, and Uzbekistan	China helped finance the pipelines, including the latest Line 4, to gain access to Turkmenistan's natural gas. The Line D, one of China's main energy projects, will connect China to the Galkynysh natural gas field to China's Kyrgyzstan border.[71]
South Caucuses Pipeline (SCP)/Baku-Tbilisi-Erzurum Pipeline (BTE) (Operating since 2007; expanded in 2018)	0.9 (originally 0.3)	430	Shah Deniz field, Azerbaijan	Türkiye via Georgia (TANAP)	It follows the route of the BTC oil pipeline from Azerbaijan through Georgia to the TANAP.

Facility (status)	Capacity (Tcf/y)	Total length (miles)	Supply regions	Destination	Details
Trans-Anatolian Pipeline (TANAP) (Operating since 2019)	0.6	1,150	Azerbaijan (SCP)	Türkiye and Europe via Greece (TAP)	It is Türkiye's longest pipeline. It will be a key entry point to Europe for the rest of the Caspian Basin countries on the other side of the Caspian from Baku if the Trans Caspian pipeline is completed.
Trans Adriatic Pipeline (TAP) (Operating since 2020)	0.4	540	Azerbaijan via TANAP and SCP	Italy, Bulgaria (via IGB), and Southeast Europe	Construction is underway to expand to 0.7 Tcf capacity; it was built mainly to carry natural gas from Azerbaijan via the SCP expansion and TANAP. The Greece-Bulgaria bridge (IGB) was recently completed.[72]
Interconnector Türkiye-Bulgaria (ITB) (Operating since 2022)	0.1	–	Azerbaijan (via TAP and TANAP)	Bulgaria	Bulgaria has been importing more natural gas from Azerbaijan instead of from Russia, which was previously its nearly sole source.[73]
East-West Pipeline (Operating since 2015)	1.1	480	Mary Province, Turkmenistan	Balkan Province near Türkmenbaşy, Turkmenistan	Connects all the major natural gas fields in Turkmenistan also supplying natural gas to the central and Caspian regions, and potentially connects a Trans-Caspian Pipeline to Azerbaijan for access to greater Europe.
Trans-Caspian Pipeline (TCGP) (Proposed)	1.1	190	Türkmenbaşy, Turkmenistan	Baku, Azerbaijan	The estimated $5 billion pipeline would connect Turkmenistan's large natural gas reserves to Europe.

Data source: U.S. Energy Information Administration, *Country Analysis Brief: Türkiye*, 2023.

Note: Tcf/y=trillion cubic feet per year; (–)= not applicable

Table 5. Caspian Sea region's major crude oil and condensate pipelines

Facility (status)	Capacity (million b/d)	Total length (miles)	Supply regions	Destination	Details
Caspian Pipeline Consortium (CPC)	1.4	940	Tengiz, Kashagan, and Karachaganak fields, Kazakhstan	Novorossiysk, on Russia's Black Sea coast	A less favored trade route since sanctions were imposed on Russia following Russia's full-scale invasion of Ukraine.[74,75]
Kazakhstan-China Pipeline	0.4	1,380	Kumkol oil field, Kazakhstan	China	Preliminary plans exist to expand the Kenkiyak-Kiumkol section of the pipeline.[76]
Baku-Tbilisi-Ceyhan (BTC) (Operating since 2006)	1.2	1,100	Baku, Azerbaijan and Kazakhstan	Türkiye to Ceyhan oil port	It currently primarily carries ACG crude oil and Shah Deniz condensate.[77] It is used as an alternative for Russia's oil and infrastructure to Europe.

Baku-Novorossiky Pipeline (Northern Route Export Pipeline) (Operating since 1996)	0.1	825	Sangachal terminal, near Baku, Azerbaijan	Novorossiysk, on Russia's Black Sea coast	A less favored trade route since sanctions were imposed on Russia.

Data source: U.S. Energy Information Administration, *Country Analysis Brief: Türkiye*, 2023

Note: b/d=barrels per day

[a] Flows to the Ceyhan port were disrupted in 2023 because of earthquake damage and weather disruptions.

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