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ENERGY POLICY OF KAZAKHSTAN: RESOURCES, OPPORTUNITIES AND WAYS TO DIVERSIFICATION

Abstract. This article examines the energy policy of Kazakhstan, focusing on the importance of hydrocarbon resources (oil, gas and coal) for the country's economic development and the need to transition to a more sustainable energy system. Kazakhstan has significant oil and gas reserves, which form the backbone of the national economy and are an important source of export revenue. However, dependence on hydrocarbons poses economic and environmental challenges, highlighting the importance of diversifying the energy sector. The article analyzes key projects in the hydrocarbon industry, including the development of the Tengiz, Kashagan and Karachaganak fields, and considers Kazakhstan's cooperation with international partners, including the EU and China. Particular attention is paid to energy efficiency issues and the prospects for introducing renewable energy sources as part of the transition to a "green economy". Geopolitical aspects and energy transportation issues affecting the sustainability of the country's energy complex are also touched upon.

Key words: *energy policy, Kazakhstan, oil, gas, coal, hydrocarbon dependence, renewable energy, diversification, geopolitics, international cooperation.*

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ҚАЗАҚСТАННЫҢ ЭНЕРГЕТИКАЛЫҚ САЯСАТЫ: РЕСУРСТАР, МҮМКІНДІКТЕР ЖӘНЕ ДЕРВЕРСИФИКАЦИЯЛАУ ЖОЛДАРЫ

Аңдатпа. Мақалада еліміздің экономикалық дамуы үшін көмірсутегі ресурстарының (мұнай, газ және көмір) маңыздылығына және тұрақты энергетикалық жүйеге көшу қажеттілігіне баса назар аудара отырып, Қазақстанның энергетикалық саясаты қарастырылады.

Қазақстанда ұлттық экономиканың негізін құрайтын және экспорттық кірістің маңызды көзі болып табылатын мұнай мен газдың айтарлықтай қоры бар. Дегенмен, көмірсутектерге тәуелділік экономикалық және экологиялық қиындықтарды туғыза отырып, энергетикалық секторды әртараптандырудың маңыздылығын көрсетеді. Мақалада Теңіз, Қашаған және Қарашығанақ кен орындарын игеру сияқты мұнай-газ секторындағы негізгі жобаларға талдау жасалып, Қазақстанның халықаралық серіктестермен, соның ішінде ЕО және Қытаймен ынтымақтастығы қарастырылған. Жасыл экономикаға көшу шеңберінде энергия тиімділігі мәселелеріне және жаңартылатын энергия көздерін енгізу перспективаларына ерекше назар аударылады. Елдің энергетикалық кешенінің тұрақтылығына әсер ететін геосаяси аспектілер мен энергетикалық ресурстарды тасымалдау проблемалары да қозғалады.

Түйін сөздер: *энергетикалық саясат, Қазақстан, мұнай, газ, көмір, көмірсутектерге тәуелділік, жаңартылатын энергия көздері, әртараптандыру, геосаясат, халықаралық ынтымақтастық.*

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ЭНЕРГЕТИЧЕСКАЯ ПОЛИТИКА КАЗАХСТАНА: РЕСУРСЫ, ВОЗМОЖНОСТИ И ПУТИ К ДИВЕРСИФИКАЦИИ

Аннотация. В статье исследуется энергетическая политика Казахстана с акцентом на значении углеводородных ресурсов (нефти, газа и угля) для экономического развития страны и необходимости перехода к более устойчивой энергетической системе.

Казахстан обладает значительными запасами нефти и газа, которые составляют основу национальной экономики и являются важным источником доходов от экспорта. Тем не менее, зависимость от углеводородов вызывает экономические и экологические вызовы, что подчеркивает важность диверсификации энергетического сектора. В статье анализируются ключевые проекты в нефтегазовом секторе, такие как разработка месторождений Тенгиз, Кашаган и Карачаганак, и рассматривается сотрудничество Казахстана с международными партнерами, включая ЕС и Китай. Особое внимание уделено вопросам энергоэффективности и перспективам внедрения возобновляемых источников энергии как части перехода к «зеленой экономике». Также затронуты геополитические аспекты и проблемы транспортировки энергоресурсов, влияющие на устойчивость энергетического комплекса страны.

Ключевые слова: *энергетическая политика, Казахстан, нефть, газ, уголь, углеводородная зависимость, возобновляемая энергия, диверсификация, геополитика, международное сотрудничество.*

Introduction.

Energy plays a pivotal role in Kazakhstan's socio-economic advancement and serves as a key catalyst for the country's integration into the global economic system. To effectively manage transformation processes, it is important to consider both historical and future stages of development. As part of the industrial and innovative development strategy, particular attention is devoted to diversifying the industrial base, including the energy industry, to promote sustainable economic growth.

The growth of production and consumption of energy resources annually outpaces supply, which confirms the importance of energy as the basis of the economy and a key source of export revenues. Supervision of the use of energy resources is important for strengthening the geopolitical position of country [1, p. 968]. The Long-Term Framework for Advancing the Fuel and Energy Complex by 2030 is designed to enhance the efficiency of resource utilization, contribute to improving the population's quality of life, and promote the expansion of external economic collaboration [2]. Kazakhstan ranks among the world's top 15 countries in terms of proven oil reserves, accounting for approximately 3% of global hydrocarbon resources [3, p. 63]. Among CIS member countries, it ranks second in oil and coal production, with major oil and gas fields located in the country's western regions [4].

Kazakhstan's energy policy is particularly important in the context of global challenges, as energy resources play a key role in international priorities. Regional conflicts and crises are often linked to energy issues, and with increasing globalization, the importance of these resources will only increase. Advancement of the energy industry and enhancement of Kazakhstan's position in the global market remain the country's priority tasks.

The purpose of this paper is to analyze Kazakhstan's energy policy in the context of using various energy resources, such as oil, gas and coal. The study is aimed at identifying key areas of development of the energy sector, assessing its contribution to the economic and social development of the country, and considering the challenges associated with dependence on hydrocarbons. The work also aims to study the possibilities of diversifying the energy system as part of the transition to a "green economy", as well as to assess the role of international cooperation and geopolitical factors in ensuring the sustainable development of the energy complex of Kazakhstan.

Methods. This paper uses an integrated approach to the study of Kazakhstan's energy policy, including several methodological tools. The basis of the study is the method of comparative analysis, which allows assessing the dynamics of development of various segments of the energy sector (oil, gas, coal) and identifying their contribution to economic development. The historical method was used to study the evolution of Kazakhstan's energy strategy and analyze key events that influenced the formation of modern policy. Geopolitical analysis was used to assess the impact of external factors and international cooperation, which made it possible to determine Kazakhstan's role in the global energy system and key areas of partnership with other countries. Quantitative methods

were used to analyze statistical data on the production, consumption and export of energy resources, which made it possible to identify trends and predict the future development of the sector. Elements of content analysis were also used in the study of strategic documents, such as “The Concept for the Development of the Fuel and Energy Complex” and the Strategy for the Transition to a "Green Economy".

Results and discussion.

Undoubtedly, given the significant energy intensity of the Republic of Kazakhstan, its energy policy has an impact on the global energy landscape. With its rich energy resources, the country is often called an "energy power" [5]. Due to its strategically advantageous geographical position, Kazakhstan has the ability to regulate the flow of oil and gas from Central Asia both to the East (China) and to the West, which makes its energy market very attractive to foreign countries [6]. Energy policy - general trends and goals. The modern energy policy of Kazakhstan began to take shape long before the collapse of the USSR [7]. The first steps in the development of the oil industry were made in November 1899, when the first well was drilled in the Karashungul tract, which yielded oil. Later, in April 1911, the discovery of a high-quality oil field in Dossor became a significant event that attracted the attention of the whole world. Today, Kazakhstan owns more than 3% of the world's hydrocarbon reserves, which strengthens its position in the global energy market [8]. Global demand for energy has continued to grow in recent years, particularly for resources such as oil, coal and renewable energy (see table below for details).

Table 1. Global demand for primary energy by fuel type, 2019–2023 y. (MMtoe) [9, c.16]

	2019	2020	2021	2022	2023*	Δ% 2021-2022
Oil	4,624	4,188	4,453	4,584	4,694	2.9
Natural gas	3,358	3,307	3,460	3,431	3,397	-0.8
Coal	3,914	3,809	3,963	4,020	3,924	1.4
Hydropower	364	373	367	371	388	1.1
Nuclear	728	700	729	699	711	-4.1
Renewable energy	331	364	408	465	545	14.0
Modern biomass	745	751	787	794	849	0.9
Others **	620	623	634	643	631	1.3
Total	14,685	14,115	14,801	15,007	15,138	1.4

*Notes: *Rating. ** Encompasses municipal solid waste, traditional biomass, ambient thermal energy, and the low-emission exchange of electricity, hydrogen, and heat.*

With its vast reserves of primary energy resources, Kazakhstan is among the countries that are capable of not only satisfying domestic energy needs, but also exporting significant amounts of energy. Among the ten largest countries in the world with rich reserves of energy and minerals, Kazakhstan can boast more than a thousand identified mineral deposits, with 2,806 balance deposits.

In terms of uranium, coal, molybdenum, iron, gold, manganese, tungsten and phosphorite reserves, Kazakhstan is among the ten largest countries in the world, leading in uranium and lead reserves, second in zinc and chromite ores, fourth in copper reserves, and seventh in gold production [4].

The basis of Kazakhstan's economy is the oil industry, including exploration and production. A substantial share of foreign direct investment in Kazakhstan is directed toward the oil and gas industry. While oil is often regarded as the country's principal economic asset, numerous scholars argue that it also serves as a major contributor to various social challenges within Kazakhstan [10, p. 11].

Initially, in the oil and gas sector, competition is intensifying between the leading world players for access to hydrocarbon resources in Central Asia. The creation of regional energy markets seems reasonable to ensure the energy readiness of countries. Energy policy is structured in such a way as to adhere to the principles of economic superiority and promote the economic development of the republic.

The National Strategy for Kazakhstan’s Development until 2030 highlights the critical role of the energy sector [11]. Its main goal is to strengthen national security by attracting foreign investment in the energy sector. Accordingly, the core objective of Kazakhstan’s energy policy is to ensure the most efficient utilization of the country's natural fuel and energy resources, leveraging the energy sector’s potential to stimulate economic growth and enhance the population’s quality of life. This entails pursuing a comprehensive transformation of the energy complex, strengthening the global competitiveness of energy-related products and services, and strategically prioritizing the sector’s integrated development [11, p. 11]. The state energy policy includes measures and mechanisms taking into account future implementation results. Kazakhstan has also adopted the Concept for the Transition to a Green Economy, which outlines strategic priorities for addressing climate change and promoting environmental sustainability [12, p. 88]. A central objective of the country's current energy policy is to achieve economic diversification by shifting from a hydrocarbon-based model toward the advancement of a green economy.

The national energy sector is undergoing dynamic expansion, with nearly all industries demonstrating growth in production, thereby contributing to the steady annual increase in Kazakhstan’s GDP. Despite this progress, the oil and gas industry remains the principal contributor to the state budget [13], serving as the foundation of an economy that continues to rely heavily on the export of raw materials. The Kazakhstan market has significant attractiveness due to access to relatively inexpensive energy resources, abundant untapped mineral deposits and political stability. Conversely, the country's landlocked geographic location significantly affects its export potential [14].

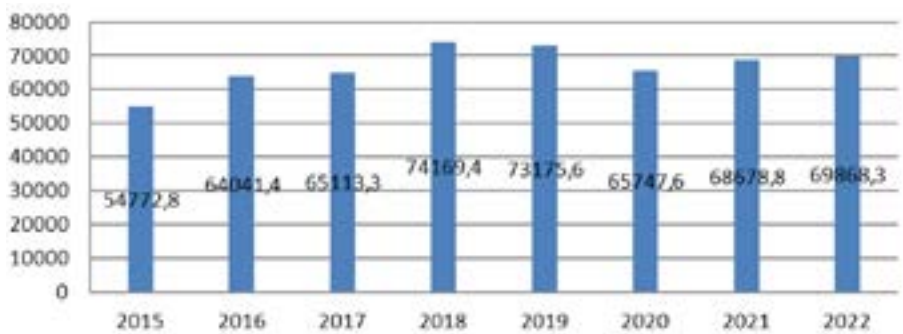
According to the Enerdata agency, at the end of 2020, Kazakhstan entered the top ten most energy-intensive economies in the world with an index of 0.149 ne/$15 (kilogram of oil equivalent per $15). This classification covers economies such as Iran, Russia, Kuwait, Taiwan and Canada. In particular, Iran demonstrates the highest energy intensity among economies: the index is 0.239.

In the United States, the energy intensity is 0.105, while in Germany it is 0.07. The peak of energy efficiency is observed in the United Kingdom, which with an index of 0.056 ne/$15 is three times more energy efficient than the economy of Kazakhstan. These indicators highlight the clearly low energy efficiency of production processes, due to outdated equipment and inefficient processes. At the same time, coal accounts for approximately 20% of the final energy consumption in Kazakhstan [15, p. 24].

Improving energy efficiency is a key factor in the development of Kazakhstan and the preservation of the environment. Kazakhstan has the potential to significantly improve its energy efficiency through targeted policies and the introduction of market mechanisms for energy pricing.

Forecasts show that primary energy demand in Kazakhstan will grow by 1.8% annually until 2030. This growth rate, although slower than the expected GDP growth of 3.8% over the same period, highlights the expected improvement in energy efficiency in various sectors [16, p. 55]. According to data from the Agency for Strategic Planning and Reforms of RK, the country's primary energy use in 2022 amounted to almost 70 thousand tonnes of oil equivalent. This reflects a 1.7% increase in total primary energy use compared to the level recorded in 2021 [16].

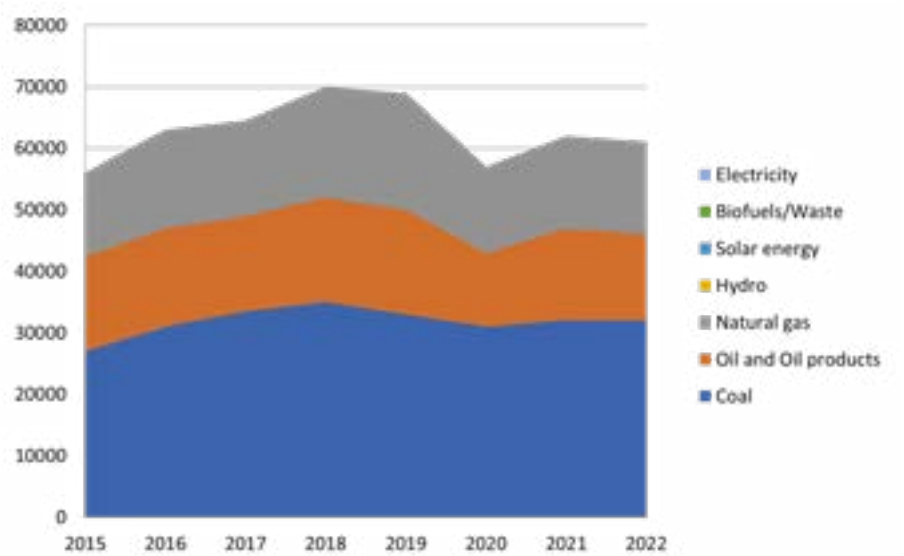
Figure 1. Aggregate Primary Energy Consumption (in 1,000 tonnes of oil equivalent) [16]



In the implementation of the total consumption of primary energy by fuel type: coal resource occupies the largest share – 48.2%; then comes natural gas – 26.4%;

oil and petroleum products constitute 23.5% of the overall primary energy consumption.

Figure 2. Total primary energy consumption by different types of fuel (1000 toe) [16]



Oil and Gas as Strategic Pillars of Kazakhstan's Energy Complex. The oil and gas industry occupies a pivotal position within Kazakhstan's national economy, contributing approximately 14% to the country's gross domestic product and generating more than 64% of its export earnings [14]. These revenues are key to stimulating economic growth and financing the budget deficit. According to expert assessments, approximately 90% of Kazakhstan's confirmed oil reserves are located within 15 key oil fields —most notably Kashagan, Tengiz and Karachaganak—which are predominantly situated in the western regions of the country and the Caspian Sea basin [17, p. 30]. These fields collectively comprise 172 oil deposits, with more than 80 currently undergoing active development. Importantly, the Tengiz, Karachaganak and Kashagan fields account for a substantial portion of the nation's hydrocarbon resources, contributing nearly 60% of total oil output and approximately 94% of natural gas production in Kazakhstan [3, p. 64]. Several large projects, such as AktobeMunaiGas and PetroKazakhstan, which involve international investors, notably CNPC, have significant stakes in Kazakhstan's oil sector. In 2020, China's involvement in Kazakhstan's oil sector represented roughly 16% of the country's total oil output, while a range of smaller companies collectively contributed an additional 10–15% to national oil production [18].

NC "KazMunayGas" JSC holds equity participation in all major international energy projects, while also operating its own fields, which in recent years have contributed approximately 10% of Kazakhstan's total oil output. Founded in 2002, the national vertically integrated oil and gas company KazMunayGas serves as the state's principal representative in the oil sector and is 90% owned

by Samruk-Kazyna, Kazakhstan's sovereign wealth fund. The government views the planned expansion of the Karachaganak and Tengiz fields as essential for increasing national oil production over the coming decade. Moreover, the advancement of offshore oil projects at Kalamkas and Khazar in the Mangistau area is expected to add up to 4 million tonnes to annual production starting from 2028 [19].

The strategic significance of Kazakhstan's hydrocarbon industry is driven by two primary considerations. First, hydrocarbons are among the country's most critical natural resources, playing a central role in ensuring national energy security. Second, the sector remains a major magnet for foreign direct investment, although this also makes it a focal point for investor competition and disputes [8].

Although all segments of the oil industry are developed in Kazakhstan, oil production remains the most mature sector [16, p. 61]. Production has stagnated in recent years, falling from 85.9 million tonnes in 2021 to 82.4 million tonnes in 2022. The forecast for 2023 is for growth to 90.5 million tons, but this is hampered by investment risks and high development costs [7].

Similar problems affect the gas industry: 53.3 billion m³ of gas was produced in 2022, but exports fell from 7.2 billion m³ in 2021 to 4.6 billion m³, and a temporary cessation of exports is expected in the winter of 2023–2024 due to a deficit [7].

Kazakhstan's oil fields are characterized by low oil recovery, and production is complicated by high paraffin content and energy-intensive transportation. As a landlocked country, Kazakhstan depends on pipelines operated by KazTransOil JSC to transport oil for export [14, p. 61].

Oil and gas export and transportation. About 80% of Kazakhstan's oil production is exported, primarily in the form of raw materials and semi-finished products [20, p.12]. Although demand remains high, oil export volumes have been declining by 11-12% annually since 2012 [21]. The majority of Kazakhstan's exports are transported across Russian territory by means of the Caspian Pipeline Consortium (CPC) system, which transports oil to the port of Novorossiysk [20, p. 12].

In 2014, Kazakhstan adopted the "Strategy for Gas Industry Development through 2030, and since 2017, Kazakhstan has been supplying gas to China, starting with 5 billion m³ per year [7]. However, logistical difficulties associated with the Russian-Ukrainian conflict have affected the transportation of oil and gas, strengthening the role of the Trans-Caspian route, which connects China and Europe via Kazakhstan. This corridor, known as the "Middle", continues to expand, including Turkish and Ukrainian railways. Kazakhstan has long-standing energy ties with China, exporting 147 million tons of oil and 44 billion cubic meters of gas since 2013 [22]. However, China remains only the tenth-largest importer of Kazakhstani oil, while the EU consistently holds leading positions among trading partners, especially Italy, France, and the Netherlands. Kazakhstan's energy policy faces challenges due to price fluctuations and the COVID-19 pandemic, which has hampered export operations. However, oil and gas transportation remains not only a source of revenue, but also a tool

for influencing foreign policy. Partnerships with countries such as the US, Russia, China, and the EU continue to shape the trajectory of Kazakhstan's energy sector.

The coal industry and its importance for the country's development. Despite the active development of renewable energy sources and the implementation of the energy transition in several developed countries, coal continues to play a vital role in the global energy sector. It represents approximately 37% of global electricity generation and serving as an essential input for 70% of global steel production [9, p. 204]. In 2022, Kazakhstan was ranked 9th worldwide in coal production, extracting 113.9 million tons, and placed 10th in terms of proven coal reserves, which total 29.3 billion tons. At the current rate of extraction, these reserves are projected to last for over 250 years. The country's principal coal basins: Karaganda (7 billion tons), Ekibastuz (10.1 billion tons) and Turgay (5.9 billion tons)—are predominantly located in Kazakhstan's central and northern regions [9, p. 204].

As of now, Kazakhstan has 49 officially registered coal deposits, with 25 companies actively engaged in mining operations [15]. The Ekibastuz basin alone accounts for 45% of Kazakhstan's thermal coal reserves. However, the coal from this region is characterized by high ash content (42–44%) and strong abrasiveness, factors that cause accelerated equipment degradation and hinder efficient combustion. Owing to its inferior quality, this type of coal is categorized as low-enriched, which restricts its suitability for further processing.

In contrast, coking coal, which is crucial for the metallurgical industry, is primarily extracted from the Karaganda basin, which contains approximately 90% of the nation's coking coal reserves. This higher-grade coal is extensively used in the production of coke. Additionally, coal from the Shubarkol deposit is notable for its superior characteristics—minimal sulfur concentration (0.5%), low ash content (5–15%) and high calorific value (approximately 5,600 kcal/kg)—making it highly efficient for energy generation.

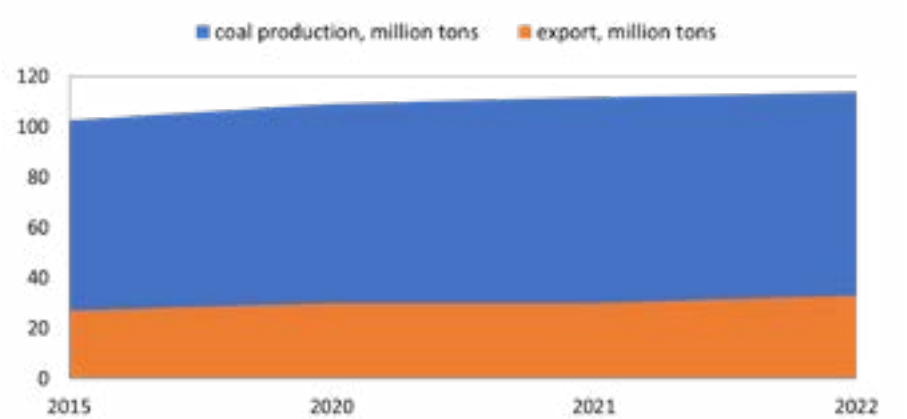
According to MIID, the leading coal producer in the country is Bogatyr Komir LLP, which operates the Bogatyr open-pit mine within the Ekibastuz basin—one of Kazakhstan's largest coal deposits. In 2022, this company alone produced more than 40 million tons of coal, accounting for nearly 40% of Kazakhstan's total annual coal output [9, p. 204].

Table 2. Coal Extraction Volumes at Major Fields, Million Tons [9, p. 207]

Coal deposits	2018	2019	2020	2021	2022
"Eurasian Energy Corporation" JSC	17	15	17	17	17
"Shubarkol Komir" JSC	11.6	12	11.5	13	12.5
Karazhyra	8.2	8.2	8.0	7.8	8.4
Shubarkol-Premium JSC	1.0	1.2	1.3	1.7	3.0
Arcelor-Mittal Temirtau	10	12	11.5	12.7	12.5
Maikuben-West	4.0	4.3	4.1	3.8	4.1
Bogatyr-Komir	45	45	43	44	42

Between 2017 and 2022, the leading coal mining enterprises recorded an 8% increase in output. Sustaining further production growth will require substantial capital investment, as many companies are approaching their operational capacity limits. Nevertheless, the potential to attract financing from a broad spectrum of international financial institutions remains constrained due to global restrictions on funding projects associated with hydrocarbon fuel extraction.

Figure 3. Coal production in Kazakhstan [9, p. 205]



The National Energy Report 2021 projects that by 2050, coal production in Kazakhstan will decrease to 69 million tons, while coal consumption is anticipated to fall to 56 million tons. The trajectory of future coal utilization will largely be influenced by factors such as the accessibility of natural gas, fluctuations in energy resource prices, and the potential implementation of a nuclear power plant development strategy. In 2022, coal accounted for 52% of total primary energy consumption, with the main consumers being power plants (57.5 million tons) and utility boiler houses (6.9 million tons). The Ekibastuz Basin remains a key source of electricity, producing 10.9 GW, additionally supported by the capacities of the Karaganda and Karazhirin basins. Despite efforts to gasify and transition to renewable energy sources, coal will retain its importance until 2040, especially in electricity generation. Experts predict that domestic coal consumption will peak in 2035, after which a decline is possible with the commissioning of nuclear power plants. Up to 75% of Kazakhstan's coal production is consumed by the domestic market [23]. However, the European energy crisis in 2022 created new opportunities for expanding coal exports. As a result, coal shipments to countries beyond the CIS region rose to 9.3 million tons, with notable increases in exports to Switzerland (reaching 6 million tons), as well as to Belgium, Cyprus, Turkey, and Poland [9].

Conclusion.

Kazakhstan's energy policy plays a key role in ensuring the country's economic growth and strengthening its position on the international stage. The petroleum sector remains a central pillar of economic activity, generating a significant portion of GDP and export revenues. The development of large fields such as Tengiz, Kashagan and Karachaganak, as well as the active attraction of foreign investment, contribute to the stability and competitiveness of the energy sector.

However, dependence on hydrocarbons presents both economic and environmental challenges. In response to these challenges, Kazakhstan is taking steps to diversify its energy sector and transition to a "green" economy, which is reflected in the state development strategy and efforts to introduce renewable energy sources.

Geopolitical changes and instability in the international arena highlight the importance of transport infrastructure and energy cooperation. Kazakhstan simultaneously confronts the critical task of enhancing energy efficiency and lowering its carbon emissions—measures that are essential for achieving long-term sustainability and ensuring the country's economic security. Thus, further development of Kazakhstan's energy policy will require a balance between the use of traditional resources and the introduction of innovations in the energy sector. Successful implementation of these initiatives will allow Kazakhstan not only to maintain stability, but also to strengthen its position amid shifting dynamics and new developments in the global energy landscape.

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