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STRATEGIES AND PROSPECTS FOR ENERGY SECURITY OF KAZAKHSTAN IN THE XXI-st CENTURY

Annotation. The foundation of the energy security of the Republic of Kazakhstan is the resilience of its energy system, which ensures reliable energy supply under conditions of technological change and external challenges. In this context, the article examines the key directions of transformation of Kazakhstan's energy sector, including the development of renewable energy sources, the condition of power grid infrastructure, and the prospects for the introduction of nuclear energy. The analysis is based on a synthesis of regulatory and legal documents, energy development strategies, and data on the current state of the country's energy complex.

The analysis shows that Kazakhstan's energy system is characterized by a high share of carbon-based generation, significant wear of grid infrastructure, and limited capacity of renewable energy sources to provide baseload power. As a result of the study, the necessity of diversifying the energy balance, modernizing infrastructure, and expanding the use of renewable energy sources is substantiated as key factors for enhancing Kazakhstan's energy resilience. It is established that wind and solar energy contribute to the diversification of electricity generation; however, they require grid modernization and the implementation of balancing mechanisms. Under these conditions, nuclear energy is considered a factor that can enhance the resilience of the energy system, reduce dependence on cross-border electricity flows, and strengthen the country's energy security in the long term.

Keywords: energy security, energy system of Kazakhstan, renewable energy sources, wind energy, solar energy, power grid infrastructure, nuclear energy.

Introduction

Energy security is a key component of sustainable development for any state in the context of the global transformations of the twenty-first century. In the modern world, the energy sector serves not only as the foundation of economic growth but also as a factor of political and strategic stability. The Republic of Kazakhstan, possessing significant hydrocarbon reserves, a developed energy infrastructure, and a favorable geographical position between the major markets of Europe and Asia, occupies an important place in the international energy landscape.

However, ongoing changes in the global energy environment driven by accelerated decarbonization, volatility in energy prices, the transition to renewable energy sources, and rising geopolitical instability require a reassessment of traditional approaches to ensuring energy security. For Kazakhstan, whose economic potential largely depends on exports of oil, gas, and electricity, the development of effective strategies to protect national energy interests is an integral part of national security, economic resilience, and the fulfillment of international environmental commitments. In the twenty-first century, energy security is increasingly

understood as a combination of energy system resilience, the ability to adapt to technological change, and the degree of independence from external factors. For the Republic of Kazakhstan, this issue is of particular importance given the high share of carbon-based generation, the deterioration of energy infrastructure, and the tightening of international climate requirements. Under these conditions, the transformation of the energy sector becomes a necessary element of the country's long-term development.

The relevance of studying strategies and prospects for energy security is further reinforced by national programs aimed at modernizing the energy sector, developing infrastructure, introducing innovative technologies, and improving energy efficiency. An analysis of risks, threats, and opportunities in the country's energy development makes it possible to formulate scientifically grounded recommendations for government institutions, businesses, and international partners, thereby contributing to economic stability and enhancing Kazakhstan's competitiveness in the global energy arena. The development of renewable energy sources and the modernization of energy infrastructure are intended to increase the flexibility and resilience of the energy system, while nuclear energy is viewed as a source of stable baseload power. The combination of these approaches forms the foundation of Kazakhstan's energy security in the context of the global energy transition and allows the country to balance decarbonization goals with economic and technological sustainability.

In recent years, the development of renewable energy sources in Kazakhstan has been regarded not only as part of the environmental agenda but also as an important instrument for the structural renewal of the energy system. In the context of the global energy transition and the implementation of commitments under the Paris Agreement, the state emphasizes the diversification of electricity generation as a means of reducing economic vulnerability and increasing the resilience of energy supply. In accordance with the Strategy for Achieving Carbon Neutrality by 2060, renewable energy sources occupy a central position in the country's long-term energy development model. As of early 2025, the installed capacity of renewable energy facilities reached approximately 2.9–3 GW, indicating a multiple increase in the sector compared to the early 2010s [2].

Materials and methods of research

The methodological framework of the study is based on general scientific and specialized methods for analyzing socio-economic and energy-related processes. The research applies a systems approach, which makes it possible to consider the energy security of the Republic of Kazakhstan as a complex and multi-dimensional phenomenon encompassing economic, political, technological, and environmental aspects.

The following methods were employed in the study: analysis and synthesis to generalize theoretical approaches and identify key factors of energy security; comparative analysis to assess Kazakhstan's national strategies in relation to international experience in ensuring energy resilience; and the structural-functional method to determine the role of individual segments of the energy sector in shaping the overall system of energy security.

A forecasting method was also used to identify potential development trajectories of Kazakhstan's energy system under conditions of the global energy transition and changing external economic conditions. The integrated application of these methods ensured the reliability of the results obtained and made it possible to formulate well-founded conclusions and practical recommendations aimed at strengthening the country's energy security in the twenty-first century.

The empirical basis of the study includes official statistical data from government authorities of the Republic of Kazakhstan, regulatory and legal acts and strategic documents

in the fields of energy and national security, materials from international energy organizations, as well as academic publications by domestic and international researchers addressing issues of energy security, sustainable development, and the energy transition.

Research Results

Wind energy represents the most developed segment of renewable energy in Kazakhstan, largely due to the country's natural conditions. The territory of the republic includes regions characterized by stable and strong wind flows, most notably the Dzungarian Gate and the Shelek Corridor. Examples of operating facilities include the Yereymentau Wind Power Plant in Akmola Region, the Zhanatas Wind Power Plant in Zhambyl Region, and the wind farm commissioned as part of the EXPO-2017 project. These facilities supply electricity to regional consumers and are integrated into the unified power system, confirming the practical viability of wind generation under Kazakhstan's conditions. Operational experience demonstrates that, where stable wind resources are available, wind energy is capable of ensuring relatively stable electricity output and reducing the load on traditional energy sources.

The development of wind energy is also закреплено at the level of state regulatory and legal frameworks. In particular, the Law of the Republic of Kazakhstan "On Support for the Use of Renewable Energy Sources," adopted in 2009 and currently in force with subsequent amendments, provides mechanisms to stimulate the construction of wind power plants, including competitive auctions and guaranteed purchase of generated electricity [1].

Further expansion of wind generation, understood as an increase in installed capacity and deeper integration of wind power plants into the unified energy system, requires the development of power grid infrastructure, the construction of new transmission lines, and the introduction of energy storage systems. Without the implementation of these measures, the utilization of the country's wind potential remains limited, and the overall resilience of electricity supply cannot be fully ensured.

Solar energy in Kazakhstan follows a different development logic than wind energy and performs a distinct function within the power system. While wind generation is primarily oriented toward large-scale facilities integrated into the backbone grid, solar power plants are more often used as a tool for rapid capacity expansion and localized energy supply. High levels of solar irradiation, especially in the southern regions of the country, make it possible to effectively utilize solar generation during daytime hours, when the load on the power system increases.

Practical experience shows that solar power plants are well suited for covering peak demand and reducing pressure on conventional energy sources. Their construction requires less time compared to large-scale generation facilities, and they can be located close to consumption centers. In Kazakhstan, solar power plants have been actively commissioned in Zhambyl, Turkestan, and Almaty regions, where they serve as an additional source of electricity for regional grids. This reduces the need for long-distance power transmission and helps lower grid losses [5].

At the same time, solar power plants have an ambiguous impact on the national energy balance. On the one hand, their deployment allows for a partial reduction in reliance on coal-fired generation, which continues to dominate Kazakhstan's energy sector. This is significant both from an environmental perspective and in the context of international commitments to reduce greenhouse gas emissions.

On the other hand, solar generation is characterized by pronounced variability in output. Maximum electricity production occurs during daylight hours, while in the evening, when

demand remains high, the contribution of solar power plants declines sharply. Under Kazakhstan's conditions, this creates additional pressure on energy flow management systems and necessitates the use of reserve capacities. The technological and operational limitations of solar generation are clearly illustrated by the example of the Saran Solar Power Plant in Karaganda Region, one of the largest facilities of its kind in Central Asia. Operating in a sharply continental climate, the plant serves as a representative case for assessing the real resilience of solar energy outside southern regions. The facility generates up to 150 million kWh of electricity annually; however, its efficiency is directly dependent on the quality of maintenance. During the winter period, snow accumulation on panels leads to a sharp decline in output, in some cases resulting in a complete halt of generation. This example demonstrates that, under Kazakhstan's conditions, solar energy requires continuous operational expenditures and cannot be regarded as a fully autonomous or low-cost solution.

The condition of the power grid infrastructure continues to play a decisive role. Kazakhstan's national electricity network was largely formed during the Soviet period, primarily between the 1960s and 1980s. At that time, the energy system was built on the principle of rigid centralization. Large coal-fired power plants located in the northern regions, most notably Ekibastuz GRES-1 and GRES-2, supplied electricity to almost the entire country through extended high-voltage transmission lines. This model proved effective under conditions of stable generation and predictable consumption; however, under contemporary conditions it faces significant limitations [3].

As of 2024–2025, the average level of depreciation of Kazakhstan's power grid infrastructure exceeds 65 percent. In certain regions, including East Kazakhstan and North Kazakhstan, wear and tear reaches 75–80 percent. This affects not only the reliability of electricity supply but also the efficiency of power transmission. Losses in regional electricity networks amount to 15–20 percent, whereas in developed countries they typically do not exceed 5–7 percent. As a result, a substantial share of generated electricity, including energy produced from renewable sources, is lost during transmission [4].

The vulnerability of the power grid infrastructure became evident in practice in January 2022, when an emergency failure occurred within the unified power system of Central Asia, affecting Kazakhstan as well. The incident disrupted the operation of transit transmission lines, including the North–South corridor, and led to temporary power outages in the southern regions of the country. The root cause of the failure was located outside Kazakhstan's borders.

Nevertheless, the incident demonstrated that the existing grid infrastructure is poorly adapted to emergency operating conditions. The high level of wear of transmission lines and substations complicated the restoration of stable system operation, and the system was unable to rapidly compensate for the resulting power imbalance [9]. This case showed that, if the current state of infrastructure persists, external disruptions will continue to amplify internal risks. Even short-term disturbances in neighboring power systems are capable of triggering outages within the country, thereby directly reducing the level of energy security.

One consequence of these limitations is the growing dependence on cross-border electricity flows. While such flows help address short-term capacity shortages, they simultaneously reduce the level of energy independence. In the long term, this situation creates additional risks associated with external conditions and regional market dynamics. Without grid modernization and the development of balancing mechanisms, further expansion of renewable energy sources may increase the burden on the power system and slow progress toward energy security objectives.

A special place in ensuring Kazakhstan's energy security is occupied by the prospective construction of a nuclear power plant. In a context where coal-fired capacity, accounting for approximately 70 percent of electricity generation, is rapidly aging, and solar and wind power plants are unable to provide base-load generation, nuclear energy emerges as the only viable instrument for sustaining industrial growth. To illustrate the scale, a single modern nuclear power plant can replace up to five or six large coal-fired thermal power plants while emitting virtually no carbon dioxide into the atmosphere.

For Kazakhstan, the construction of a nuclear power plant represents a feasible and realistic prospect. Until 1999, the BN-350 nuclear reactor operated on the Caspian Sea coast, generating electricity and providing water desalination. More than 25 years after its shutdown, the state has returned to this idea. In October 2024, nearly 70 percent of the population supported the construction of a new nuclear power plant in a national referendum [6]. At the same time, a segment of society continues to express concerns, primarily due to historical nuclear accidents such as the Chernobyl disaster. As a result, the government faces not only technical challenges but also the need for ongoing public engagement to reduce fears and build trust in the safety management system of the future nuclear facility.

One of the initial steps in this direction was the selection of partners for the construction of the first nuclear facility. In mid-2025, Kazakhstan and the Russian state corporation Rosatom agreed on a roadmap for the construction of the first nuclear power plant. The document outlines the stages of site preparation, design, equipment supply, and construction. Site preparation has begun in Zhambyl Region near Lake Balkhash, where the first facility is planned to be located. This decision is based on an analysis of power system loads in the central and southern parts of the country, where capacity shortages occur frequently.

According to current estimates, the first nuclear power plant will have a total capacity of approximately 2.4 GW and will consist of two power units. This capacity is viewed as a means of compensating for part of the load currently covered by coal-fired power plants. Although the project remains at an early stage, preliminary schedules indicate that commissioning is expected in the mid-2030s, around 2035–2036. These timelines appear realistic given standard cycles for the design and construction of large-scale energy facilities [5].

In parallel with work on the first plant, negotiations are underway with other international partners. In particular, Kazakhstan has agreed to cooperate with the China National Nuclear Corporation (CNNC). The Chinese side is involved in discussions regarding the second and third nuclear power plants. While final sites for these facilities have not yet been approved, several regions are under consideration, including East Kazakhstan and Mangystau Region. The choice of multiple partners reflects an intention to reduce dependence on a single technology supplier and gain access to diverse engineering solutions. Financing of the nuclear project is being discussed jointly with international institutions and investors. The cost of constructing the first nuclear power plant is estimated at approximately USD 12–15 billion. This substantial figure reflects not only construction costs but also infrastructure preparation, safety systems, personnel training, and integration of the plant into the national grid. Moreover, nuclear projects require long-term planning, as their impact on the energy system extends over several decades.

Cooperation with Rosatom and CNNC opens significant opportunities for Kazakhstan but also generates certain risks for energy security. Engaging two major partners helps avoid full dependence on a single supplier and allows for the selection of optimal technologies and financial conditions. Russia plays a key role in the first nuclear power plant due to its proven

technologies and extensive experience, while China offers faster construction timelines and the potential localization of fuel production in Kazakhstan, thereby reducing costs [7].

At the same time, challenges remain. On the one hand, Russia faces the risk of secondary sanctions, which may complicate the supply of certain components, such as automation systems manufactured in Europe. On the other hand, China may be vulnerable to trade restrictions imposed by the United States, potentially affecting the supply of high-tech equipment. To mitigate these risks, Kazakhstan is pursuing a “clean ownership” strategy, under which the nuclear power plant remains state-owned while foreign companies act as contractors. This approach helps reduce the impact of sanctions on the project itself.

International experience demonstrates that nuclear energy requires not only technical solutions but also a well-developed system of control, regulation, and personnel training. The example of the Barakah Nuclear Power Plant in the United Arab Emirates shows that modern nuclear facilities can be constructed in compliance with strict safety standards. For Kazakhstan, this experience serves as an important benchmark, as it illustrates which processes and approaches are effective and which require increased attention.

In Kazakhstan, nuclear energy may prove economically advantageous due to its low generation costs and the long operational lifespan of power units. According to estimates, the cost of generating 1 kWh at modern nuclear power plants amounts to approximately 4–5 tenge, whereas coal-fired generation costs around 6–7 tenge, and wind and solar generation about 8–10 tenge when accounting for reserve capacity and grid losses [10]. These calculations indicate that a nuclear power plant is capable of stabilizing the energy system not only in terms of reliability but also from the perspective of economic efficiency.

From the standpoint of energy security, nuclear power possesses a number of significant advantages. Unlike coal- and gas-fired power plants, it is less sensitive to fluctuations in global fuel prices. This makes nuclear generation particularly attractive as a component of system resilience. For Kazakhstan, which already faces the need to import electricity during periods of peak demand, the presence of a domestic nuclear power plant could reduce dependence on external sources and enhance the predictability of electricity supply.

A crucial element in this context is the country’s resource base. Kazakhstan ranks among the world’s leading producers of uranium, accounting for approximately 40 percent of global uranium production [8]. This means that a portion of this raw material could be utilized domestically rather than exclusively exported. In the long term, this may strengthen the country’s energy sovereignty and reduce vulnerability to external suppliers. However, the mere availability of resources does not in itself guarantee success.

If successfully implemented, the project will reduce dependence on coal-based generation, strengthen the base of the energy system, and create a new industry with high-technology jobs. Nevertheless, the final outcome will depend not only on technical execution but also on the quality of project management at all stages, as well as on how effectively the country addresses the accompanying social and institutional challenges.

Conclusion

The analysis conducted shows that Kazakhstan’s energy system has entered a complex transitional period. On the one hand, the country continues to rely on infrastructure formed during the Soviet era, characterized by a high level of physical deterioration and limited flexibility. On the other hand, the energy sector is increasingly influenced by external factors, including the global climate agenda, stricter emission reduction requirements, and growing electricity demand. Under these conditions, energy sector development is no longer a purely technical task and is directly linked to issues of national sustainability and strategic autonomy.

The key conclusion is that it is ineffective for Kazakhstan to treat renewable energy sources and nuclear generation as mutually exclusive pathways. Renewable energy plays an important role in diversifying the energy mix and reducing carbon intensity; however, its inherent intermittency prevents it from serving as the backbone of the energy system. Nuclear power, by contrast, is capable of providing stable baseload generation essential for industry and large urban centers. In this sense, the issue is not a choice between technologies, but rather their combination within an integrated energy model.

At the same time, the effectiveness of any new generation capacity depends directly on the condition of the electricity grid. The high level of wear of transmission lines and substations reduces the reliability of power supply and increases dependence on cross-border electricity flows. The experience of recent emergency incidents demonstrates that without modernization of grid infrastructure, the expansion of both renewable energy sources and nuclear generation will be accompanied by additional risks. This makes the development of transmission networks and load management systems one of the key prerequisites for strengthening energy security.

Overall, the results of the study indicate that the resilience of Kazakhstan's energy system can only be achieved through a comprehensive approach. The development of nuclear generation, the expansion of renewable energy sources, and the modernization of grid infrastructure should be considered interrelated elements of a single strategy. Uncoordinated development of these areas would exacerbate existing imbalances, whereas their synchronization can create a more reliable and predictable energy system.

The findings of this study may be used in revising the development programs of Kazakhstan's energy sector through 2035. The main recommendation is a transition toward integrated planning, in which the pace of commissioning renewable energy facilities and nuclear power plants is strictly synchronized with the modernization of transmission networks and the construction of flexible gas-fired power plants. Only a comprehensive approach that combines nuclear power development, the expansion of renewable generation, and the modernization of the electricity grid can form a more resilient and predictable model for the development of Kazakhstan's energy system.

REFERENCES

[1] Law of the Republic of Kazakhstan On Support for the Use of Renewable Energy Sources, July 4, 2009, No. 165-IV. Electronic resource. Available at: https://adilet.zan.kz/rus/docs/Z090000165

[2] Strategy for Achieving Carbon Neutrality of the Republic of Kazakhstan until 2060: Decree of the President of the Republic of Kazakhstan, February 2, 2023, No. 121. Electronic resource. Available at: https://adilet.zan.kz/rus/docs/U2300000121

[3] Key Performance Indicators of the Electric Power Industry of the Republic of Kazakhstan for 2024: Statistical Report. Ministry of Energy of the Republic of Kazakhstan. Astana, 2025. 45 p.

[4] JSC KEGOC (Kazakhstan Electricity Grid Operating Company). Official website. Electronic resource. Available at: https://www.kegoc.kz/ru/operations/electro-energy-system/

[5] Concept for the Development of the Electric Power Industry of the Republic of Kazakhstan for 2023–2029: Resolution of the Government of the Republic of Kazakhstan, March 28, 2023, No. 255. Astana, 2023.

[6] Results of the National Referendum on the Construction of a Nuclear Power Plant in Kazakhstan. Central Referendum Commission of the Republic of Kazakhstan. Electronic resource. Available at: https://www.election.gov.kz

[7] Akhmetov A.S., Ibraeva G.R. Energy Security and the Development of Nuclear Power in Kazakhstan. Bulletin of the National Engineering Academy of the Republic of Kazakhstan, 2023, No. 3 (89), pp. 112–119.

[8] Kazakhstan in 2024: Statistical Yearbook. Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. Astana, 2025. 420 p.

[9] World Bank Group. Kazakhstan Energy Sector Review: Scaling up Renewables and Grid Modernization. Electronic resource. 2024. Available at: https://www.worldbank.org/en/country/kazakhstan

[10] Technical and Economic Performance Indicators of Renewable and Nuclear Energy Facilities: Analytical Review. Ed. by K.M. Tokbaev. Almaty: Kazakh Research Institute of Energy, 2024. 88 p.

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ХХІ ҒАСЫРДАҒЫ ҚАЗАҚСТАННЫҢ ЭНЕРГИЯ ҚАУІПСІЗДІГІН ДАМУ СТРАТЕГИЯЛАРЫ МЕН БОЛАШАҚТАРЫ

Аңдатпа. Қазақстан Республикасының энергетикалық қауіпсіздігінің негізі - энергетикалық жүйенің тұрақтылығы, технологиялық өзгерістер мен сыртқы қиындықтарға қарамастан сенімді энергиямен жабдықтауды қамтамасыз ету. Осыған байланысты, бұл мақалада Қазақстанның энергетикалық секторындағы трансформацияның негізгі бағыттары, соның ішінде жаңартылатын энергия көздерін дамыту, электр желісі инфрақұрылымының жағдайы және ядролық энергияны енгізу перспективалары қарастырылады. Талдау нормативтік құжаттардың, энергетиканы дамыту стратегияларының және елдің энергетикалық кешенінің қазіргі жағдайы туралы деректердің қысқаша мазмұнына негізделген.

Талдау көрсеткендей, Қазақстанның энергетикалық жүйесі көміртегі негізіндегі генерацияның жоғары үлесімен, желілік инфрақұрылымның айтарлықтай тозуымен және жаңартылатын энергия көздерінің базалық жүктеме қуатын қамтамасыз ету мүмкіндігінің шектеулілігімен сипатталады. Зерттеу Қазақстанның энергетикалық тұрақтылығын арттырудың негізгі факторлары ретінде энергетикалық балансты әртараптандыру, инфрақұрылымды жаңғырту және жаңартылатын энергия көздерін кеңейту қажеттілігін негіздейді. Жел және күн энергиясы генерацияны әртараптандыруға ықпал ететіні, бірақ желіні жаңғыртуды және теңгерім механизмдерін енгізуді қажет ететіні анықталды. Осы жағдайларда ядролық энергетика энергетика жүйесінің тұрақтылығын арттыру, сыртқы энергия ағындарына тәуелділікті азайту және елдің ұзақ мерзімді энергетикалық қауіпсіздігін нығайту факторы ретінде қарастырылады.

Кілт сөздер: жаңартылатын энергия көздері, жел энергиясы, күн энергиясы, энергетикалық қауіпсіздік, Қазақстанның энергетикалық жүйесі, электр желісінің инфрақұрылымы, ядролық энергия.

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СТРАТЕГИИ И ПЕРСПЕКТИВЫ ЭНЕРГЕТИЧЕСКОЙ БЕЗОПАСНОСТИ КАЗАХСТАНА В XXI ВЕКЕ

Аннотация. Основой энергетической безопасности Республики Казахстан является устойчивость энергосистемы, обеспечивающая надёжное энергоснабжение в условиях технологических изменений и внешних вызовов. В связи с этим в статье рассматриваются ключевые направления трансформации энергетического сектора Казахстана, включая развитие возобновляемых источников энергии, состояние электросетевой инфраструктуры и

перспективы внедрения атомной энергетики. Анализ основан на обобщении нормативно-правовых документов, стратегий энергетического развития и данных о текущем состоянии энергетического комплекса страны.

Проведённый анализ показывает, что энергетическая система Казахстана характеризуется высокой долей углеродной генерации, значительным износом сетевой инфраструктуры и ограниченными возможностями возобновляемых источников энергии по обеспечению базовой нагрузки. В результате исследования обоснована необходимость диверсификации энергетического баланса, модернизации инфраструктуры и расширения использования возобновляемых источников энергии как ключевых факторов повышения энергетической устойчивости Казахстана. Установлено, что ветровая и солнечная энергетика способствуют диверсификации генерации, однако требуют модернизации сетей и внедрения механизмов балансировки. В этих условиях атомная энергетика рассматривается как фактор повышения устойчивости энергосистемы, снижения зависимости от внешних перетоков электроэнергии и укрепления энергетической безопасности страны в долгосрочной перспективе.

Ключевые слова: атомная энергетика, возобновляемые источники энергии, ветроэнергетика, солнечная энергетика, энергетическая безопасность, энергетическая система Казахстана, электросетевая инфраструктура.