Cooperation of Central Asian countries in the field of energy security: problems and solutions

Ensuring energy security is one of the main challenges of our time for almost every state, regardless of the level of economic development.

In recent decades, this issue has become particularly acute due to the observed geopolitical tensions, instability of energy prices, limited reserves of traditional fuels and growing competition for control over strategic resources. The situation is aggravated by the effects of climate change, which create additional pressure on the energy systems of countries around the world.

Many countries that previously relied solely on their own resources or established supplies from outside are now forced to reconsider their energy policies. Priorities are shifting toward increasing energy efficiency, diversifying energy sources, and more actively using renewable sources.

Against the backdrop of these global trends, Central Asia plays an increasingly important role in ensuring regional and international energy stability. The countries of the region have a unique energy potential, which is formed due to rich reserves of oil, gas, coal, as well as existing opportunities for the development of renewable energy.

For instance, Kazakhstan and Turkmenistan concentrate the bulk of the region’s hydrocarbon resources, which allow not only to cover domestic needs, but also to increase export potential. In particular, Kazakhstan has significant balance oil reserves, reaching about 4.4 billion tons. Astana actively cooperates with Russia and European countries, exporting oil through the Caspian Sea. In 2023, the volume of supplies exceeded 70 million tons of oil, which is 78% of total production (90 million tons).

Turkmenistan has some of the largest natural gas reserves in the world. According to the World Energy 2023 review, prepared with the support of British Petroleum, the country’s proven gas resources are estimated at 13.6 trillion cubic meters - fourth place after Russia (37.6 trillion), Iran (32.1 trillion) and

Qatar (24.7 trillion). At the same time, according to the Turkmen side, the country's natural gas reserves amount to about 50 trillion cubic meters.

By the end of 2023, Turkmenistan produced 80.6 billion cubic meters of natural gas, of which 48 billion or 60% were exported. The main recipients of Turkmen gas are China (via the Central Asia - China gas pipeline) - 40 billion cubic meters (83.3%), Russia (via the Central Asia - Center gas pipeline) - 5 billion cubic meters (10.5%), Uzbekistan - 1.5-2 billion cubic meters (3.1-4.1%), Azerbaijan (under a swap agreement via Iran) - 1.5 billion cubic meters (3.1%).

In turn, Kyrgyzstan and Tajikistan have rich water resources. According to the International Energy Agency, Tajikistan has enormous hydropower potential and ranks 8th in the world in this indicator. The country's potential for generating electricity based on hydropower is about 527 billion kWh, technical - 317 billion kWh.

By the end of 2023, 22 billion kWh were generated, which is a record figure since independence. The most significant project in this area is the Rogun HPP (it is planned to have six hydroelectric units with a total capacity of 3,600 MW and an average annual output of 13.8 billion kWh), the total cost of which is estimated at $9 billion, and the estimated launch date is 2032.

Kyrgyzstan also has significant water and hydropower resources, which are considered one of the country's main assets. In terms of the potential of hydro resources and their concentration, the country ranks third in the CIS after Russia and Tajikistan. Hydroelectric power plants produce 93% of the country's electricity.

There are two thermal power plants and more than 30 hydroelectric power stations in Kyrgyzstan, incl. Toktogul, providing 40% of the country's electricity. According to experts, currently the Kyrgyz Republic uses only 10.5%, or 15 billion kWh per year, of its hydropower potential – 142 billion kWh.

Uzbekistan is in the top 20 in terms of available natural gas reserves – about 1.8 trillion cubic meters. Proven oil reserves are small and amount to about 100 million tons.

The country also has enormous potential in renewable energy sources. According to estimates by the International Energy Agency and the UN Economic Commission for Europe, Uzbekistan's total renewable energy potential for electricity production is 2,091 billion kWh (30 times higher than annual consumption).

In particular, this is due to the country's great potential for the development of solar energy and the high level of insolation – more than 300 sunny days a year.

Prospects for the development of nuclear energy in Central Asia

The development of nuclear energy in Central Asia deserves particular attention. According to experts, the region has approximately 20% of the world's uranium reserves, which makes nuclear energy particularly attractive for countries in this part of the world.

Thus, the two largest economies in the region - Kazakhstan and Uzbekistan - have begun work on building nuclear power plants on their territory to achieve energy independence, support economic growth and eliminate environmental pollution.

Currently, Uzbekistan has begun construction of a small modular nuclear reactors. In May 2024, the National Directorate for the Construction of Nuclear Power Plants and Atomstroyexport (an engineering division of Rosatom) signed a contract for the construction of a small modular nuclear reactors (SMRs). The 330 MW SMRs, consisting of six reactors with a capacity of 55 MW each, will be built in the Jizzakh region near Lake Tuzkan.

In turn, in October 2024, following a referendum in Kazakhstan, a decision was made to implement a full-capacity nuclear power plant project in the country. At the same time, the construction of the Nuclear

power plant, as stated by the government of Kazakhstan, will be carried out by an international consortium.

Kyrgyzstan is also interested in developing nuclear energy. In 2022, the Kyrgyz government signed a memorandum with Russia’s Rosatom to study the possibility of building two small nuclear power plants in Kyrgyzstan, each with a capacity of 50 MW.

Key issues in the energy sector of Central Asia

Meanwhile, despite significant energy reserves, the countries of the region face a number of challenges, such as outdated infrastructure, the need to modernize energy systems and coordinate interstate policies in the field of water and energy resources.

Most energy facilities in the region, including power plants and transmission lines, were built during the Soviet period - more than 30-50 years old, which leads to low efficiency, high losses in the networks and frequent accidents.

It is estimated that the total amount of funding needed to modernize Central Asia's energy systems is about $40-50 billion. This includes reconstruction of transmission lines and support for sustainable energy supply.

In addition, Central Asian states have different priorities in using the water and energy resources of the Amu Darya and Syr Darya. Upstream countries seek to use water for power generation, which requires increased water discharges in winter, while downstream countries are interested in preserving water for summer irrigation.

Added to these factors is the significant population and economic growth in Central Asia, which places a huge strain on the energy systems of the region’s countries.

Thus, the dynamic increase in the population, which has already reached more than 80 million people (annual growth is 1 million people), is accompanied by a high growth of the young population: more than 50% of the region’s residents are under 25 years old.

Urbanization is also gaining momentum. For example, the share of the urban population in Kazakhstan and Uzbekistan exceeds 40%, which creates additional loads on energy systems.

It is predicted that by 2030, electricity consumption in the region will increase by 30-40%, which requires significant investment in energy infrastructure, including the construction of new power plants and network modernization. In Uzbekistan alone, annual electricity consumption growth is expected to be 7%.

Currently, about 250 billion kWh of electricity is produced in Central Asia (in Kazakhstan - 113 billion kWh, Uzbekistan - 78 billion kWh, Turkmenistan - 23 billion kWh, Tajikistan - 22 billion kWh, Kyrgyzstan - 13.8 billion kWh).

In addition, industrial growth in Central Asia also requires increased energy support. In recent years, the region's industrial sector has been growing by an average of 6.2%, which requires a correspondingly larger volume of energy resources. Moreover, at the sixth Consultative Meeting of the Heads of State of Central Asia, an Industrial Cooperation Plan was adopted, which is aimed at developing joint projects and improving economic integration. In this regard, sustainable energy supply is becoming a key condition for the implementation of these large-scale tasks.

Taken together, these factors exacerbate the need to modernize the energy infrastructure.

Environmental problems also have a direct impact on ensuring energy security.

The development of the fossil fuel energy sector is leading to environmental degradation. The use of coal in Kazakhstan and Uzbekistan creates high levels of air pollution and requires a transition to cleaner

energy sources.

Along with this, the countries of the region remain dependent on external supplies, which makes them vulnerable to price fluctuations on world markets, forcing them to seek ways to diversify their energy sources and routes.

These issues require a comprehensive approach based on a balance of national interests and regional cooperation.

From National Initiatives to Regional Synergy: A Comprehensive Approach to Energy Security in Central Asia

In these conditions, in order to ensure the sustainability of energy systems, the Central Asian states are carrying out consistent work, both at the national and regional levels. In particular, each country in the region is developing and implementing national strategies aimed at increasing energy efficiency and developing renewable energy sources.

For example, Kazakhstan, as part of its Green Strategy, is developing projects to use renewable energy sources and modernize infrastructure to reduce energy losses. Turkmenistan is expanding its gas transportation system, focusing on diversifying export routes and strengthening energy ties with neighboring states.

Kyrgyzstan and Tajikistan are focused on attracting investors to build new hydroelectric power plants and modernize existing ones, which will ensure uninterrupted power supply even in the face of growing demand.

In turn, Uzbekistan is implementing a number of initiatives aimed at strengthening energy security, where diversification of energy sources is becoming a key element. Particular emphasis is placed on the development of solar and wind energy.

By 2030, it is planned to increase the capacity of "green" energy sources to 20 GW (wind, solar power plants, solar photovoltaic panels and micro hydroelectric power plants), which can generate up to 50 billion kWh of electricity per year, contributing to savings of about 25 billion cubic meters of natural gas, as well as reducing harmful emissions into the atmosphere by 34 million tons.

It should be noted that the development of renewable energy in Uzbekistan is taking place on a full-scale. Since 2019, large solar and wind power plants with a total capacity of 3,500 MW equal to 10 billion kWh have been launched in the field of "green energy", which has increased the share of "green energy" in the energy system to 16%.

In addition, by 2030, the country will build additional "green capacities" of 19,000 MW, the share of renewable energy will be increased to 54%.

By 2025, it is planned to introduce 18 solar and wind stations with a capacity of 3,500 MW, as well as energy storage systems with a capacity of 1,800 MW.

In addition, the country has launched a large-scale "Solar Home" program, according to which residents are allowed to install solar panels in their homes with a capacity of up to 50 kW.

The issue of introducing “agrovoltaics” is being considered – the installation of solar panels in the fields by farmers to generate energy for their needs.

Uzbekistan is also actively working to strengthen ties with neighboring countries in the energy sector. For example, in 2022, several agreements on the joint use of hydro resources were signed with Kyrgyzstan and Tajikistan, which allows for the optimization of water use and the increase in the efficiency of energy systems.

Efforts are also being made at the regional level. Today, the Unified Energy Ring is functioning and developing in Central Asia. The region can not only meet its own needs, but also export electricity to such destinations as South Asia and Europe.

Development of a unified energy space in Central Asia is a strategic priority, since the countries of the region have significant energy resources that can effectively complement each other.

The heads of state of Central Asia have repeatedly emphasized the importance of cooperation in this area, confirming their readiness to strengthen energy integration. The single energy ring operating in the region allows not only to meet the needs of countries, but also to ensure the export of electricity to such promising destinations as South Asia and Europe.

Successful examples of regional cooperation include:

– Kambarata HPP-1 (capacity 1860 MW) – an agreement was reached between Uzbekistan, Kyrgyzstan and Kazakhstan on the joint construction of the facility, which will increase the energy security of the region;

– Yavan HPP (capacity 140 MW) – a joint project of Uzbekistan and Tajikistan to increase the energy supply of the two countries;

– the regional program "Green Agenda" for Central Asia, agreed upon by the countries of the region, which laid the foundation for the transition to sustainable energy, including the development of renewable energy sources;

– the meeting of energy ministers of the Central Asian countries in Astana (August 2024), which confirmed the high level of interest in coordinating energy policies and joint work on projects aimed at modernizing infrastructure and improving energy efficiency;

– adoption of the concept for the development of regional cooperation “Central Asia-2040”, which, among other things, reflects the commitment to joint actions in the energy sector to ensure sustainable development of the region.

However, to implement these ambitious projects, it is necessary to take measures that will ensure the coordination of efforts to attract investment and stimulate new technological solutions.

In this regard, the development of a common energy market in Central Asia would allow the region to effectively use its potential, increase its security in the energy supply sector and make it a major player in the global energy market.

At the same time, despite subsidies and the promotion of renewable energy sources, their share in the global fuel balance over the past 50 years has reached only 18.5%, while fossil fuels account for 81.5% of the world’s energy.

In addition, renewable energy remains more expensive than hydrocarbons, which hinders a full energy transition. It is used primarily for electricity generation and cannot replace fossil fuels in industrial sectors.

Despite the active development and significant potential of renewable energy sources, Central Asian countries should not limit themselves to “green” energy alone. To ensure long-term energy security and sustainability, it is necessary to develop traditional energy sources in parallel, including geological exploration of oil, gas and coal.

Energy diversity balance is important for:

– energy supply stability. Renewable energy sources are weather-dependent, while fossil fuels provide a reliable base load;

– economic growth. Exploration and extraction of natural resources contribute to industrial growth and energy exports;

– transition period. Countries will need to use traditional energy resources as a “bridge” to gradually transition to low-carbon technologies.

Given the region’s rich natural resources, including undeveloped hydrocarbon deposits, geological exploration remains a strategically important area. The balance between renewable energy sources and traditional sources will be the key to the region's energy sustainability in the face of global challenges.

In order to further deepen regional cooperation in the field of energy security, it is necessary to highlight the following key areas in which Central Asian countries could intensify their joint efforts.

Firstly, the priority task is to implement measures in the energy sector that will take into account both economic and environmental aspects (including the creation and updating of strategies, concepts at both the national and regional levels). This in turn will minimize risks and increase resilience to change.

Secondly, there is an objective need to implement programs for training and advanced training of specialists in the field of renewable energy sources, since the personnel shortage is one of the key problems for the development of the sector.

Most Central Asian countries lack specialists with skills in designing, constructing and operating renewable energy facilities, as well as engineers who can adapt and develop local technologies.

This leads to dependence on foreign experts and technologies, increasing the cost of projects and slowing down their implementation.

The introduction of educational programs and advanced training of specialists will not only ensure the training of personnel, but will also accelerate the development of local technologies, which will strengthen the energy sustainability of the region and create conditions for the effective implementation of renewable energy sources.

Thirdly, there is a demand for attracting foreign investment in the modernization of energy infrastructure and the introduction of new technologies that help improve energy efficiency.

The creation of specialized funds to support startups in the field of clean energy can significantly improve the situation and accelerate the implementation of innovative solutions.

In addition, to accelerate the development of the energy infrastructure of Central Asia, it is necessary to actively promote cooperation with extra-regional actors in the "CA plus" format, which will attract additional investment, introduce advanced technologies and ensure sustainable development of the region's energy sector.

Interaction with large international organizations such as the World Bank, the Asian Development Bank and the European Bank for Reconstruction and Development, as well as attracting private investors, will help implement large-scale projects to modernize energy systems, develop renewable energy sources and improve energy efficiency, which in turn will increase the energy security and sustainability of Central Asian countries in the context of global changes.

Fourthly, it seems promising to create multilateral platforms for discussing energy issues and sharing resources.

Regional agreements on water management can facilitate more efficient distribution of water resources and electricity, as well as help resolve water and energy issues between countries.

Fifthly, it is important to intensify regional cooperation in matters of geological exploration and efficient use of mineral resources.

Regional agreements in this area can contribute to more rational development of energy reserves, improvement of industrial cooperation and reduction of economic dependence on energy imports from

third countries.

Thus, the energy security of the Central Asian countries requires a comprehensive approach and active cooperation at the regional level. In turn, solving current problems will ensure sustainable development of the region, increase its strategic importance in the global arena and create conditions for more efficient use of available energy resources.

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