



ENERGY SECURITY AS A FACTOR OF SUSTAINABLE ECONOMIC DEVELOPMENT OF THE FUEL AND ENERGY COMPLEX

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Article history:	Abstract:
Received: 6 th December 2023 Accepted: 4 th January 2024 Published: 6 th February 2024	In the current conditions of escalating global competition, the advantage lies with countries that actively work on the development of infrastructure projects, the implementation of innovations, and the adoption of new technologies, enabling them to produce competitive products with minimal costs
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One of the most important measures to increase the competitiveness of the national economy and ensure economic security is the accelerated innovative development of the fuel and energy complex. This direction has been and remains a priority in the policy of the Republic of Uzbekistan.

The Presidential Decree of the Republic of Uzbekistan on "Measures to Implement National Goals and Objectives in the Field of Sustainable Development until 2030" establishes ensuring access to affordable, reliable, sustainable, and modern sources of energy for all as one of the priority goals of Uzbekistan's state policy.

In general, the strategic goals of the development of the power industry in Uzbekistan are aimed at addressing the following tasks:

- Deepening economic reforms aimed at further developing the electricity market;
- Reliable supply of the country's economy and population with quality electricity;
- Technical re-equipment and modernization of energy enterprises, increasing the efficiency of their production activities;
- Reducing the negative impact of energy production on the environment;
- Ensuring the economic security of the industry;
- Further development of integration processes within the Unified Power System of Central Asia.

Research by domestic scientists indicates that Uzbekistan's economy is highly energy-intensive compared to foreign countries. In particular, when comparing Uzbekistan with Western European countries, the republic lags behind in this regard by 4-5 times on average, 3.5 times compared to the United States, and more than 4 times compared to Japan and Korea. Within the CIS group of countries, Uzbekistan has the highest value for this indicator. The energy intensity of Uzbekistan's GDP exceeds the established value in Russia by 80%, in Kazakhstan by 70%, and in Ukraine by 20%.

The high energy intensity of the national economy is explained by the use of outdated equipment in the country, requiring urgent modernization and intensification. Additionally, modern production and consumption accounting systems for electricity are not universally and timely implemented. Scientific planning and forecasting principles of energy consumption are not adequately utilized.

To address these problems and others in the energy sector of Uzbekistan, the government has implemented measures reflected in industry development programs, legislative acts, and sublegal acts.

The main directions of state policy in the field of electric power are outlined in laws such as "On Electric Power," "On the Use of Renewable Energy Sources," "On Rational Energy Use," as well as decrees and resolutions by the President, and more. In 2019, regulatory frameworks for the use of renewable energy sources were developed, focusing on:

The government of Uzbekistan has developed and implemented measures to improve the efficiency and rationality of energy resource use. Priority measures in this direction include organizing the accounting of electricity production and consumption, determining energy efficiency indicators, organizing statistical observations, and state monitoring of the quality of supplied electricity.

The mentioned law provides producers of energy from renewable sources with a range of benefits and preferences. This includes complete long-term exemption from property tax for renewable energy installations and land tax for areas occupied by these installations (with a nominal capacity of 0.1 MW and above) for a period of ten years from the date of commissioning. Additionally, the law provides for medium-term (up to three years) exemption for individuals from property and land taxes if they use alternative energy sources.

Responsibility for the effective implementation of state policy in the rational use of energy is entrusted to the Ministry of Energy of the Republic of Uzbekistan. Ensuring access to affordable, reliable, sustainable, and modern sources of energy for all is defined as one of the priority goals of Uzbekistan's sustainable development, aiming to double the indicators of energy efficiency improvement by 2030.

To enhance the management mechanisms of the fuel and energy complex (FEC) of Uzbekistan, a Presidential Decree "On Measures for Fundamental Improvement of the Management System of the Fuel and Energy Sector of the Republic of Uzbekistan" was adopted in 2019. The decree highlights the importance of institutional transformations aimed at accelerating the development of all sectors of the economy, increasing investment attractiveness, and promoting business activity in the energy sector. However, the decree also identifies existing issues in the state management of the energy sector, including:

- Low coordination and systematicity in managing the FEC.
- Excessive regulation of energy enterprises' activities by government bodies.
- Low level of liberalization in the sector and the absence of a healthy competitive environment.
- Slow pace of updating fixed assets and infrastructure.
- Insufficient use of planning and forecasting methods in the industry.
- Currently, the following threats and risks affecting the sustainable development of the FEC have been identified:
- Human factors (various criminal organizations, terrorist groups, etc.).

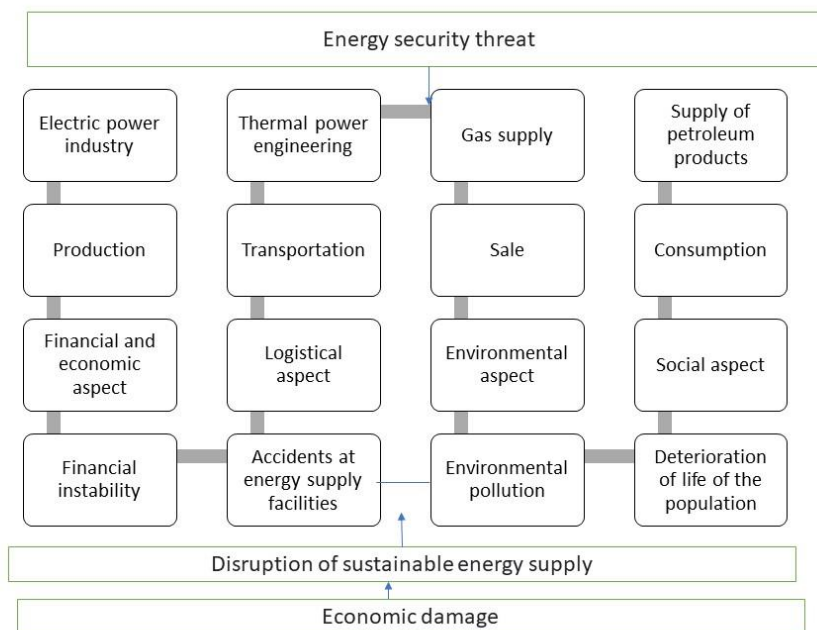


Figure 1. Priority Directions for the Further Development of the Fuel and Energy Complex in Uzbekistan.

Uzbekistan is the largest electricity producer in Central Asia, with a total installed capacity of over 12 GW, generating more than 61 TWh per year, which is approximately 2 MWh per capita.

The backbone of Uzbekistan's electricity sector consists of eleven large thermal power stations with an installed capacity of 16.4 GW, providing 87.3% of electricity production. Among them are Navoi Thermal Power Plant with a capacity of 1540 MW (electricity generation volume - 9.2 billion kWh per year), Tashkent Thermal Power Plant - 1860 MW (7.9 billion kWh), Talimarjan Thermal Power Plant - 2600 MW (7.2 billion kWh), and others. The calculated capacity of thermal power stations for electricity generation using gas is 73%, and solid fuels (fuel oil, coal) constitute 27%.

Additionally, the republic operates 32 hydroelectric power stations (HPPs) with a total installed capacity of 1.79 GW, contributing to 9.3% of the country's electricity production. Among them are the Cascade of Middle Chirchik HPPs with a capacity of 1031 MW (electricity generation volume - 3.5 billion kWh per year), Chirchik Cascade HPPs - 190 MW (1.1 billion kWh), Tuyamuyun HPP - 150 MW, Andijan HPP - 140 MW.

However, the infrastructure of electricity production is aging and inefficient, relying almost exclusively on natural gas. Hydroenergy represents a small percentage of total electricity generation, and other renewable sources account for less than 0.1% of consumption. Domestic experts consider the high level of wear and tear of energy-generating equipment - over 50% of the main production assets - a serious problem in Uzbekistan's energy sector, leading to a deterioration of the technical and economic indicators of operating power plants.

The potential of solar energy in Uzbekistan is practically untapped. In 2021, solar energy capacity was only 0.13 MW, or 0.001% of the total electricity capacities. However, the gross potential of renewable energy sources (solar, wind, etc.) in the country is estimated at approximately 51 billion tons of oil equivalent. About 97% of this potential is attributed to solar energy (0.13 MW) with wind energy estimated at 2.22 million tons of oil equivalent per year according to expert assessments.

Uzbekistan manages a significant portion of the installed capacity of the Central Asian Unified Power System and has a well-developed electricity sector that covers almost 100% of the population. The country can meet its energy needs through its own primary energy resources, with the majority of electricity provided by two companies - Thermal Power Plants and the Hydroenergy Company of Uzbekistan. The National Electric Grids of Uzbekistan and Regional

Electric Grids are responsible for the transmission and distribution of electrical energy. Uzbekistan also has cross-border transmission lines with Afghanistan, Kazakhstan, the Kyrgyz Republic, Tajikistan, and Turkmenistan, providing opportunities for regional energy system integration and overall interconnectivity to accelerate the region's decarbonization.

- 1) fuel and energy complex enterprises, facilities from other industrial sectors;
- 2) various force majeure situations and natural phenomena.

The realization of energy threats leads to the following:

- disruptions or cessation of fuel and energy resource supplies to consumers;
- breakdown of production capacities;
- significant deterioration of living conditions;
- various cascade accidents;
- economic losses;
- various socio-economic upheavals, up to the emergence of force majeure situations such as revolutions, protest marches, etc.

Our research has shown that all emerging risks and threats to the sustainable development of the fuel and energy complex can be roughly divided into two directions. One group of threats arises under the influence of destabilizing factors, putting the fuel and energy complex into an emergency (force majeure) mode of operation. During normal operation, the fuel and energy complex may have a group of threats (in real or potential form) with varying degrees of risk. It should be noted that all groups of threats and risks can lead to various types of damage to consumers due to insufficient supply of fuel and energy resources.

The main conclusion of our research is that any system (social, technical, economic) should operate steadily despite the influence of random circumstances. In other words, the stability of a system, in general, is its ability to return to the baseline state after eliminating all negative effects.

We believe that, for the sake of preserving stability in a constantly changing market environment, the equilibrium of the fuel and energy complex should be dynamic. However, equilibrium can be disrupted at any moment, leading to an imbalance in the main components of the system. In a normal situation, the fuel and energy complex should be in a stable or neutral state. Therefore, we can conclude that the balance and stability of the development of the fuel and energy complex are determined by the positive parity of internal and external circumstances.

Of course, various processes and events today affect the stability of the development of the fuel and energy complex. If you already have tools, tactics, and strategies for emergencies, you can adapt to them. As a result, threats are fully or partially equated. However, threat factors can be controllable or uncontrollable.

Uncontrollable factors are those threats and risks that come from external influences - socio-political, natural, partial management deficiencies. The system can be adapted to the impact of uncontrollable risks. Controllable factors include threats arising within the fuel and energy complex itself. The main types of threat sources in the fuel and energy complex are shown in Figure 2.

Let's classify the types of threats and risks affecting the enterprises of the fuel and energy complex. Economic threats include:

- Lack of competition in the energy market, monopolies of suppliers and producers of fuel and energy resources;
- Irrational use of fuel and energy resources;
- Financial instability of TEC enterprises;
- Insufficient investment in modernization, updating of basic production assets, as well as an unsatisfactory position in the field of innovation processes in the fuel and energy complex;
- High prices for energy carriers.

The theme of effective use of energy resources in all types of economic activities is currently extremely relevant for the Republic of Uzbekistan. One of the main priorities of the Concept for Ensuring the Republic of Uzbekistan with Electricity for 2020-2030, approved by the Government of the Republic of Uzbekistan on May 4, 2020, is the improvement of energy efficiency in the economy of Uzbekistan and the reduction of energy intensity of GDP.

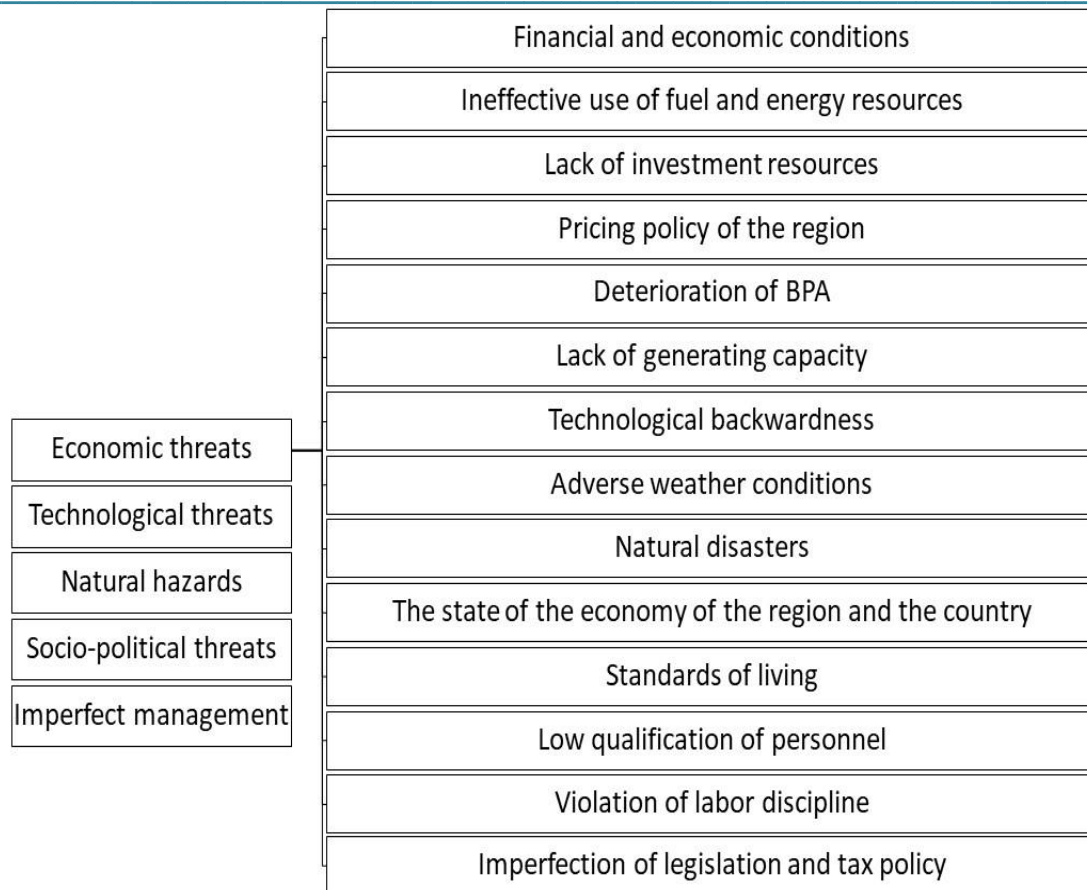


Figure 2. Types of sources of risks and threats to the sustainable development of the fuel and energy complex (FEC) ¹

While the energy intensity of Uzbekistan's GDP has been decreasing in recent years, this indicator remains significantly higher than that of developed countries. Currently, the average global value of energy intensity in GDP is 240 kg of oil equivalent per 1000 US dollars. Uzbekistan's energy intensity is nearly 4 times higher than that of the European Union (EU) and 2 times higher than the global average. As a result, Uzbekistan falls into the group of countries with a relatively high level of CO2 emissions per unit of gross domestic product.

Socio-political threats. Achieving an acceptable standard of living and sustainable economic development can be realized through the management of socio-political threats. This type of threat is directly related to the society's standard of living and can be exacerbated by other threats. ²

Natural threats. Measures to mitigate potential natural disasters are often considered during the design and construction phase of energy facilities. However, unforeseen natural events can lead to emergencies, considering all natural factors. The problem lies in the fact that the actual course of natural phenomena does not always correspond to the forecast. Natural disasters often vary in origin, severity, negative impact, scale, and frequency.

Artificial threats. Malfunctions and accidents can occur in any technical system for various reasons. Therefore, the concept of technological threat is introduced. Large-scale fires and accidents in the fuel and energy complex pose a serious threat to the population and the environment.

**Table 1
Projects for ensuring the energy security of Uzbekistan, adopted in 2021**

Nº	The content of the project	Additional information
1.	10 contracts have been concluded for the construction of thermal, solar, and wind power stations in the power industry with a total capacity of 4341 MW.	Data indicates that the capacities are equivalent to one-third of the current capacities in the country.
2.	The launch of 2 large solar power plants with a capacity of 100 MW each is planned.	Location - Navoiy and Samarkand regions.
3.	Planned commissioning of thermal and solar power stations with a total capacity of 1800 MW.	In terms of capacity and implementation timelines, this measure has no analogs in the entire history of the Republic.

¹ Built by the author

² Sh. Zokirov. Renewable Energy for Sustainable Development. Scientific Research Center "Scientific Foundations and Problems of Economic Development in Uzbekistan."

4.	Installation of additional high-voltage transformers with a total capacity of more than 1.5 thousand megavolt-amperes at 17 electrical substations.	In terms of capacity and implementation timeline, this measure has no analogs in the entire history of the republic.
5.	Reconstruction and modernization of 15,000 km of low-voltage power transmission lines.	This is the first large-scale reconstruction in the history of Uzbekistan's power industry.
6.	Modernization and reconstruction of 4,000 transformer substations.	In terms of scale, this is the first reconstruction of this kind.
7.	Launch of the Uzbekistan GTL project in the Kashkadarya region.	This is the largest investment project in the region and the only one of its kind in the CIS territory.
8.	Implementation of the Automated Electricity Metering and Control System (ASCUE) for nearly 7.5 million subscribers.	The project was carried out within the framework of the state program.
9.	The implementation of an automated system for accounting and control of natural gas (ASGUG).	As a result, modern electronic gas meters were installed free of charge for more than 3.5 million consumers.
10.	Completion of the process of installing barcodes on household gas cylinders throughout the country.	As a result of this measure, the control of cylinders with liquefied gas will be carried out in online mode.

Starting from 2020, the main parameters of the state budget of the Republic of Uzbekistan began to be approved in the form of a law (previously they were approved by the Decree of the President of the Republic of Uzbekistan). Additionally, up until 2019, State Budget expenditures were planned based on the consideration and compilation of budget requests according to the functions of the state (economy, social sphere, centralized investments, etc.). Since 2020, a division into first-level budget managers, the list of which is determined by the Cabinet of Ministers, and second-level budget managers (attached to first-level budget managers) has been introduced. According to this reform, specific allocations are annually allocated for the current expenditures of the Ministry of Energy of the Republic of Uzbekistan (Table 2).

Table 2
Allocations from the state budget of Uzbekistan for the current expenditures of the Ministry of Energy in 2020-2022.

Indicators	2020 г.		2021 г.		2022 г. (plan)	
	mln. sum	%	mln. sum	%	mln. sum	%
Funds allocated from the national budget in total:	100 830 566,4	100	135 800 591,4	100	171 894 044,6	100
Ministry of Energy of the Republic of Uzbekistan (current expenses)	41 059,5	0,04	43 839,8	0,003	55 034,9	0,03

According to the data presented in the above table, the funding volumes for the energy sector from the state budget of Uzbekistan have a relatively small share but show a growth trend.

In order to develop the electric power sector in Uzbekistan, a project has been adopted for implementation with the assistance of the World Bank titled "Transformation of the Power Sector and Sustainable Electricity Transmission." This initiative aims to expand the production of "green" energy, ensure its reliable supply to approximately 32 million consumers, and facilitate the connection of new large-scale projects for renewable energy production.

For the implementation of the project, the International Development Association, a part of the World Bank Group, has allocated a credit of \$380 million, and the Green Climate Fund will provide a loan of \$43 million under the Renewable Energy Risk Mitigation Initiative, along with an additional \$4 million for specific activities within the project. This financing will be provided to the government of Uzbekistan at very low interest rates and with a maximum repayment term of up to 40 years.

The government of Uzbekistan has planned the implementation of investment projects totaling around \$52.15 billion in the years 2022-2024, as reflected in the Investment Program of Uzbekistan for 2022-2024.

Table 3
Financing of Uzbekistan's Energy Sector in 2022-2024

Year	Total project funding amount	Into the energy and geology sector
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2022 y.	\$16.57 billion, including FDI \$6 billion.	\$7,51 billion
2023 y.	\$17.34 billion, including FDI \$7.06 billion.	\$9,24 billion
2024 y.	\$18.2 billion, including FDI \$7.73 billion.	\$10,36 billion

At present, the energy sector of Uzbekistan is implementing a series of initiatives aimed at further digitizing the fuel and energy complex, including: Implementation of a comprehensive program for the digitization of the power industry for the years 2019-2021, with the goal of automating enterprise resource planning (ERP) processes and dispatch control and data collection (SCADA).

The project "Implementation of an Automated System for Accounting and Control of Electricity (ASCUE)" is being implemented, resulting in the connection of approximately 5.5 million consumers to the automated system for monitoring and accounting of electricity by the end of 2020.

Thus, the analyzed threats and risks to the sustainable development of the energy sectors have shown that the financially stable, economically sustainable, developing in accordance with international standards, environmentally efficient, innovation-driven, and staffed with qualified personnel national fuel and energy complex is not just a necessity and a requirement of the time but will also elevate the economy of the republic to a qualitatively new level.

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