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GREEN ENERGY CAPACITY AND ITS USE ISSUES IN UZBEKISTAN

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Abstract. This article analyzes the green energy potential of Uzbekistan, the territorial distribution of renewable energy sources, and the prospects for their utilization. During the research, the country's solar, wind, and hydropower capacities were studied using statistical and analytical data. Investments attracted to the energy sector in recent years, newly implemented energy projects, and the share of renewable energy sources in the overall energy balance were evaluated. The results indicate that the development of green energy in Uzbekistan is an important factor in ensuring energy security, strengthening environmental sustainability, and increasing economic efficiency.

Keywords: green energy, renewable energy sources, solar energy, wind energy, energy security, investments, environmental sustainability.

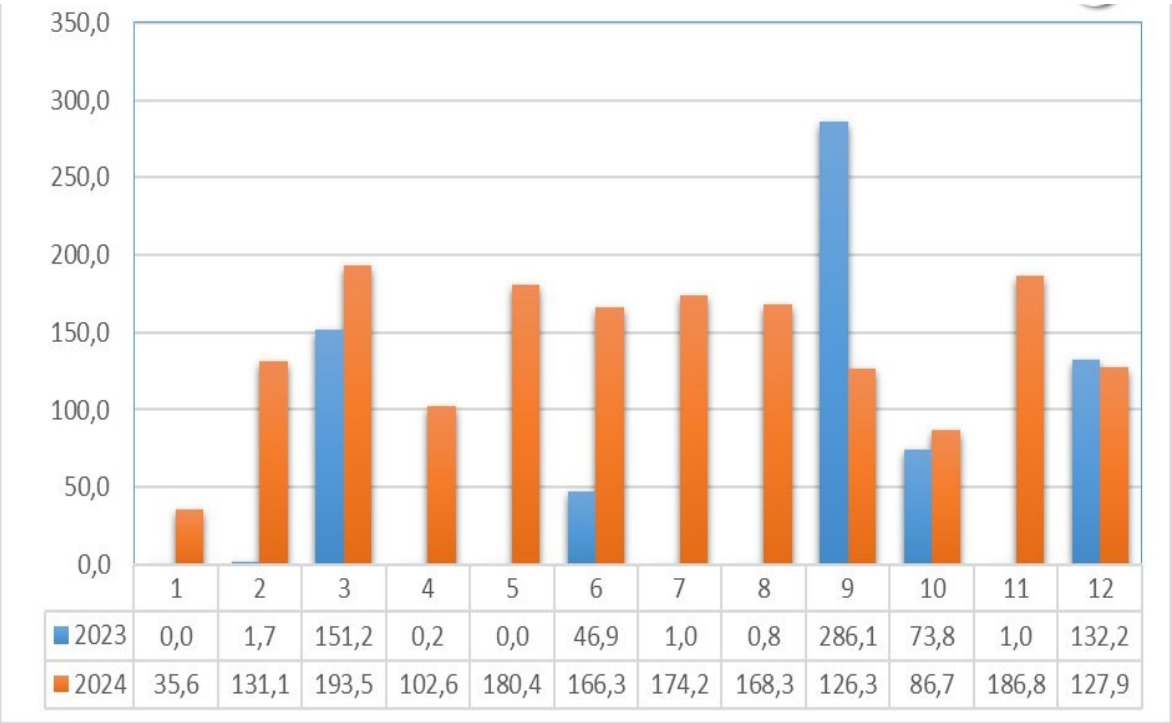
Introduction. The growing demand for energy resources in the global economy is increasingly highlighting the need for the efficient use of renewable energy sources. Global climate change, the depletion of natural resources, and the intensification of environmental problems are prompting many countries to transition toward green energy. From this perspective, Uzbekistan has also identified the development and utilization of renewable energy sources as one of its priority directions.

Uzbekistan possesses significant potential for solar and wind energy due to its favorable natural and climatic conditions. According to preliminary expert estimates, the country's total green energy potential amounts to 610 GW. Of this, 500 GW is attributed to solar energy, 100 GW to wind energy, and 10 GW to hydropower.

In recent years, as a result of reforms implemented in the energy sector, the volume of foreign investments has been steadily increasing. In particular, over the past five years, more than 20 billion US dollars in investments have been attracted to the energy sector, and new energy capacities have been commissioned. This plays a crucial role in diversifying the country's energy system and ensuring energy security.

Economic growth in Uzbekistan is also leading to a steady increase in demand for energy resources. The vast majority of electricity in the Republic is generated by thermal power plants. The outdated condition of the equipment and the shortage of natural gas for electricity production have been causing frequent energy shortages

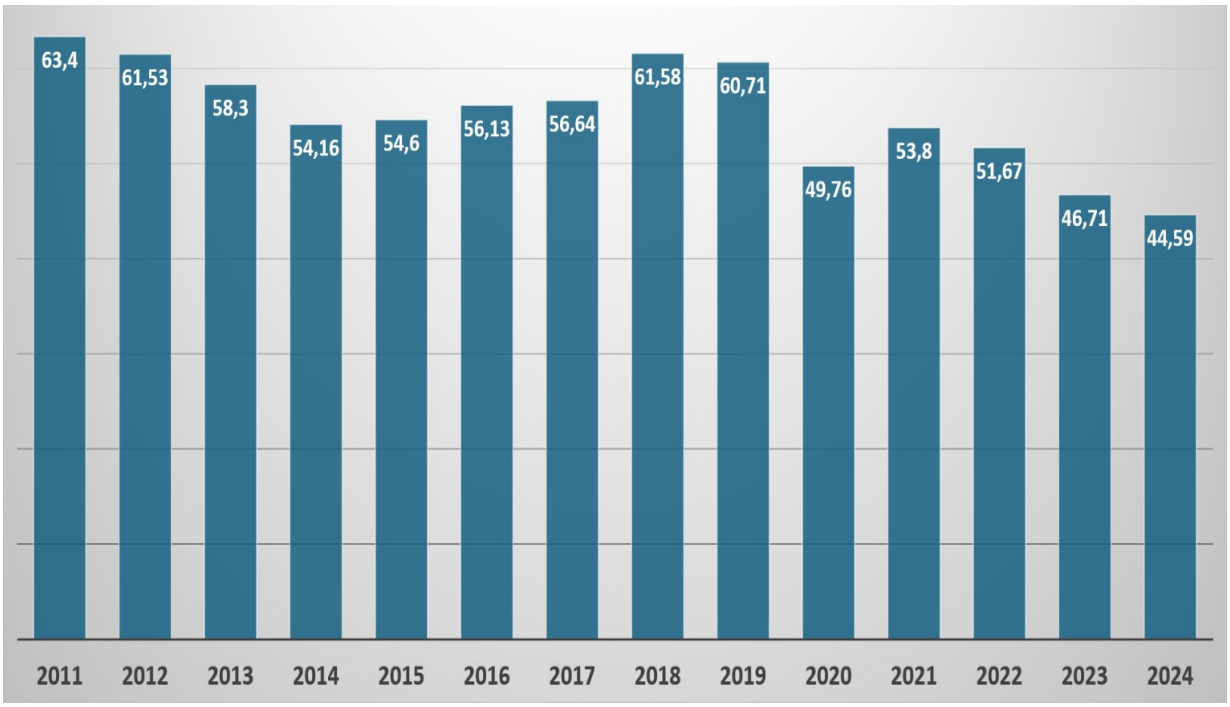
during unusually hot and cold days in recent years. As a result, the disconnection of tens of thousands of business entities from the grid in winter months and long queues at gas stations have become a common occurrence.



	1	2	3	4	5	6	7	8	9	10	11	12
2023	0,0	1,7	151,2	0,2	0,0	46,9	1,0	0,8	286,1	73,8	1,0	132,2
2024	35,6	131,1	193,5	102,6	180,4	166,3	174,2	168,3	126,3	86,7	186,8	127,9

Picture 1. Gas imports (by month, million dollars)

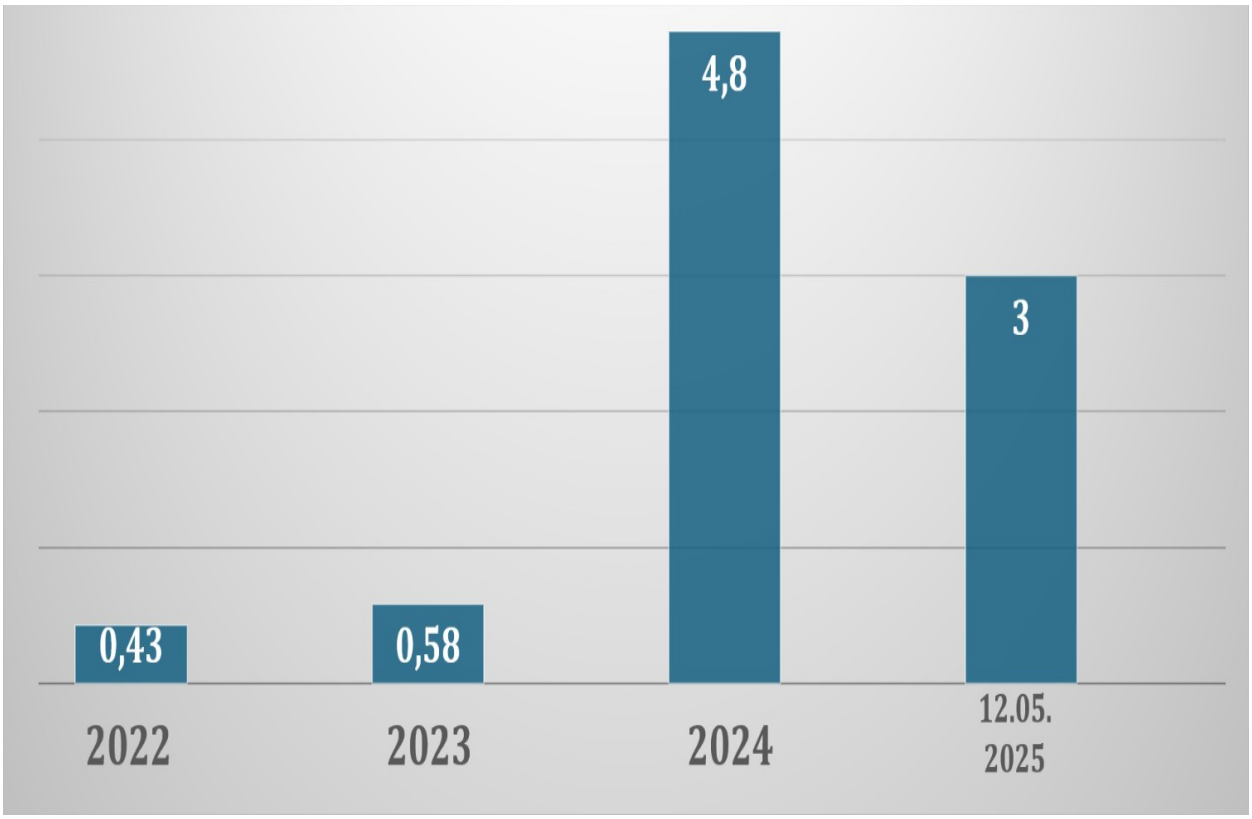
In 2024, Uzbekistan purchased gas worth $1.7 billion from Russia and Turkmenistan. This is 2.4 times more than in 2023 and 6 times more than in 2022.



Picture 2. Dynamics of natural gas production in Uzbekistan

(billion cubic meters)

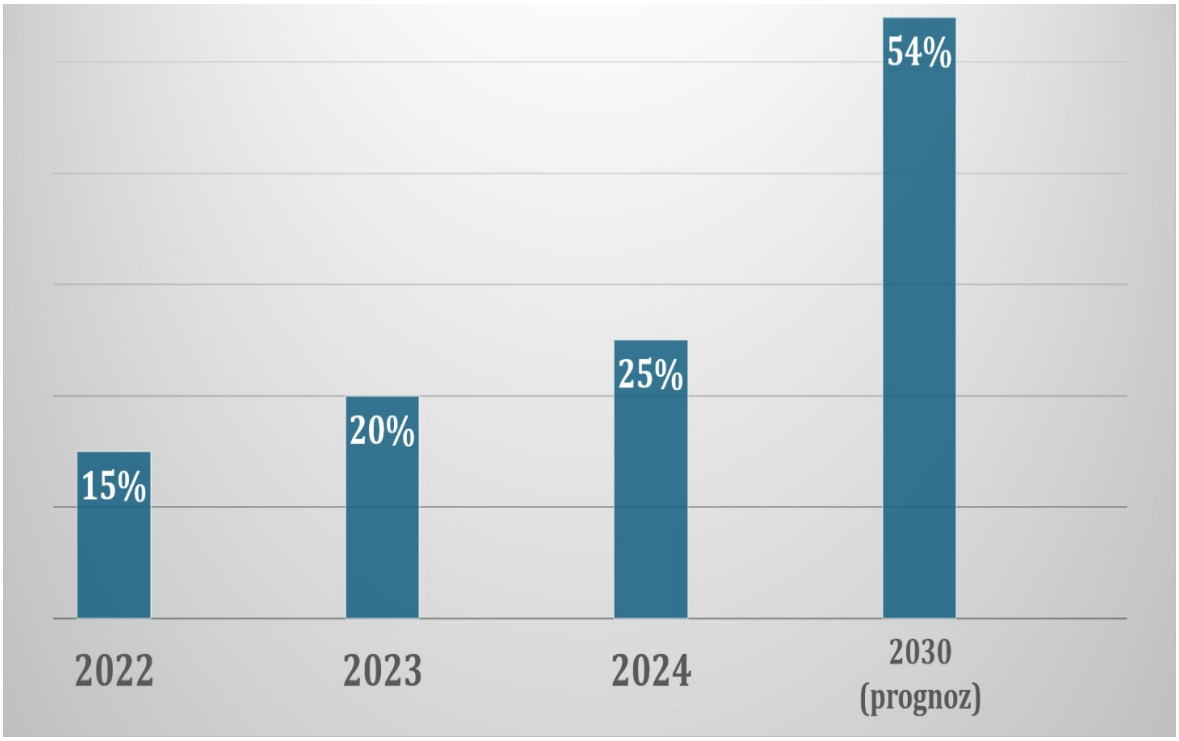
After the pandemic, Uzbekistan has seriously begun diversifying its energy system. In particular, over the past 5 years, 50 agreements worth a total of about $30 billion have been signed in the energy sector. Currently, 11 solar photovoltaic power plants and 3 wind power plants with a capacity of 4,067 MW are producing green energy in 10 regions of the republic.



Picture 3. Amount of electricity generated by solar and wind power plants in Uzbekistan (billion kilowatt hours)

As of May 12, 2025, the amount of electricity generated by solar and wind power plants in Uzbekistan since the beginning of the year reached 3 billion kWh. For comparison, this indicator stood at 434 million kWh for the whole of 2022, 576.9 million kWh in 2023, and 4.86 billion kWh in 2024.

Accordingly, the share of renewable energy sources in total electricity consumption was 15% in 2023 and 20% in 2024. It is expected to reach 25% in 2025, with forecasts indicating that this figure will increase to 54% by 2030.



Picture 4. Share of renewable energy sources in total consumption in Uzbekistan

Research Methodology. The present study employed statistical, analytical, and comparative methods. The main sources of the research included official data from the Ministry of Energy of the Republic of Uzbekistan, reports of international energy organizations, and scientific literature.

The territorial analysis method was used to study the distribution of solar and wind energy potential across the regions of the country. Through the analysis of statistical data, the annual growth dynamics of renewable energy sources and their share in the energy balance were assessed.

In addition, a comparative analysis was conducted on the volume of investments attracted to the energy sector and the economic and ecological efficiency of the projects being implemented.

Results. According to the research findings, the indicators of the use of renewable energy sources in Uzbekistan have increased significantly in recent years. The most favorable regions for solar energy within the country are Surkhandarya, Kashkadarya, Navoi, and Bukhara regions. The wind energy potential is particularly high in the Republic of Karakalpakstan, Navoi, and Bukhara regions.

As of 2025, the installed capacity of renewable energy sources in the country has approached 10 GW. Solar photovoltaic and wind power plants with a total capacity of 4,067 MW are currently operating in the Republic.

The share of renewable energy sources in total electricity consumption constituted 15% in 2023 and 20% in 2024. It is forecasted that this indicator will reach 25% in 2025. By 2030, it is planned to increase this share to 54%.

The study also revealed that the decline in natural gas production volumes alongside the rising energy consumption in Uzbekistan is further strengthening the need to diversify energy sources.

Discussion. The analysis shows that the development of green energy in Uzbekistan holds significant economic, environmental, and strategic importance. Firstly, the utilization of renewable energy sources contributes to reducing the cost of electricity generation. Secondly, it helps ensure environmental sustainability by decreasing greenhouse gas emissions.

At the same time, certain challenges persist in the sector. These include insufficient transparency in the energy system, the implementation of some projects through direct contracts without tenders, and relatively high technological costs.

Uzbekistan possesses substantial potential for transitioning to green energy. The country experiences more than 300 sunny days per year, and there are favorable regions for wind energy development. In other words, the potential of natural resources is very high. However, the main problems in this area are related to the lack of transparency in the energy system and the inefficient management of existing resources.

It is noteworthy that in recent years, projects for the development of renewable energy sources have been awarded to investors through direct contracts without tenders. Government officials explain this by the need to save time. Nevertheless, the most critical issue in these direct negotiation contracts is that the prices are not disclosed publicly.

Electricity purchase agreements are usually concluded in foreign currency. In the event of sharp devaluation of the national currency, this may significantly increase the financial burden on the government. On the other hand, the costs of producing technologies for renewable energy sources are steadily decreasing year by year.

Another challenge is Uzbekistan’s arid climate. Due to water scarcity and decreasing precipitation, dust storms and similar natural phenomena have become more frequent. These factors can seriously affect the performance of solar panels and reduce their operational efficiency.

In addition, Uzbekistan’s arid climatic conditions may negatively affect the efficiency of solar panels. Dust storms and sand migration processes are among the main factors impacting the technical condition of solar panels.

International experience shows that the transition to renewable energy sources is a crucial direction for ensuring long-term economic stability. Therefore, the

modernization of the energy system and the widespread introduction of green technologies are of strategic importance for Uzbekistan as well.

Conclusion. Uzbekistan has significant natural and economic opportunities for the development of green energy. The country's high potential in solar and wind energy creates favorable conditions for the widespread use of renewable energy sources.

The results of the study indicate that the share of renewable energy sources is steadily increasing year by year, and the process of diversifying the energy system is accelerating. This serves as an important factor in strengthening energy security, reducing dependence on imports, and mitigating environmental problems.

In the future, it is advisable to widely introduce modern technologies in the implementation of green energy projects, improve the investment environment, and further develop scientific research activities.

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