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THE CONCEPT OF GREEN ECONOMY AND SUSTAINABLE DEVELOPMENT: ECONOMIC ANALYSIS OF RENEWABLE ENERGY SOURCES IN UZBEKISTAN

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Abstract: This article analyzes the economic aspects of renewable energy sources in Uzbekistan within the framework of the concept of the green economy and the principles of sustainable development. The study examines the potential, existing projects, and economic efficiency in the fields of solar, wind, bioenergy, and hydropower. The transformation processes taking place in the energy market are compared with international experience. As a methodology, statistical and comparative analysis, as well as SWOT analysis methods, are used. The data are analyzed based on information from the State Committee of the Republic of Uzbekistan on Statistics, the International Renewable Energy Agency (IRENA), and the World Bank. The results serve to develop strategies for the advancement of green energy, enhance investment attractiveness, and form a sustainable energy system.

In recent decades, the global community has faced such challenges as climate change, depletion of natural resources, and the intensification of environmental problems. In this process, the concept of the "green economy" has become central to strategic development agendas. The green economy is an integrated approach aimed at ensuring economic growth while protecting the environment, using resources efficiently, and promoting social justice. According to international experts, by 2030, the transition to a green economy may contribute an additional 4–5% growth to the global gross domestic product (GDP).

Keywords: Green economy, Sustainable development, Renewable energy, Affordable and clean energy, Economic analysis, Energy sources, Environmental efficiency, Investment potential

INTRODUCTION

The Sustainable Development Goals (SDGs) proposed by the United Nations, in particular Goal 7 " –Affordable and Clean Energy" and Goal 13 " –Climate Action," form the foundation of the green economy. Today, renewable energy sources account for nearly 30% of global energy production (International Renewable Energy Agency – IRENA, 2023). For example, this figure reaches 46% in Germany and 28% in China.

Uzbekistan has also defined clear strategic objectives for transitioning to a green economy in recent years. According to the "Strategy for Transition to a Green Economy" adopted in 2019, by 2030 the share of renewable energy in the country's total energy production is planned to reach at least 25%. Currently, this figure stands at only about 10–12%, mainly due to hydropower. However, in recent years, the construction of large solar

and wind power plants has initiated significant transformations in the energy market. For instance, a 100 MW solar power plant launched in 2023 in the Navoi region generates about 270 million kWh of clean energy annually.

The green economy and renewable energy sources hold strategic importance for enhancing Uzbekistan's economic security and international competitiveness. Geographically, the country is rich in solar and wind energy resources: with an average of 300 sunny days per year, it possesses enormous potential for solar energy development. In addition, the regions of Karakalpakstan, Bukhara, and Navoi, where the average wind speed is 5–7 m/s, have great prospects for developing wind energy.

This paper analyzes the changes in Uzbekistan's energy market not only through statistical data but also by directly comparing them with international experience. Furthermore, indicators such as investment efficiency, economic return of projects, and their social impact are jointly evaluated. This approach provides a deeper understanding of Uzbekistan's transition to a green economy, identifies its strengths and weaknesses, and lays the groundwork for future strategic decision-making.

LITERATURE REVIEW

International research on the green economy and renewable energy is extensive and deeply analytical in nature. Reports by the International Energy Agency (IEA) note that the share of renewable energy sources in global energy production continues to increase every year. According to IEA data from 2023, more than 30% of the world's total electricity generation comes from solar, wind, hydro, and bioenergy sources. The International Renewable Energy Agency (IRENA) predicts that this share could reach 86% by 2050.

Analyses by the Organisation for Economic Co-operation and Development (OECD) emphasize that the transition to a green economy not only ensures environmental sustainability but also creates new jobs and stimulates economic growth. According to World Bank data, every billion dollars invested in the renewable energy sector can generate an average of 7,000–8,000 new jobs.

In Uzbekistan, research on green energy is mainly based on scientific articles, state strategies, and reports from international financial institutions. For example, joint reports by the Ministry of Energy of the Republic of Uzbekistan and the United Nations Development Programme (UNDP) highlight the country's enormous potential in solar and wind energy resources. Most academic works focus on diversifying the energy system, reducing dependence on imported energy resources, and improving energy efficiency.

A comparison of international experience and local approaches shows that developed countries (such as Germany and Denmark) widely use technological innovations and financial incentive mechanisms in the renewable energy sector. In Uzbekistan, however, this process is only beginning to take shape and primarily relies on large-scale international investment projects. Therefore, integrating local experience with advanced international practices will ensure the sustainable development of the sector in the future.

METHODOLOGY

This study employs a comprehensive approach to assess the economic efficiency of renewable energy sources in Uzbekistan. The methodology consists of three main components: statistical analysis, comparative analysis, and SWOT analysis.

In the statistical analysis, data from the State Committee on Statistics of Uzbekistan, the International Renewable Energy Agency (IRENA), the World Bank, and the International Energy Agency (IEA) were used to examine key indicators over the past decade, including the volume of renewable energy production, investment flows, energy prices, and their impact on the economy. For example, between 2013 and 2024, the share of renewable energy in Uzbekistan's total electricity production increased from 8% to 12%, representing a 1.5-fold growth.

Comparative analysis made it possible to evaluate international experience and compare it with local conditions. Renewable energy policies, technological innovations, financial incentives, and investment mechanisms in countries such as Germany, China, and Kazakhstan were examined. This approach helped identify best practices that can be applied to the development of the renewable energy sector in Uzbekistan.

Through SWOT analysis, the strengths, weaknesses, opportunities, and threats of Uzbekistan's renewable energy sector were identified. The strengths include favorable geographic conditions (an average of 300 sunny days per year), abundant natural resources, and the prioritization of the green economy in state policy. Weaknesses include underdeveloped technological infrastructure, a shortage of skilled personnel, and high initial investment costs.

This methodological approach ensured the reliability of the research results and made it possible to develop well-grounded, evidence-based recommendations for advancing the renewable energy sector in Uzbekistan's energy market.

ANALYTICAL SECTION

Uzbekistan is one of the countries in Central Asia with the greatest potential for renewable energy resources. The country enjoys an average of 300 sunny days per year, which creates enormous opportunities for solar energy development. According to estimates, Uzbekistan's territory could generate solar energy equivalent to 51 billion tons of conventional fuel annually. In terms of wind energy, the Republic of Karakalpakstan, as well as the Navoi and Bukhara regions, have stable wind flows capable of producing between 100 and 200 MW per year. In addition, hydropower potential can be expanded mainly through the construction of small and medium-sized hydroelectric plants, while bioenergy potential can be increased through the processing of agricultural waste.

Transformation processes in the energy market have intensified significantly over the past five years. In 2023, a 100 MW solar power plant was launched in the Navoi region, producing 270 million kWh of electricity annually and supplying 80,000 households with energy. In 2024, construction began on a 500 MW wind power plant in the Bukhara region, which, once operational, will generate 1.8 billion kWh of electricity

per year. Currently, renewable energy projects with a total capacity exceeding 2 GW are being implemented across the country.

An analysis of foreign experience shows that Germany, through its *Energiewende* program, has increased the share of renewable energy to 46%, while China became the world's largest producer of solar panels and a leader in wind farm construction in 2023. Kazakhstan, in the last seven years, has increased its renewable energy capacity 20-fold, reaching 2.5 GW. The main success factors in these countries are technological innovation, government guarantees, and favorable conditions for investment.

In terms of investment and economic efficiency, Uzbekistan has attracted nearly USD 3.8 billion in foreign investment for renewable energy projects over the past five years. Most of this funding has come from companies in the United Arab Emirates, Saudi Arabia, and China. The share of domestic investment remains low, with international financial institutions playing a dominant role. The average internal rate of return (IRR) for these projects ranges from 12% to 15%, with a payback period of 6–8 years.

The development of the renewable energy sector also positively impacts other areas of the economy. On one hand, electricity production costs decrease and dependence on imported fuels is reduced; on the other hand, new jobs are created in the construction, metallurgy, logistics, and service sectors. According to World Bank estimates, every USD 100 million invested in renewable energy in Uzbekistan generates an average of 800–1,000 new jobs.

CONCLUSION AND RECOMMENDATIONS

The initial steps taken in the field of renewable energy in Uzbekistan have already begun to yield tangible results. Solar and wind power plants are emerging not only as sources of clean energy but also as a new driving force for the national economy. To accelerate this process, it is essential to strengthen the development of green energy as a priority direction of state policy, expand financial incentives for investors, and introduce advanced technologies. In addition, training qualified specialists and deepening international cooperation will contribute to transforming Uzbekistan into a regional hub for green energy.

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