

Article

Transition to a Green Economy in Uzbekistan: Opportunities and Barriers

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Abstract: This article analyzes the main opportunities and challenges of the transition to a green economy in Uzbekistan. The study examines the theoretical foundations of the green economy concept, its economic and environmental significance, and the reforms being implemented in this area. Particular attention is paid to renewable energy development, energy efficiency improvement, green investments, and environmental sustainability. The findings indicate that Uzbekistan possesses significant potential for green economic transformation due to its natural resources and ongoing policy reforms. However, limited financial resources, technological constraints, shortage of qualified personnel, and institutional barriers remain major challenges. Based on the research findings, several practical recommendations for accelerating the transition to a green economy in Uzbekistan are proposed.

Keywords: Green economy, sustainable development, renewable energy, green investments, energy efficiency, environmental sustainability, climate change, innovation, Uzbekistan economy, green transformation.

1. Introduction

The rapid development of the world economy in the 21st century has created global problems such as overexploitation of natural resources, environmental pollution, loss of biodiversity, and climate change. These problems have a negative impact not only on environmental sustainability, but also on economic growth and the well-being of the population. Therefore, many countries are paying special attention to the introduction of the concept of “green economy” as a new model of economic development. The concept of green economy was first widely used within the framework of the United Nations and its environmental programs, which, along with ensuring economic growth, implies maintaining environmental safety, rational use of natural resources, and increasing social well-being.

The transition to a green economy covers areas such as expanding the use of renewable energy sources, increasing energy efficiency, developing waste recycling systems, introducing environmentally friendly technologies, and reducing carbon emissions[1].

Today, the negative consequences of climate change are one of the urgent problems for the countries of Central Asia, including Uzbekistan. The limited water resources in the country, the intensification of desertification processes, problems with air quality, and the need for efficient use of energy resources require the introduction of the principles of a green economy. Therefore, in recent years, the Republic of Uzbekistan has adopted a number of strategic documents and programs on the transition to a green economy[2]. In particular, large-scale reforms are being implemented to develop renewable energy sources, increase energy efficiency, attract “green” investments, and stimulate environmentally sustainable production.

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Uzbekistan's transition to a green economy creates significant economic, environmental, and social opportunities for the country. In particular, the effective use of solar and wind energy serves to strengthen energy security, create new jobs, and accelerate the innovative development of the economy. In addition, the introduction of environmentally friendly technologies allows reducing production costs and increasing the efficiency of resource use. At the same time, there are a number of problems and obstacles in the transition to a green economy. These include the lack of financial resources, the limited availability of modern technologies, the shortage of qualified personnel, the insufficient level of environmental culture and awareness of the population, as well as the high level of dependence on traditional energy sources in some sectors[3,4]. These factors to some extent hinder the widespread implementation of the principles of the green economy.

2. Methodology

This study employs a mixed-method approach combining qualitative and quantitative research designs to evaluate the opportunities and barriers of Uzbekistan's green economy transition. The theoretical framework is based on the principles of ecological economics and sustainable development.

The empirical research relies on the following structural methods:

- **Policy and Literature Review:** Analysis of national strategic documents, including the *Uzbekistan 2030 Strategy*, alongside reports from international organizations such as UNEP, the World Bank, and IRENA.
- **Statistical Analysis:** Examination of quantitative data on renewable energy potential, energy consumption, and carbon emissions obtained from the Statistical Agency of Uzbekistan, the Ministry of Energy, and UN databases.
- **Comparative Analysis:** Evaluation of Uzbekistan's green initiatives in comparison with other developing and transition economies in Central Asia.
- **SWOT Analysis:** Systematic categorization of internal factors (strengths and weaknesses) and external factors (opportunities and threats) affecting the country's green transformation.

By integrating these methods, the study ensures an objective, data-driven assessment of the socio-economic and ecological factors shaping Uzbekistan's green economy.

3. Results and Descussion

The purpose of this article is to analyze the economic and environmental significance of the transition to a green economy in Uzbekistan, to identify existing opportunities and key obstacles in this direction, as well as to develop scientifically based proposals and recommendations on promising areas for the development of a green economy. The results of the study will serve to ensure sustainable economic development in the country, reduce environmental problems, and accelerate the processes of green transformation.

The concept of a green economy has been widely studied in international scientific literature as one of the important directions of modern economic development. This concept is aimed at ensuring a balance between economic growth, environmental sustainability and social well-being, and its theoretical foundations are based on the ideas of sustainable development. The concept of a green economy was first formulated by scientists who studied the relationship between environmental problems and economic development. The United Nations Environment Programme (UNEP) defines a green economy as "an economy that increases human well-being and ensures social equity, while significantly reducing environmental risks and resource scarcity."

Pearce, Markandya and Barbier[5] analyzed the environmental aspects of economic development in their study and noted that the preservation of natural capital is one of the important factors of economic growth. In their opinion, taking into account environmental factors in economic policy ensures long-term sustainable development.

Stern[6] studies the economic consequences of climate change and identifies carbon dioxide emissions as one of the greatest threats to the global economy. The author argues that investing in green technologies and renewable energy sources can help prevent future economic losses.

Jacobs[7] describes the green economy as a new model of economic development, identifying energy efficiency, innovative technologies, resource efficiency, and environmental management systems as its key elements. The author notes that the green economy, in addition to increasing economic competitiveness, also serves to create new jobs.

Studies conducted in Central Asian countries on the issue of green economy indicate the region's environmental problems, in particular, water scarcity, desertification, and the impact of climate change, as key factors. Researchers emphasize that the use of renewable energy sources and effective management of water resources are among the priorities for the region.

Scientific research on the green economy in Uzbekistan has become significantly more active in recent years. Local scientists are widely studying the issues of increasing energy efficiency, developing renewable energy sources, attracting green investments, and ensuring environmental safety[8]. The studies recognize Uzbekistan's high solar energy potential as an important advantage in the country's transition to a green economy. An analysis of the existing scientific literature shows that the green economy is an effective tool for combining economic growth and environmental sustainability. However, financial, institutional, and technological problems remain in implementing this model in developing countries, including Uzbekistan.

Therefore, in-depth study of the national characteristics of the transition to a green economy and the effective use of existing opportunities remain a relevant area of scientific research. This study used complex scientific approaches to assess the opportunities and obstacles to the transition to a green economy in Uzbekistan. The methodological basis of the study is the theory of sustainable development, the concept of ecological economics, and the principles of the green economy. Qualitative and quantitative analysis methods were used throughout the study. First of all, in order to study the theoretical foundations of the green economy, domestic and foreign scientific literature, reports of international organizations and regulatory and legal documents were analyzed. In particular, strategic documents of the United Nations Environment Program (UNEP), the World Bank, the International Energy Agency (IEA) and the President of the Republic of Uzbekistan on the green economy were used. The study used the method of comparative analysis to compare Uzbekistan's transition to a green economy with the experience of other developing countries. This method served to identify the country's existing opportunities and problems[9,10].

Also, based on the statistical analysis method, existing data on renewable energy sources, energy consumption, greenhouse gas emissions and environmental indicators were studied. Statistical data were obtained from the databases of the Statistical Agency of the Republic of Uzbekistan, the Ministry of Energy, the World Bank and the UN. The SWOT analysis method was also used in the research process. Using this method, Uzbekistan's strengths, weaknesses, opportunities and threats in the transition to a green economy were systematically assessed (Table 1).

Table 1. SWOT analysis on the transition to a green economy in Uzbekistan

Strengths	Weaknesses
• High solar energy potential; • Government support policy; • Opportunity to attract green investments; • Growing interest in renewable energy.	• Limited financial resources; • Lack of modern technologies; • Low number of qualified specialists; • Dependence on traditional energy sources.
Opportunities	Threats
• Increased foreign investment inflows; • Creation of new jobs; • Increased ecological export products; • Increased energy efficiency.	• The negative impact of climate change; • Global economic instability; • The presence of investment risks; • The risk of technological dependence.

These methodological approaches made it possible to comprehensively assess the state of the transition to a green economy in Uzbekistan, identify existing opportunities and obstacles, and develop scientifically based conclusions. The results of the study showed that Uzbekistan has the natural, economic, and institutional potential necessary for the transition to a green economy. The country is one of the countries in Central Asia with high potential for renewable energy resources, especially solar energy. According to expert estimates, Uzbekistan has an average of more than 300 sunny days per year, which creates favorable conditions for the development of solar energy[11].

In recent years, a number of reforms have been implemented in the country to develop a green economy. In particular, the number of projects aimed at building solar and wind power plants, increasing energy efficiency, and introducing environmentally friendly technologies is increasing. This helps reduce the carbon intensity of the economy and strengthen energy security (Table 2).

Table 2. Key opportunities for transitioning to a green economy in Uzbekistan

Direction	Available opportunities	Expected results
Solar energy	High solar radiation levels	Increase in electricity production
Wind energy	Great potential in Karakalpakstan and Navoi regions	Diversification of energy sources
Green investments	Funds from international financial institutions	Increased investment flow
Energy efficiency	Introduction of modern technologies	Increased resource efficiency
Green jobs	New environmental projects	Increase in employment rate

The analysis showed that the transition to a green economy can have a positive impact on the growth of the country's gross domestic product, reducing energy costs and increasing export potential. In addition, the use of renewable energy sources helps to improve the environmental situation by reducing greenhouse gas emissions. However, a number of problems were also identified during the study. One of the main obstacles is the high investment required to introduce green technologies. Many enterprises do not have sufficient financial resources to implement environmental innovations in practice (Table 3).

Table 3. The main obstacles to the transition to a green economy in Uzbekistan

Obstacles	Level of impact
Limited funding sources	High
Lack of modern technologies	High
Skilled labor shortage	Medium
Low environmental culture	Medium
Dependence on traditional energy sources	High
Insufficient development of institutional mechanisms	Medium

Also, the insufficient formation of environmental knowledge and culture in some regions hinders the widespread popularization of the principles of a green economy. It is necessary to strengthen advocacy work on the use of energy-saving technologies among enterprises and the population.

The results show that further development of cooperation between the state, private sector and international organizations is important for the successful transition to a green economy. In particular, the promotion of green investments, support for scientific and research activities and training of qualified specialists are among the priority tasks[12,13].

Based on the results of the study, it can be said that although Uzbekistan has great potential for the transition to a green economy, overcoming existing financial, technological and institutional problems is a decisive factor in the successful implementation of this process. The results of the study showed that the transition to a green economy in Uzbekistan is one of the important factors in ensuring economic development, environmental sustainability and social well-being. The country's rich solar and wind energy resources, government reforms, and opportunities for international cooperation provide a solid foundation for accelerating the green transformation.

The analysis shows that the transition to a green economy has the potential to increase energy efficiency, reduce carbon emissions, create new jobs, and enhance the competitiveness of the economy. However, limited financial resources, a lack of modern technologies, a shortage of qualified specialists, and an insufficiently developed environmental culture are the main obstacles[14,15].

Based on the research, the following proposals were developed:

1. Increase investment in renewable energy sources and expand private sector participation.
2. Develop a system of preferential loans and subsidies to finance green projects.
3. Encourage the introduction of innovative technologies aimed at increasing energy efficiency.
4. Expand the training of specialists in the areas of green economy and environmental management in higher educational institutions.
5. Increase the ecological culture of the population and promote an energy-efficient lifestyle.
6. Increase the volume of green investments by strengthening cooperation with international financial institutions.
7. Develop modern infrastructure for waste recycling and efficient use of resources.

4. Conclusion

In conclusion, the transition to a green economy in Uzbekistan is an important direction for ensuring long-term sustainable economic development, reducing environmental problems, and increasing the well-being of the population. By effectively utilizing existing opportunities and overcoming existing barriers, the country can successfully implement the principles of a green economy.

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