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GREEN ENERGY DEVELOPMENT: GLOBAL TRENDS AND THE CASE OF UZBEKISTAN

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Abstract

The transition to green energy has become a global priority due to environmental challenges, resource depletion, and the need for sustainable development. This article examines the main types of renewable energy sources, their advantages, and their implementation in Uzbekistan. Using an analytical approach, the study explores national strategies, technological advancements, and educational initiatives aimed at promoting green energy. The results indicate that Uzbekistan has significant potential in solar and wind energy, and ongoing reforms are accelerating the adoption of sustainable energy solutions. The paper concludes that integrating green energy into education and infrastructure is essential for long-term economic and environmental stability.

Keywords: green energy, renewable resources, solar power, Uzbekistan, sustainability, energy transition

1. Introduction

The rapid industrial development of the 20th and 21st centuries has significantly increased global energy demand. Traditional energy sources such as oil, gas, and coal are becoming limited and environmentally harmful. This has led to a growing interest in renewable energy sources, commonly referred to as green energy [1].

Green energy includes power generated from natural resources such as sunlight, wind, water, and biomass. These sources are replenishable and environmentally friendly. Countries around the world are investing heavily in renewable technologies to ensure energy security and reduce carbon emissions.

Uzbekistan, with its high solar radiation and favorable climatic conditions, has strong potential for developing green energy. Recent reforms and government policies have accelerated the adoption of renewable energy technologies in the country [2].

2. Methods

This study uses qualitative and analytical methods, including:

1) Review of scientific literature and international reports
2) Analysis of Uzbekistan's national energy policies
3) Comparative analysis of renewable energy types
4) Evaluation of educational initiatives in green technology

Data sources include academic publications, government reports, and international energy agency statistics.

3. Results

3.1 Types of Green Energy

The most widely used renewable energy sources include:

Solar Energy

Solar energy is generated by converting sunlight into electricity using photovoltaic panels. Uzbekistan has over 300 sunny days per year, making it highly suitable for solar power generation.

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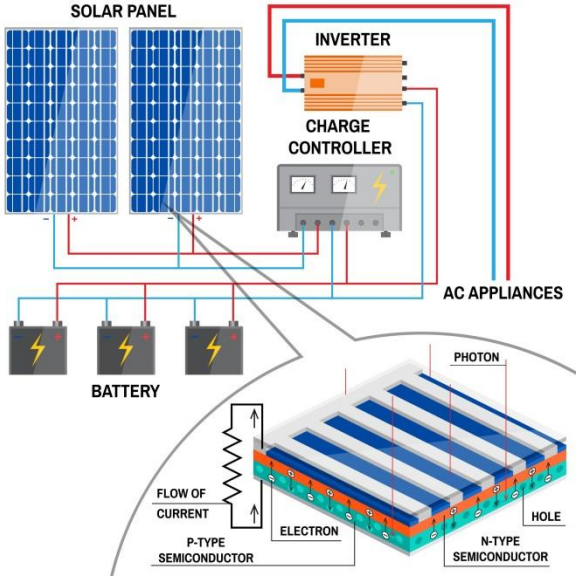

Fig 1. **Solar Energy**

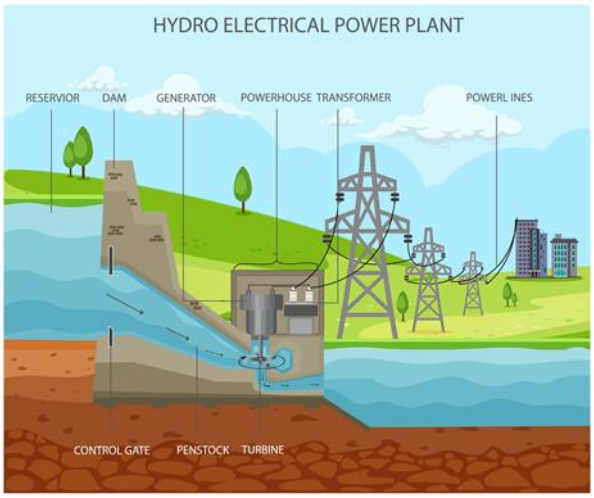

Fig 1. Wind Energy

Wind turbines convert kinetic energy into electricity. Wind energy is stable and efficient, especially in open and elevated areas.

Hydropower

Hydropower uses flowing water to generate electricity. It is one of the oldest and most cost-effective renewable sources.

Geothermal Energy

This type of energy uses heat from the Earth's interior. It is less common but highly efficient in regions with geothermal activity.

Bioenergy

Bioenergy is produced from organic materials such as agricultural waste and plants. It supports waste recycling and energy production simultaneously.

3.2 Green Energy in Uzbekistan

Uzbekistan has launched several large-scale renewable energy projects:

1. Construction of solar power plants in Navoi and Samarkand regions
2. Development of wind farms in Karakalpakstan
3. Government incentives for private sector investment

Additionally, educational institutions and technoparks are introducing green energy topics to students, helping to build future expertise in this field.

4. Discussion

The transition to green energy offers multiple advantages:

A. **Environmental Protection:** Reduces greenhouse gas emissions
B. **Sustainability:** Renewable resources are inexhaustible
C. **Energy Independence:** Reduces reliance on imported fuels
D. **Economic Growth:** Creates new jobs and industries

However, challenges remain, including high initial costs, technological limitations, and the need for skilled professionals. In Uzbekistan, addressing these challenges requires continued investment in education and innovation.

Environmental Benefits of Renewable Energy in Uzbekistan

Indicator	Value
Natural gas saved (2025)	2.1 billion m³
CO_2 emissions reduced	~2.9 million tons
Early 2026 gas savings	400 million m³
Avoided emissions (2026)	~863,000 tons

Renewable Energy Infrastructure in Uzbekistan

Year	Solar Plants	Wind Plants	Total Capacity (MW)
2022	2	0	Initial stage
2024	9	1	Rapid expansion
2025	12	4–5	~4,500+ MW
2026	15	5	~5,500+ MW

Renewable Energy Potential in Uzbekistan

Energy Type	Technical Potential
Solar	Extremely high (dominant)
Wind	Moderate
Hydropower	Limited but stable
Geothermal	Low utilization

5. Conclusion

Green energy is essential for sustainable development and environmental protection. Uzbekistan has significant potential to become a leader in renewable energy in Central Asia. By integrating green technologies into education, infrastructure, and industry, the country can ensure long-term energy security and economic growth.

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