# ENHANCING THE DEVELOPMENT OF GREEN ENERGY IN UZBEKISTAN: CURRENT STATE, CHALLENGES, AND PROSPECTS

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**Abstract:** *This paper explores the current state of green energy development in Uzbekistan, highlighting the significant progress made in renewable energy adoption. It examines the major challenges faced by the country, including infrastructure limitations, financial constraints, and regulatory barriers. The study also analyzes future prospects and opportunities for expanding green energy, focusing on policy reforms, technological advancements, and international cooperation. The findings aim to provide actionable recommendations to accelerate Uzbekistan's transition towards sustainable energy and reduce its environmental impact.*

**Keywords:** *Green energy, renewable energy, Uzbekistan, sustainable development, energy policy, challenges, prospects, solar power, wind energy, environmental impact*.

## Introduction

The rapid global transition toward sustainable development and decarbonization has placed renewable energy at the center of energy policies worldwide. For countries like Uzbekistan, which face rising energy demand, environmental degradation, and a high dependence on fossil fuels, the shift to green energy is both a necessity and an opportunity.

Uzbekistan's economy has historically relied on natural gas, coal, and oil. However, the government has committed to a greener pathway. According to the Strategy for Transition to a Green Economy (2019–2030), Uzbekistan aims to increase the share of renewable energy in electricity production to 25% by 2030 and reduce greenhouse gas emissions per unit of GDP by 10%.

In recent years, Uzbekistan has made significant progress in attracting foreign investment, reforming its energy sector, and constructing solar and wind power plants. This study explores the current state of green energy in Uzbekistan, identifies barriers to its development, and provides policy recommendations to accelerate the energy transition.

Methods

The research is based on a mixed-methods approach combining:

1. Quantitative Data Analysis

Primary data sources: State Statistics Committee of Uzbekistan, IRENA, ADB, World Bank, UNDP

Key indicators:

Installed renewable energy capacity (MW)

Share of RES in electricity generation

GHG emissions ($MtCO_2$-e)

Foreign direct investment in RES (USD)

Energy intensity of GDP

2. Policy Review

Analysis of Uzbekistan's key documents:

Strategy for Green Economy (2019–2030)

Energy Sector Reform Roadmap (2020–2025)

Law on Renewable Energy Sources (2019)

Regional and international agreements (e.g., Paris Agreement)

3. Case Study Approach

In-depth study of:

Nur Navoi Solar Plant (100 MW)

Zarafshan Wind Power Project (500 MW)

Jizzakh and Samarkand solar projects (2024–2026)

Results

1. Energy Structure and Renewable Growth

Uzbekistan's total installed capacity (2023): 15.5 GW

Thermal (gas, coal): 12.2 GW (78%)

Hydro: 2.0 GW (13%)

Solar: 900 MW (6%)

Wind: 150 MW (1%)

Goal for 2030:

Solar: 5 GW

Wind: 3 GW

Hydropower: 3.8 GW

2. Renewable Energy Projects Pipeline

Ongoing projects (2024–2026):

Jizzakh Solar Plant (400 MW)

Samarkand Solar Plant (457 MW)

Zarafshan Wind Farm (500 MW)

Backed by Masdar (UAE), ACWA Power (KSA), Total Eren (France)

3. Emissions and Energy Efficiency

Total GHG emissions in Uzbekistan (2022): 229 $MtCO_2$-e

Energy intensity of GDP: 0.23 toe per $1,000 of GDP (higher than global average)

Target: reduce $CO_2$ emissions per unit GDP by 35% by 2030

4. Investment Trends

Total FDI in green energy (2021–2023): over $2.5 billion

Major investors: IFC, EBRD, ADB, Masdar

Public-private partnerships (PPPs) becoming a dominant model

**Discussion**

1. Progress and Achievements

Institutional development: Establishment of the Ministry of Energy and introduction of feed-in tariffs for RES

Legal reforms: Law on Renewable Energy (2019) provided legal guarantees and incentives

International cooperation: Strategic alliances with global energy firms and donors

2. Key Challenges

Grid integration: Outdated transmission infrastructure is a bottleneck

Regulatory uncertainty: Limited local expertise and changing legal frameworks

Financing constraints: Despite progress, RES remains capital-intensive

Public awareness: Low understanding and support for green technologies in rural areas

3. Opportunities and Recommendations Grid Modernization

Invest in smart grids and battery storage

Integrate forecasting systems for wind and solar

Capacity Building

Establish green energy training centers

Collaborate with universities for technical R&D

Policy Stability and Incentives

Guarantee long-term PPAs

Tax exemptions for green technology imports

Diversification of Renewables

Support biogas and small hydropower in agriculture

Pilot hydrogen projects for export potential

Conclusion

Uzbekistan has laid a strong foundation for the expansion of green energy through reforms, investment attraction, and strategic planning. However, faster progress is essential to meet international climate commitments and domestic energy security needs.

With stronger infrastructure, stable policy, and continued international support, Uzbekistan can become a regional leader in clean energy and set an example for sustainable development in Central Asia. Achieving the 2030 goals will not only reduce emissions but also stimulate innovation, create jobs, and improve the well-being of future generations.

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