



CURRENT STATE AND DEVELOPMENT PROSPECTS OF WIND ENERGY UTILIZATION IN UZBEKISTAN

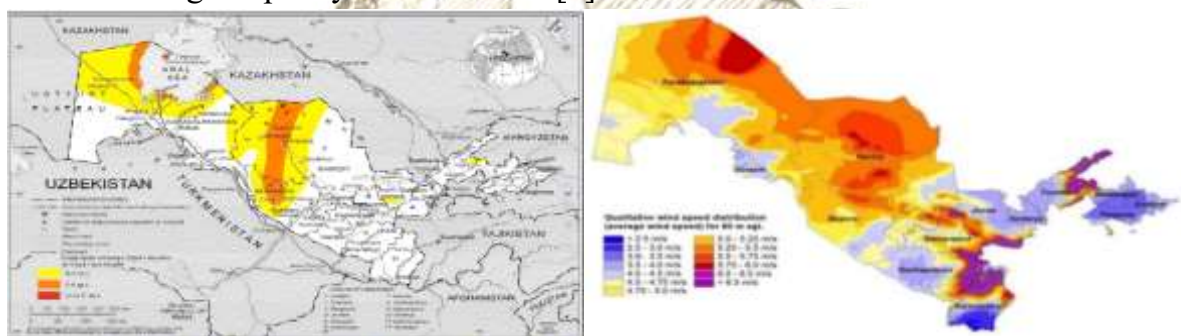
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Renewable energy sources, particularly wind energy, are playing an increasingly critical role globally in enhancing energy security, mitigating environmental issues, and conserving fossil fuel reserves. Currently, China, India, and European countries lead the world in the development and deployment of wind power installations. China ranks first globally, manufacturing onshore wind power capacities of approximately 82 GW per year. European nations collectively hold the second position with an annual production capacity of 21.6 GW, followed by the United States (13.6 GW), India (11.5 GW), and Latin America (6.2 GW) [1].

Until recently, the gross (theoretical) potential of wind energy resources in our republic was estimated at 2.2 million toe (tonnes of oil equivalent). However, this estimate did not fully account for the local wind energy potential in specific regions such as Navoi, Ustyurt, Bukhara, and Bekabad. Furthermore, this assessment was based on data from widely dispersed actinometric stations measured at heights of only 5–8 meters, whereas realistic technical assessments require measurements at hub heights of 25–100 meters. In 2015, a comprehensive study was conducted in collaboration with the German companies "Intec-Gopa" and "GEONET" alongside JSC "Uzbekenergo" to assess the potential of wind energy resources and develop a wind atlas of Uzbekistan.

Using 3D modeling techniques, the German specialists developed a detailed wind atlas of the region (Figure 1). Consequently, Karakalpakstan, Navoi, Bukhara, Tashkent, Kashkadarya, and Samarkand regions were identified as the most promising areas for the installation of high-capacity wind turbines [2].





MODERN PROBLEMS IN EDUCATION AND THEIR SCIENTIFIC SOLUTIONS

On January 28, 2022, the Decree of the President of the Republic of Uzbekistan "On the Development Strategy of New Uzbekistan for 2022–2026" was adopted. Under this strategy, the construction of eight wind power plants with a total installed capacity of 4,000 MW is planned. Specifically, the commissioning of four wind power plants totaling 1,600 MW in the Republic of Karakalpakstan, Bukhara, and Navoi regions was scheduled for 2023–2024, followed by another four wind power plants totaling 2,400 MW across the country during 2025–2026 [4].

Within the framework of a project by Masdar (United Arab Emirates) to construct a 500 MW wind farm in the Tomdi district of the Navoi region, the first turbine supplied by Goldwind (China) was erected. It is reported that the turbine has a generating capacity of 4.7 MW, a hub height of 97 meters, and a blade length of 77 meters. Figure 2 illustrates the wind power installations deployed in the Navoi (a) and Bukhara (b) regions.

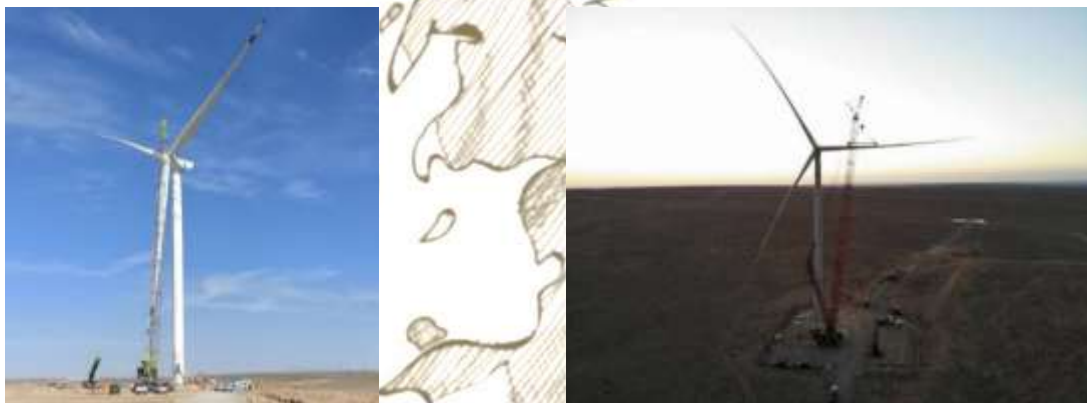


Figure 2. Wind power plants in Navoi (a) and Bukhara (b) regions.

Under this major project, a total of 111 wind turbines are scheduled for installation. The initial generating capacities of the wind farm were slated to come online by the end of 2023, making it the largest installation of its kind in Central Asia. Once fully operational, the plant will generate 1.8 billion kWh of electricity annually. Consequently, this will enable savings of 540 million cubic meters of natural gas per year and prevent the emission of 720,000 tonnes of greenhouse gases into the atmosphere.

In the Peshku and Gijduvon districts of Bukhara region, the engineering design and construction of wind power plants, each valued at \$650 million, have commenced. To date, implementation work has begun across 154 hectares allocated in Peshku and 172 hectares in Gijduvon for turbine mast installations, the construction of two electrical substations in each district, and the erection of 500 kV overhead transmission lines spanning a total distance of 291 kilometers. Table 1 provides the targeted project pipeline for the construction of wind power plants in Uzbekistan.





Table 1.

Targeted pipeline of wind power plant construction projects in Uzbekistan

Plant Location	Investors	Commissioning Timeline (year, month)	Project Value (USD million)	Plant Capacity (MW)	Annual Generation Output (million kWh)
Tomdi district WPP, Navoi region	Masdar, UAE	2023–2025	600	500	1,825
Peshku district WPP, Bukhara region	ACWA Power, Saudi Arabia	2024–2025	600	500	1,800
Gijduvon district WPP, Bukhara region	ACWA Power, Saudi Arabia	2024–2025	600	500	1,800
Karauzyak district WPP, Republic of Karakalpakstan	ACWA Power, Saudi Arabia	2024–2025	107	100	350

Based on the analytical data presented above, it is possible to enhance energy security and mitigate environmental concerns in Uzbekistan by constructing high-capacity wind power plants in regions with high wind potential, as well as deploying small-scale wind energy installations for off-grid (autonomous) consumers.

REFERENCES

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3. R. A. Zakhidov and M. V. Kremkov, "The wind power potential of Uzbekistan," Applied Solar Energy, vol. 51, pp. 336–337, 2015.
4. Resolutions of the President of the Republic of Uzbekistan No. PP-4933 dated December 22, 2020; No. PP-5003 dated February 23, 2021; and No. PP-169 dated March 18, 2022.

