

## Renewable Energy in Uzbekistan

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**Abstract:** Renewable energy is derived from natural processes that are replenished constantly. Included in the definition is electricity and heat generated from solar, wind, ocean, hydropower, biomass, geothermal resources, and biofuels and hydrogen derived from renewable resources. The article discusses the sources of renewable energy in Uzbekistan.

**Keywords:** renewable energy, Uzbekistan, natural process, electricity, solar, wind, ocean, biomass, hydropower.

The development of renewable energy (RE) in Uzbekistan (solar energy, wind and biogas, hydropower small natural and artificial watercourses) and energy efficiency are a subject of long-standing concern of society. In the long term, the use of renewable energy sources for the development of Uzbekistan is obvious and necessary to ensure energy, environmental and economic security, as well as to ensure the sustainable development of the energy sector of the country and the preservation of natural resources for future generations, improving the environment.

Over the past 15 years, renewable energy technologies have been actively developed in many countries of the world and have achieved technical and economic indicators showing their competitiveness with traditional technologies for the production of heat and electric energy based on the use of fossil fuels and nuclear energy. At present, with the total installed capacity of all power plants in the world around 5,000 GW, the capacity of existing power plants in the world using renewable energy technologies, excluding large hydropower stations, approached 1,000 GW and exceeded the capacity of all nuclear power plants (about 350 GW)

by 3 times. Investments in renewable energy in recent years amounted to at least \$ 250 billion a year, which is 3 times more than in traditional energy and 5 times more than in nuclear and large hydropower. Since 2013, the annual commissioning of renewable energy in the world significantly exceeds the input of traditional power plants. The practical development of renewable energy is uneven across regions of the world. Its most rapid development takes place in countries heavily dependent on energy imports and having high energy tariffs. At the same time, even the fact that renewable energy in the foreseeable future will take a significant place in the energy of all countries, including those still rich in fossil fuel reserves. In this regard, support for research and development of promising technologies for the practical use of renewable energy sources is an urgent task for all countries concerned with the development of national scientific and technical competences in this promising area and the prevention of full technological dependence on the import of technologies and equipment in the future.

At the present stage of the development of the Russian economy, the use of renewable energy is important both for ensuring energy security and for improving the social conditions of the population and areas remote from centralized power lines. At the same time, the possibility of preserving hydrocarbon fuel reserves for future generations and mitigating the ecological situation is of no small importance. The main components of renewable energy sources in Uzbekistan are: solar, hydraulic, wind and geothermal energy, as well as biomass energy. According to the results of research carried out by Uzbek scientists, the technical potential of renewable energy sources in Uzbekistan is 270

million tons of reference fuel, which is more than three times the annual need for energy resources.

Along with the energy of solar radiation, the most studied and technologically prepared for development in the country are hydropower resources. At this stage, the capacity of all operating hydropower plants in Uzbekistan is 1,700 MW with an annual average of many years of electricity generation of about 6 billion kWh, i.e. 12% of electricity generated by all power plants in the country. Further development of hydropower in Uzbekistan will be carried out by realizing the potential of small rivers, irrigation canals, reservoirs and watercourses, on which it is possible to build about 150 small and micro hydro power plants with an installed capacity of more than 1,700 MW with electricity generation up to 8 billion kWh per year. As can be seen, with the implementation of the technical potential of these small and micro hydropower plants in the republic, the total annual electric power generation by all hydropower plants can be increased to 14-15 billion kWh.

Along with solar and hydraulic energy, on a part of the territory of the Republic of Uzbekistan with an area of 100 thousand sq.km. (the territory in the Aral Sea areas, the Ustyurt plateau, Navoi, Bukhara and other regions) there are wind flows, the magnitudes and structures of which provide the possibility of wind energy use of their energy with the help of modern serial wind-driven units. The region between Bekabad and Kokand, where winds prevail with a speed of more than 6 m/s with 42% frequency in a year where 400 wind power plants can be located, is considered promising for the production of electric energy on an industrial scale. The total capacity of 240 MW, with an annual output of more than 800 million kWh of electricity. The feasibility and feasibility of using wind and solar energy to generate electrical energy have been proven by the practical operation of a pilot combined wind-solar power system with a 3 kW wind power plant and a 5 kW solar photovoltaic plant, created to perfect the power supply of a television broadcasting station in Charvak village of the Tashkent region in the framework of the Inco-Copernicus project of the

European Union. Installed industrial wind turbine - 750 KW, output 1.3 million KW/h.

Geothermal waters are available in all regions of Uzbekistan. Perennial surveys made it possible to identify 8 large basins with hydrothermal resources on its territory. The gross potential of geothermal waters is estimated at 171 thousand toe. However, the technical potential of geothermal sources has not yet been determined. Fergana valley and Bukhara provinces have the greatest potential of geothermal waters. The average temperature of geothermal waters in the country is 45.5 ° C, the warmest waters in the Bukhara (56 ° C) and Syrdarya (50 ° C) regions. It should be noted that the practical implementation of the energy of geothermal waters is associated with the development of appropriate environmental protection measures, due to their chemical composition. The country also revealed petrothermal energy in the form of dry rocks with a temperature of 45 to 300 ° C. Realization of the potential of petrothermal energy (heat of dry rocks, granitoids) can be carried out with the help of power plants at low-boiling working fluids with a capacity of 40 MW unit based on the Chust-Adrasman petrothermal anomaly in the Fergana Valley.

The prerequisites for the use of agricultural waste in Uzbekistan as biomass are small. Vegetable waste (wheat and rice straw, stalks and tops of vegetable crops, alcohol bard) are used by local people to feed livestock or fuel. Livestock and poultry waste go to fertilizer, harvesting local fuels. One of the possible options for biogas production is the use of "guzapaya". The technical potential of this type of biomass is estimated from 0.1 to 0.3 million toe. Private entrepreneurs developed a technology for producing fuel briquettes from guzapai, which are not inferior in calorific value to Angren coal. Potential sources for biogas can be solid household waste and activated sludge from municipal wastewater treatment plants. The results of the estimates show that it is economically advantageous to use 2.2 million tons of household waste (garbage) in the republic, whose calorific value is 6.3-10.5 MJ / kg (1.75-2.92 KWh / kg). The total amount of activated sludge generated annually in aeration

stations is more than 1 million tons. The resulting biogas can be used to produce heat and electricity at aeration stations, and recycled sludge as a biological fertilizer. Western investors (Germany, Switzerland) are showing interest in setting up biogas production in Uzbekistan. However, for its practical implementation, a deeper study of the issues of availability of raw materials and adaptation of existing technologies for biogas production to local conditions is necessary.

Main motives for RE development:

- The electricity consumption of the country in 2025 will be increased by about 2 times against the year of 2015 and will amount to over 117 billion kWh;
- Oil and natural gas comprise 97% of the country's energy balance;
- Primary energy shares consist of 86.3% gas, 1.9% hydro, 2.5% coal, and 9.3% crude oil;
- The national electrification rate is 94.4%, but electrical supply to rural areas is unreliable and of low quality;
- Potential of solar, wind and hydro energy at over 1126 billion kWh;
- Fossil fuel resources are decreasing.

The singularly important role energy plays in human lives, and in society as a whole, has made it possible to increase many times over the possibilities for satisfying various human and social needs. The progress of human civilization has always been closely associated with the amount and types of energy utilized.

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