JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205

Volume 15 Issue 06, June 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

POWER PLANTS AND THEIR OPERATING PRINCIPLES

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Annotation: This article discusses power plants, their operating principles, structure, types of functions, and their importance today**.**
Key words: Power station, generator, rotor, steam turbine, hydroelectric station, water supply, water flow, arc, gravity, hydro transformer, photo transformer, EDS (ultra-high frequency), autotransformer, welding transformers, measuring transformers, single-phase and three-phase power transformers, etc.

Introduction. Today, there are huge changes in every sphere and direction. The demand for electricity is also very high. The production of electricity does not happen by itself. The production of electricity comes at the expense of large sums of money. The production of electricity is carried out using various devices. Power plants are the main devices that produce electricity. The energy sector of Uzbekistan is the main sector of the national economy and is a solid foundation for the economic and technical development of the republic. In 1913, the capacity of all power plants in Uzbekistan was 3 thousand kW, and 3.3 million kWh of electricity were produced per year. The development of energy in the republic began with the construction of the Bozsuv HPP near Tashkent. This station with a capacity of 2 thousand kW was commissioned in May 1926. At the same time, a 6-kW cable network with 39 transformer stations (points) with a length of 34 km was built, connecting the Bozsuv HPP with a diesel power plant supplying electricity to the Tashkent tram. Thus, the foundation for the creation of the energy system of Uzbekistan was laid. The construction of power plants on the Chirchik-Bozsuv tract continued at a rapid pace, and from 1926 to 1940, 67 thousand kW of power was commissioned in this direction. In 1940, the installed capacity of power plants in Uzbekistan was 170.5 thousand kW, and the production of electricity reached 482 million kWh. Of this, 200 million kWh was generated at hydraulic power plants. In 1940, electricity production in the republic was 72.5 kWh per capita, but by 2000 this figure had exceeded 350 kWh. The energy system of Uzbekistan has the capacity to produce about 60 billion kWh of electricity per year, and 42 thermal and hydraulic power plants with a total installed capacity of 12.3 million kW are operating in it. The total length of all voltage power networks in the energy system of Uzbekistan is more than 235 thousand km, including 220 kV lines - 5.5 thousand km, 500 kV lines - 1.7 thousand km. The total capacity of network transformers is more than 42 thousand MVA. The share of thermal power plants in the installed capacity of the energy system of Uzbekistan is 87 percent. The Fergana Thermal Power Plant (TPP) has a capacity of 330 thousand kW, Mubarak 1PPP has a capacity of 60 thousand kW, and Tashkent TPP has a capacity of 30 thousand kW. The largest thermal power plants of the republic's energy system are the Syrdarya TPP with a capacity of 3120 MW, Navoi TPP with a capacity of 1250 MW, Tashkent TPP with a capacity of 1920 MW, and Takhiyatosh TPP with a capacity of 730 MW. More than 30 modern power units with a capacity of 150 MW to 300 MW each have been installed on them. Currently, the largest in Central Asia, the Ta`limarjon TPP with a design capacity of 3200 MW (4 units of 800 MW

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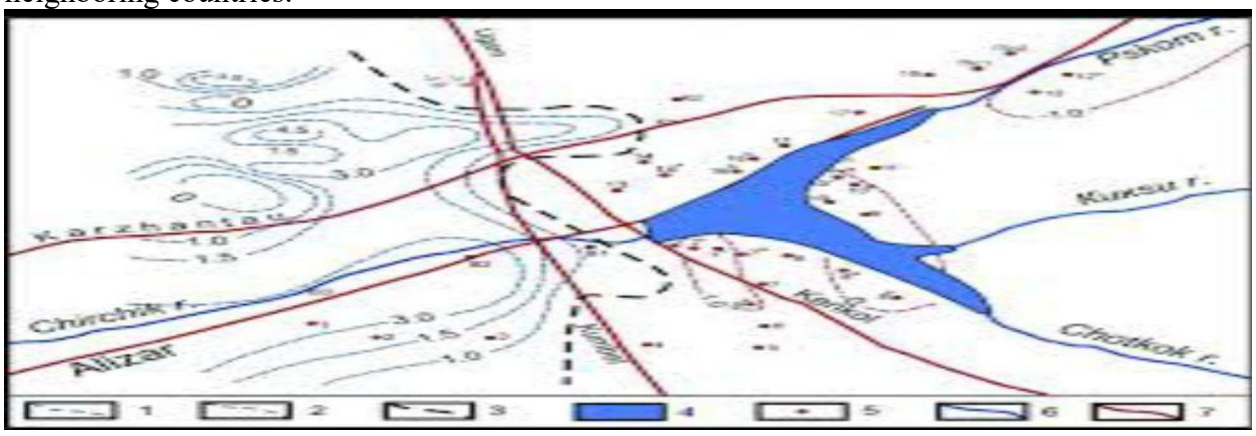
each), has been built, and its first unit was commissioned in 2005. The largest hydroelectric power plants are Charvak HPP (620 MW), Khojakent HPP (165 MW), Farhod HPP, Ghazalkent HPP (120 MW). The future development of hydropower is based on the construction of a series of HPPs with a total capacity of 1250 MW, including the Pskom HPP with a capacity of 450 MW, and the use of small watercourses. In 14 major cities of the republic, consumers are centrally supplied with thermal energy. The total installed capacity of water heating boilers is more than 250 thousand KJ. The length of two-pipe heating networks under the Ministry of Energy and Electrification alone is more than 550 km. The energy sector of Uzbekistan now fully meets the energy needs of the republic's national economy, and exports electricity to neighboring countries.



Location of Charvak HPP. Today, 69 large and small HPPs are operating in Uzbekistan. Newly built HPPs are mainly micro-HPPs, 13 of which are under construction. The construction of micro hydroelectric power plants began for the first time in Andijan. One of such micro hydroelectric power plants, a new wheel-type micro hydroelectric power plant, was also commissioned at a new capacity at the eighty-fifth station of the Ulugnor Canal in the Altinkul district of Andijan region. This micro hydroelectric power plant, with a capacity of 50 kW and an annual production capacity of 360 thousand kWh, is capable of providing 150 households with uninterrupted electricity. It is important that the design, construction and installation of equipment within the project were completed in a relatively short period of time, that is, in 2 months. One of such micro-hydroelectric power plants, which will provide 300 households or 1,200 residents of Andijan district with an environmentally friendly source of electricity in the future, was launched on the first picket of the Zavrok mahalla canal of Andijan district, the Zavrok micro-hydroelectric power plant with a capacity of 200 kW and an annual production capacity of 1.2 million kWh. The project's economic payback period is 4.4 years. The total cost of the project is 3.4 billion soums, including 1.9 billion soums for equipment, 1.5 billion soums for construction and installation works, of which 220 million soums were the costs of transmitting power to the network. It is noteworthy that the design documentation for this project was developed by Gidroproyekt JSC, part of Uzbekgidroenergo JSC, within 10 days, while the project units were manufactured by Suvsanoatmash JSC, together with Chinese partners, on the basis of industrial cooperation, and delivered to the project site in a short period of 1 month. It should be noted that, according to the initial list identified in the Andijan region alone, it is

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planned to build a total of 52 micro hydropower plants with a total capacity of 19 MW. Of these, this year, it is planned to launch 7 renewable energy sources with a total capacity of 2,130 kW, in particular, 3 micro hydropower plants operating under water pressure, 2 floating kinetic hydropower units, and 2 windmill-type projects. Most importantly, the implementation of these projects will provide the local area with uninterrupted electricity supply, as well as create about 40 new jobs on a permanent basis. Construction and installation works were carried out by a local contractor determined through tenders in 45 days. In addition, in 2023-2024, it is planned to implement the project "Construction of JFK-3 HPP on the South Fergana Canal" in Andijan region with a capacity of 6.9 MW and an average annual energy production capacity of 33.0 million kWh. The launch of this project will allow in the future to provide 14 thousand households in the Bulokbashi district of Andijan region with an environmentally friendly source of energy. The agreement between "Uzbekgidroenergo" JSC and the Indian company "MAKLEK" is intended to produce and widely implement innovative hydropower units with kinetic turbines floating on the water surface in Uzbekistan under the "Made in Uzbekistan" brand. These innovative hydropower units will be introduced for the first time in the republic in July 2023, in Shahrikhonsoy, the city of Khanabad, Andijan region, and 2 units with a total capacity of 800 kW will be installed.

The country's electricity generation has increased by 38%, from 59 billion kWh in 2016 to 81.5 billion kWh in 2024. At the same time, per capita electricity generation has increased by 18%, reaching 2,200 kWh. Over the past seven years, 11,000 MW of new generation capacity has been commissioned, which is three times more than the energy volume in the previous 25 years.

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In the Republic of Uzbekistan, during January–September of 2024, large hydroelectric power stations produced 6,410.9 million kWh of electricity.

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