

## PRINCIPLE OF OPERATION AND EFFICIENCY OF THE VARGANZA-2 PUMPING STATION

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**Abstract:** This article analyzes general information about the Varganza-2 pumping station, the principle of operation of the pumping station, technical characteristics and efficiency indicators. The role of the pumping station in the water supply and irrigation system of Kitab district, as well as proposals for improving its energy efficiency, are considered.

**Key words:** Pump station, Varganza-2, pump unit, pump type, pressure pipe, push pipe, principle of operation, energy efficiency, irrigation, water supply, technical service.

**Абстрактный.** В данной статье проанализированы общие сведения о насосной станции «Варганза-2», принцип работы насосной станции, технические характеристики и показатели эффективности. Рассмотрена роль насосной станции в системе водоснабжения и орошения Китабского района, а также предложения по повышению ее энергоэффективности.

**Ключевые слова.** Насосная станция, Варганза-2, насосный агрегат, тип насоса, напорный трубопровод, напорный трубопровод, принцип работы, энергоэффективность, орошение, водоснабжение, техническое обслуживание.

**Annotatsiya.** Mazkur maqolada Varganza-2 nasos stansiyasi haqida umumiy ma'lumotlar, nasos stansiyaning ishlash prinsipi, texnik xususiyatlari va samaradorlik ko'rsatkichlari tahlil qilinadi. Nasos stansiyasining Kitab tumanidagi suv ta'minoti va irrigatsiya tizimidagi roli, shuningdek, uning energiya samaradorligini oshirish bo'yicha takliflar ko'rib chiqiladi.

**Kalit so'zlar.** Nasos stansiyasi, Varganza-2, nasos agregati, nasos rusumi, bosim quvur, suruvchi quvur, ishlash prinsipi, energiya samaradorligi, irrigatsiya, suv ta'minoti, texnik xizmat ko'rsatish.

**Introduction.** The President of the Republic of Uzbekistan, Shavkat Mirziyoyev, declared the year 2025 as the "Year to Improve Pump Efficiency" in the water management sector. This decision is an important initiative aimed at improving energy efficiency in the management and use of water resources in our country. In Uzbekistan, 2.5 million hectares of land are being irrigated, with more than 1,600 pump stations consuming 6.8 billion kilowatt-hours of electricity annually. Unfortunately, 94% of these pump stations have exceeded their normative service life, meaning they have been in use for more than 10 years. This leads to a reduction in their efficiency and results in excessive energy consumption.

Under the initiative put forward by our President, the following measures are planned to be implemented:

**Modernization of pump stations:** Reducing electricity consumption by replacing outdated equipment with modern, energy-efficient models.

**Utilization of solar energy:** Diversifying the energy supply of pump stations through the installation of solar panels based on private partnerships and using environmentally friendly energy sources.

**Construction of small hydropower plants:** Accelerating water flow by concreting canals and constructing small hydroelectric stations, which would generate additional electricity.

If these initiatives are implemented, an additional 600 million kilowatt-hours of electricity could be generated annually. This would not only help save energy resources but also positively impact

environmental protection. One of the pump stations of significant importance for our country is the Varganza-2 pump station.

Varganza-2 Pump Station is one of the large hydraulic structures located in the Kitob district of the Kashkadarya region, Uzbekistan. It mainly serves water supply and irrigation systems. This pump station is particularly significant as part of large irrigation systems and plays a key role in providing water to agriculture in the region. The Varganza-2 pump station, which was commissioned in 1991, is designed to lift water to irrigate 360 hectares of land. The water source for the station is the left bank of the Kashkadarya River. The station is equipped with 8 pump units: 4 SN 180-170 and 4 200 D-90 pumps. These pump units are powered by 5AM355MB6eY3 and AHP-315-S6 motors.

The station is primarily used during the spring and summer months and consumes an average of 398,000 kWh of electricity annually. Water supply through the Varganza-2 pump station is crucial for agriculture, especially for managing irrigation systems. This is also essential for the efficient organization of agricultural production in the region. The station plays a significant role in Uzbekistan's comprehensive programs aimed at water resource management, improving energy efficiency, and conserving water in agriculture.

Water enters the Varganza-2 pump station from the left bank of the Kashkadarya River through intake chambers. The water is then distributed to 300 hectares of land through 8 pump units (4 SN 180-170 and 4 200 D-90). This process takes place through pressure pipelines and canals. Pressure pipelines carry the water to the canals, which then deliver it to the fields. The pressure pipelines have a diameter of 430 mm and a length of 450 meters. The pump station lifts water to a height of 89.9 meters using these pipelines.

The Varganza-2 pump station mainly serves the Varganza neighborhood, which spans 360 hectares of land. Several agricultural enterprises operate in the area. The annual water delivery limit for the Varganza-2 station is set at 2,441,000 cubic meters, with 2,570,000 cubic meters delivered in 2022, 2,984,000 cubic meters in 2023, and 3,310,000 cubic meters in 2024. If we look at the activities carried out over the last two years, no major construction, reconstruction, repair, or restoration work has been done; only funds have been spent on the operation and maintenance costs of the pump station. In 2023, 522.6 million UZS and in 2024, 753.7 million UZS were spent on the station's operation costs.

To improve the efficiency of the Varganza-2 pump station, several key measures need to be taken. First, to improve energy efficiency, modern energy-efficient pump units should be installed. New pumps use less power, operate with high efficiency, and have a longer service life. Additionally, the implementation of automated control systems is important. The ability to remotely control and monitor the station will help optimize the operation of the pumps, detect faults early, and simplify the maintenance process.

The efficiency of the pump station is directly related to the pipeline system. Outdated pipelines and water losses in them reduce the overall efficiency of the system. Therefore, modernizing the pressure pipelines, installing high-quality materials, and addressing faults in a timely manner are essential.

Technical maintenance also directly affects efficiency. Regular diagnostics and preventative maintenance ensure the long-term effective operation of the pumps. The lubrication system of the pumps and motors, as well as the condition of the rotor and bearings, should be constantly monitored.

Moreover, using hybrid energy sources (such as combining solar panels or wind turbines) will help save electricity and increase the system's independence.

By implementing the above measures, the efficiency of the Varganza-2 pump station's water supply and irrigation systems can be significantly improved.

### **Conclusion**

The Varganza-2 pump station plays a crucial role in the water supply and irrigation systems of the Kitob district. However, its efficiency is limited due to manual management by operators and lack of automation. To improve efficiency, it is necessary to install modern pumps, implement automation, modernize the pipeline system, and enhance technical maintenance. These changes will increase the station's energy efficiency and operational sustainability, improving water delivery quality. If additional technological upgrades are made in the future, the Varganza-2 pump station could become one of the most advanced facilities in Uzbekistan's water supply system.

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