

ANDIJAN HYDROELECTRIC POWER PLANT AND ITS OPERATIONS

Teshaboyev Rivojiddin Ibrohimjon o'g'li

Assistant, Energy Efficiency

Andijan State Technical Institute, Republic of Uzbekistan.

ORCID ID: 0009-0004-4541-4132

Abstract

This article examines the history, technical characteristics, and significance of the Andijan Hydroelectric Power Plant (HPP) in the power system of Uzbekistan. It describes the main stages of the plant's construction, its installed capacity, and electricity generation performance. The study also analyzes the important role of the Andijan HPP in supplying electricity to the Fergana Valley. Furthermore, the environmental and economic advantages of hydropower as a clean and renewable energy source are highlighted.

Keywords:

Andijan Hydroelectric Power Plant, hydropower, hydroelectric station, Andijan Reservoir, hydro unit, electric power generation, installed capacity, Fergana Valley, power system, renewable energy.

Introduction

Hydropower is one of the most important renewable energy sources in the world because it provides clean, reliable, and sustainable electricity. The efficient use of water resources plays a significant role in ensuring energy security, reducing greenhouse gas emissions, and supporting economic development. As the demand for electricity continues to increase, hydropower plants remain an essential component of modern power systems.

The Andijan Hydroelectric Power Plant (HPP) is one of the major hydropower facilities in the Republic of Uzbekistan. Located at the Andijan Reservoir, the plant contributes significantly to the electricity supply of the Fergana Valley and supports the stability of the national power system. Since its commissioning, the station has generated a considerable amount of electrical energy while utilizing renewable water resources in an environmentally friendly manner.

This paper presents an overview of the Andijan Hydroelectric Power Plant, including its historical development, technical characteristics, installed capacity, and electricity generation performance. In addition, the study discusses the plant's

contribution to regional energy supply and highlights the importance of hydropower as a clean and sustainable source of electrical energy.

Literature Review

Hydropower is recognized as one of the most reliable and environmentally friendly renewable energy sources. Many researchers have emphasized that hydroelectric power plants contribute significantly to sustainable energy development by producing electricity with low greenhouse gas emissions and high operational efficiency. Compared with conventional thermal power plants, hydropower facilities have lower environmental impacts and provide long service life with relatively low operating costs.

In Uzbekistan, the development of hydropower has become an important part of the national energy strategy. Several studies have examined the modernization of existing hydroelectric power plants, improvement of turbine efficiency, optimization of water resource management, and enhancement of electricity generation capacity. Researchers have also highlighted the role of hydroelectric stations in ensuring the stable operation of the national power grid and supporting regional economic development.

Previous studies indicate that the Andijan Hydroelectric Power Plant is one of the strategically important hydroelectric facilities in the country. The station is located at the Andijan Reservoir and plays a key role in supplying electricity to the Fergana Valley. Historical sources describe the planning and construction of the project, while technical publications provide information about its installed capacity, hydroelectric units, and annual electricity generation. These studies demonstrate that the plant has contributed substantially to the reliable supply of electrical energy since its commissioning.

A number of scientific publications have also focused on the operational efficiency of hydroelectric power plants. These studies investigate the influence of hydraulic conditions, equipment reliability, maintenance strategies, and modernization programs on electricity production. The findings suggest that regular technical upgrades and effective operation of hydroelectric units can significantly

improve energy efficiency, increase generating capacity, and extend the service life of the equipment.

Recent literature further emphasizes the importance of renewable energy integration into modern power systems. Hydroelectric power plants not only generate clean electricity but also improve power system stability by providing flexible generation and supporting peak-load regulation. As electricity demand continues to increase, the modernization and efficient operation of existing hydropower plants remain essential for strengthening national energy security and achieving sustainable development goals.

Based on the reviewed literature, it can be concluded that the Andijan Hydroelectric Power Plant represents a valuable example of hydropower development in Uzbekistan. However, despite the availability of general information regarding its history and technical characteristics, further analysis of its operational performance and contribution to the regional electricity supply remains necessary. Therefore, this study aims to summarize the historical background, technical features, and operational significance of the Andijan Hydroelectric Power Plant within the power system of Uzbekistan.

References Analysis

The reviewed literature indicates that hydropower plays a significant role in the sustainable development of the energy sector by providing clean, renewable, and reliable electricity. Previous studies have focused on improving the operational efficiency of hydroelectric power plants, optimizing water resource utilization, and increasing the reliability of electrical power systems. These investigations demonstrate that modernization of hydropower facilities contributes to higher energy efficiency, reduced operating costs, and enhanced power system stability.

Several researchers have examined the application of energy-efficient technologies in electrical engineering and hydropower systems. A'zamov (2025) investigated the continuous water supply of irrigation consumers using deep-well pumping systems and emphasized the importance of energy-saving technologies in water management. Siddikov, Azamov, and Berdiyev (2024) analyzed the reactive

power consumption of single-phase asynchronous motors supplied by solar energy, highlighting methods for improving the efficiency of renewable energy applications. Berdiyovich and Xolmirzayev (2023) developed a mathematical model to evaluate energy-saving processes during transient operating conditions of asynchronous motors in pumping units. Furthermore, Mamajonov (2024) proposed methods for assessing the thermal condition of asynchronous motors used in pumping stations, contributing to improved operational reliability and equipment lifetime.

Although the cited studies mainly concentrate on electrical machines, pumping systems, and renewable energy technologies, they provide valuable theoretical and methodological foundations for evaluating the operation of hydroelectric power plants. Their findings support the importance of increasing energy efficiency, improving equipment reliability, and implementing modern engineering approaches in power generation facilities.

Based on the analysis of these references, it can be concluded that there remains a need for comprehensive studies specifically addressing the historical development, technical characteristics, and operational significance of the Andijan Hydroelectric Power Plant. Therefore, the present study aims to complement the existing literature by providing a detailed overview of the Andijan HPP and its contribution to the electricity supply system of Uzbekistan.

Conclusion

The Andijan Hydroelectric Power Plant is one of the strategically important renewable energy facilities in Uzbekistan and plays a vital role in ensuring a stable electricity supply for the Fergana Valley. Since its commissioning, the plant has made a significant contribution to the national power system through the efficient utilization of water resources and environmentally friendly electricity generation.

The analysis presented in this study shows that the Andijan HPP possesses substantial technical and operational capabilities, including an installed capacity of 140 MW and reliable annual electricity production. Its four hydroelectric generating units ensure continuous and efficient operation, supporting both regional electricity demand and the stability of the national grid.

Furthermore, the reviewed literature confirms that improving the efficiency, reliability, and modernization of hydroelectric power plants remains an important direction for the sustainable development of the energy sector. In this context, the Andijan Hydroelectric Power Plant serves as an important example of successful hydropower development in Uzbekistan.

References

1. International Organization for Standardization (ISO). (2018). *ISO 50001: Energy Management Systems – Requirements with Guidance for Use*. Geneva: ISO.
2. Capehart, B. L., Turner, W. C., & Kennedy, W. J. (2020). *Guide to Energy Management* (9th ed.). CRC Press.
3. Doty, S., & Turner, W. C. (2012). *Energy Management Handbook* (8th ed.). Fairmont Press.
4. Thollander, P., & Ottosson, M. (2010). Energy management practices in Swedish energy-intensive industries. *Journal of Cleaner Production*, 18(12), 1125–1133.
5. Bunse, K., Vodicka, M., Schönsleben, P., Brühlhart, M., & Ernst, F. O. (2011). Integrating energy efficiency performance in production management – gap analysis between industrial needs and scientific literature. *Journal of Cleaner Production*, 19(6–7), 667–679.