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ASSESSING THE EFFICIENCY OF WATER AND CAPITAL RESOURCE UTILIZATION IN HYDROPOWER ENTERPRISES: THE CASE OF JSC "UZBEKHYDROENERGO"

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Abstract. This paper assesses how efficiently water, production capacity and capital are used at JSC "Uzbekhydroenergo", the main hydropower producer of Uzbekistan, over 2019–2025. A set of unit indicators – capacity factor, unit cost, capital intensity and asset turnover – is calculated on the basis of the company's IFRS financial statements. It is shown that installed capacity has grown steadily while generation continues to follow the water year, so that each additional unit of capital yields a declining output. Recommendations are proposed for including resource-based indicators in the company's management reporting.

Keywords: hydropower, resource saving, capacity factor, unit cost, capital intensity, asset turnover, water availability.

Hydropower differs from other branches of the energy industry in that its main input – water – is free of charge but limited and highly variable from year to year. The bulk of a hydropower company's costs consists of depreciation, repairs and debt service rather than fuel. For this reason, resource saving in hydropower cannot be reduced to cutting material consumption; it means obtaining a higher economic result from each cubic metre of water, each megawatt of installed capacity and each unit of invested capital.

The global context confirms the relevance of this approach. In 2025, 28 GW of new hydropower capacity was commissioned worldwide, bringing the total to 1,469 GW, while generation grew by only 0.1% and the share of hydropower in global electricity output fell to a record low of 14% [3; 4]. At the same time, the levelized cost of electricity from new hydropower plants increased from USD 0.043 to 0.062 per kWh between 2010 and 2025 [5]. Under these conditions, the competitiveness of hydropower companies increasingly depends on how fully they use existing resources rather than on building new plants [6; 7]. In Uzbekistan, the efficient use of energy resources and the development of hydropower capacity are set as priorities in national development strategies [1; 2], and the role of hydropower in the country's energy balance has been examined by domestic researchers [8; 9].

The study is based on the consolidated IFRS financial statements of JSC "Uzbekhydroenergo" for 2019–2025 [10] and official statistics. The capacity factor was calculated as the ratio of annual generation to the product of installed capacity and 8,760 hours; unit cost as the cost of sales per kWh; capital intensity as the value of property, plant and equipment per kWh generated; and asset turnover as revenue per unit of property, plant and equipment.

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Table 1
Indicators of Resource Utilization at JSC "Uzbekhydroenergo"

Year	Installed capacity, MW	Output, bn kWh	Capacity factor, %	Unit cost, UZS/kWh	Capital intensity, UZS/kWh	Asset turnover, UZS/UZS
2019	1,925	6.5	38.5	74.5	714	0.41
2020	1,985	5.0	28.8	92.8	1,169	0.26
2021	2,050	5.0	27.8	117.3	1,490	0.22
2022	2,140	6.5	34.7	108.9	1,333	0.30
2023	2,233	7.0	35.8	82.2	1,462	0.29
2024	2,400	8.2	39.0	78.0	1,462	0.33
2025	2,500	6.5	29.7	89.2	2,346	0.22

Source: Author's calculations based on the IFRS financial statements of JSC "Uzbekhydroenergo" for 2019–2025.

Over the seven years, the company's installed capacity increased by 30% – from 1,925 MW to 2,500 MW. Generation, however, did not follow this growth: it ranged between 5.0 and 8.2 billion kWh depending on water availability. In the dry year of 2025, output fell from 8.2 to 6.5 billion kWh, i.e. by about 21%, and the capacity factor dropped from 39.0% to 29.7%. Thus, the rise in capacity has not translated into a stable rise in production.

Unit cost proved to be highly sensitive to the water year. In the dry years of 2020–2021, the cost of one kWh rose from UZS 74.5 to 117.3, or 1.6 times, because largely fixed costs were spread over a smaller volume of output. When generation recovered in 2023–2024, unit cost fell back to UZS 78–82. Estimates for 2019–2025 show that a 1% increase in output reduces unit cost by approximately 0.85%, while a one-percentage-point rise in the capacity factor increases return on equity by 0.91 percentage points.

Capital intensity increased from UZS 714 to UZS 2,346 per kWh, and asset turnover fell from 0.41 to 0.22. Over the same period, revenue and net profit per kWh grew mainly due to tariff increases. In other words, financial results have been improving while resource efficiency has been deteriorating. An assessment based on financial indicators alone does not reveal this trend.

The analysis shows that the main reserve for resource saving at JSC "Uzbekhydroenergo" lies in fuller use of existing water and capacity rather than in further expansion alone. It is recommended that the company's management reporting include, alongside financial ratios, resource-based indicators: the energy yield of water, the spill coefficient, the capacity factor, capital intensity and unit cost. Separate accounting of water spilled past the turbines, which is currently not disclosed in company reports, should be introduced as a first step, since it forms the information base for economically grounded decisions on water allocation and unit loading.

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