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To Investigate on the Readiness of the Employees Towards the Social Interaction with Technology in the Workplace in Malaysia

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Abstract: More than 45 hydroelectric power stations are used to meet the national economy of the republic, including agriculture, and their age is 30-40 years or more.

Currently, the total installed power of power plants belonging to "Uzbekenergo" JSC is 14140 MW. Of them, 12,129 MW are due to thermal power plants and 1,878.7 MW are to hydropower plants. Natural gas, fuel oil, and coal are used as fuel in thermal power stations.

All the energy resources of Uzbekistan have developed operational resources, and their further use can lead to a decrease in the stability and efficiency of power plants.

Keywords: hydropower, power plant, derivation.

Introduction

Uzbekistan's energy sector heavily relies on thermal power plants, which account for approximately 85% of the country's electricity production. However, the increasing demand for energy, reliance on organic fuels, and environmental concerns highlight the need for sustainable alternatives. Hydropower plays a crucial role in Uzbekistan’s energy mix, contributing about 14.5% of electricity generation. The country has significant hydropower potential, with numerous operational and planned hydroelectric power plants. Expanding the use of hydropower can enhance energy security, reduce environmental impact, and support economic growth. This study explores the current state, potential, and future prospects of hydropower in Uzbekistan’s energy system.

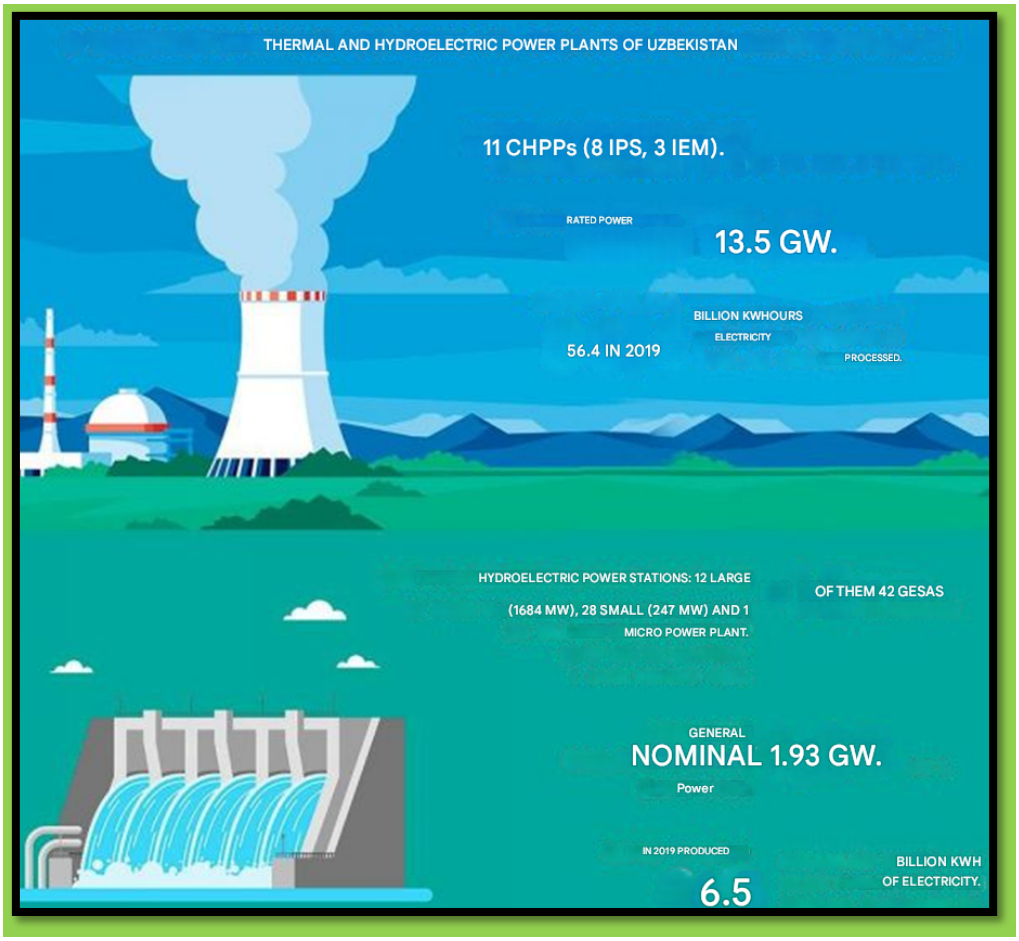
Today, the power of any country and the development of society are determined by its energy supply. However, the growth of energy consumption and the use of organic fuel for its production lead to global environmental pollution and, as a result, pose a serious threat to human life.

One of the pressing problems of modern energy is the use of environmentally friendly, renewable, non-traditional energy sources.

Today, 85% of electricity produced in our republic is generated at thermal power plants running on organic fuel. Only 14.5% of electricity is generated by hydroelectric power plants (HPPs).

To a large extent, it is recyclable, which means that it can be used repeatedly.

Small hydropower plays an important role in our country, which has rich energy resources. Hydropower resources of the Republic of Uzbekistan are estimated as follows.



Since our republic is a developed agricultural country and is located in an arid zone, agricultural crops are harvested by artificial irrigation.

To supply irrigation water to the irrigation systems of our country, there are 75 large main and inter-farm canals with a length of 28.6 thousand km and 207 large hydraulic structures on them, as well as 172.2 thousand km of on-farm irrigation networks with a volume of 19.6 billion cubic meters. 56 reservoirs with a capacity of 100 thousand m3 and 25 flood-control reservoirs are in operation.

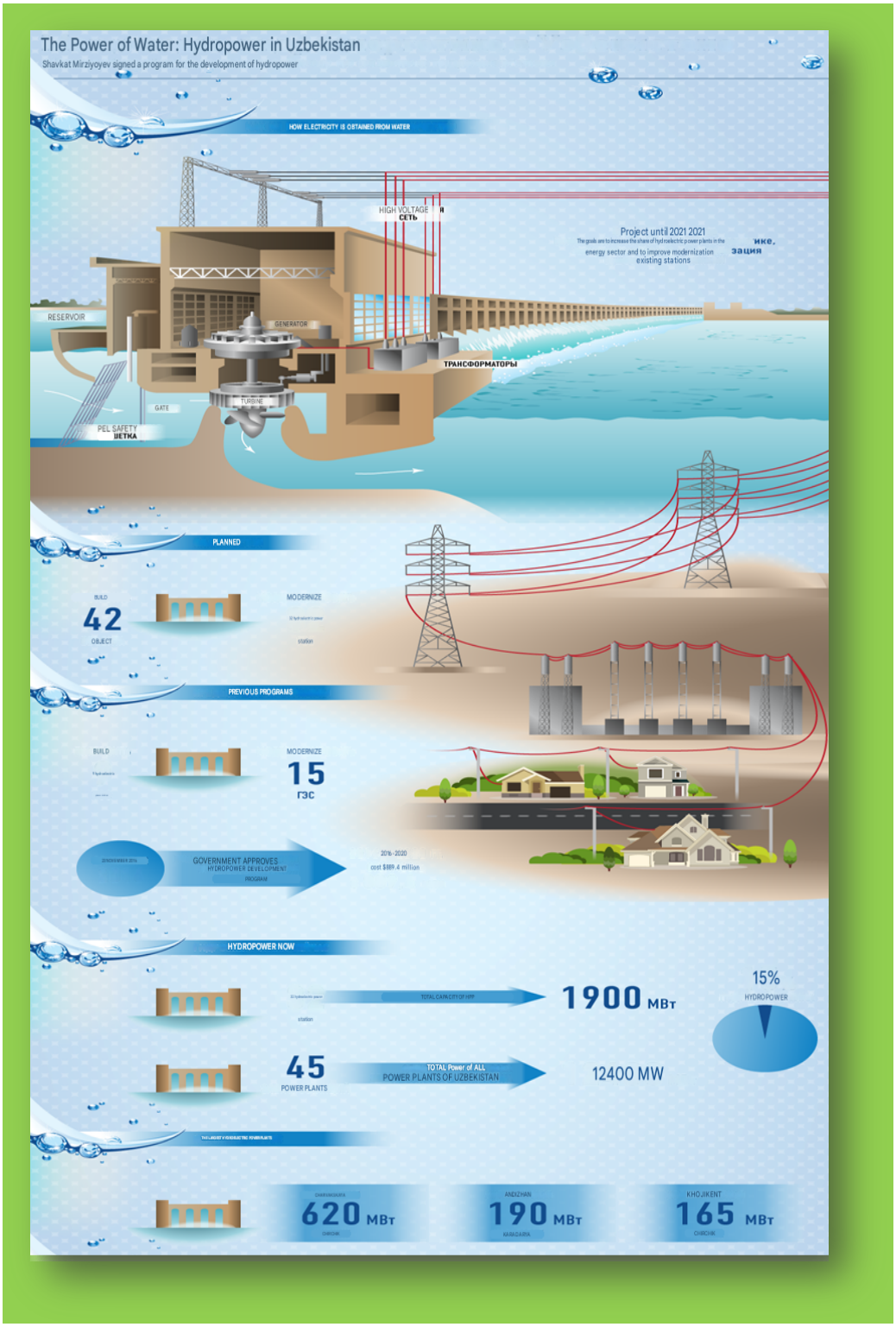
In small, medium and large rivers of Uzbekistan, the number of planned, operating, under construction, designed and in the design and survey stage hydroelectric power plants on irrigation systems is 204.

Of these: 34 hydroelectric power plants in operation (30 Uzbekenergo State Joint Stock Company, 4 Suvenergo specialized associations of the Ministry of Agriculture and Water Resources of Uzbekistan); 11 mothballed hydroelectric power plants; intended for construction.

The number of hydroelectric power plants for which exploration and design work is underway is 45; Potential hydroelectric power plants include 12 on rivers, 23 on reservoirs and 79 on main canals.

Currently, the association has built the following small hydroelectric power plants:

- Hydroelectric power plant on the Topalang reservoir in the Surkhandarya region;
- Hydroelectric power plant on the Akhangaron reservoir in the Tashkent region;
- Hydroelectric power plant on the Gisorak reservoir in the Kashkadarya region;
- Small Gulba hydroelectric power plant on the Dargom canal in the Samarkand region;
- Hydroelectric power plant No. 2 on the Andijan reservoir in the Andijan region;
- Shakhiardon hydroelectric power plant on the small Koksuv river in the Fergana region



In addition, it is planned to build the following small hydroelectric power plants:

Design documentation has been developed for the following facilities:

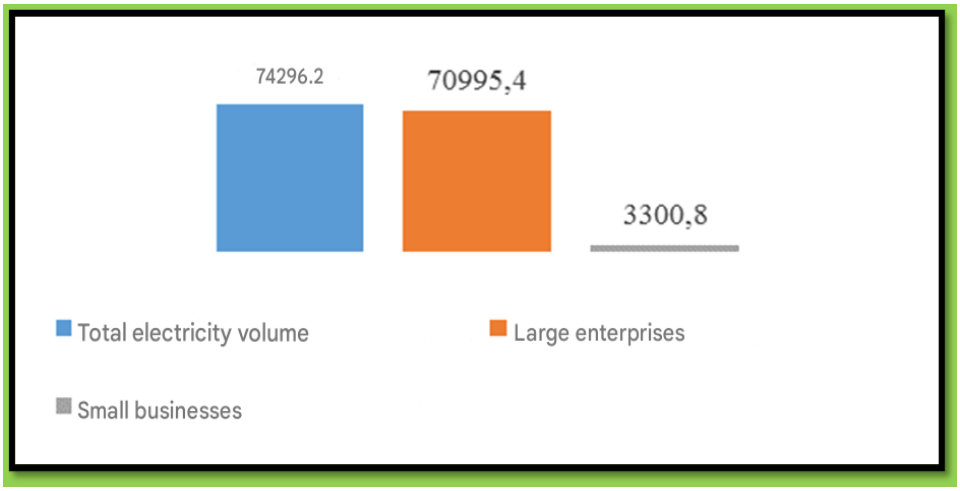
- Shakhrikhan-0 hydroelectric power plant in the Andijan region;
- Shakhrikhan-1 hydroelectric power plant in the Andijan region;
- Pionerskaya hydroelectric power plant of the Chirchik-Bozsu energy cascade in the Tashkent region;
- Chaudarskaya hydroelectric power plant on the Dargom canal, Samarkand region;

Bogishamol 2 hydroelectric power plant in the Samarkand region;

The economic efficiency of industries is inextricably linked with the competitiveness of the national economy and the socio-economic development of the country. One of the main factors in the economic development of any country is energy resources.

Energy resources are divided into non-renewable, renewable sources and nuclear energy. Systematic management and distribution of these resources is the task of the energy sector of Uzbekistan, and the role of hydropower in it is quite important. Uzbekistan intends to increase electricity production from 79.0 billion kWh to 90.6 billion kWh in 2022-2024.

In 2026, Uzbekistan plans to increase the share of "green" energy to 8 thousand MW per year, which will reduce carbon dioxide emissions into the atmosphere by 5 million tons in the period from 2022-2026. By 2030, it is planned to double the energy efficiency of the economy, bringing the share of renewable energy sources to 25% [2]. In 2022, 74,296.2 million kWh of electricity was produced in our country, a growth rate of 104.1% compared to 2021. 95.6% of electricity (70,995.4 million kWh) was produced by large enterprises, 4.4 percent by small enterprises (Figure 1). Consumption is growing year after year along with production.



Hydropower potential of Uzbekistan. The basis of water resources of Uzbekistan are glaciers, rivers, lakes, reservoirs, transboundary rivers and groundwater

The total gross theoretical hydropower potential of the country's rivers is estimated at 88.5 billion kWh per year, of which the technical hydropower potential is 27.4 billion kWh per year. Currently, about 24% is used.

The Pskem River has the greatest potential (1324 MW) of the studied watercourses in the republic, which is 45.3 percent of the available hydropower resources of Uzbekistan. The shares of other large watercourses are: Topalangdarya (292 MW, 10.2%), Chatkal River (243 MW, 8.3%), Sangardak River (149 MW, 5.1%), Koksuv River (96 MW, 3.3%), Akhangaran River (73 MW, 2.5%), Ugam and Khalkajar Rivers (67 MW, 2.3%) and other rivers (672 MW, 23%) [4].

In 2022, hydroelectric power plants in Uzbekistan produced about 9% of all electricity. At the same time, 13 percent of the current capacity was used.

The demand for electricity in the country's energy balance in 2023 will be equal to 84,653.4 million kWh, the contribution of hydropower will be equal to 8 percent (6.8 billion kWh).

Hydropower generation per capita is 168 kWh, per unit area - 13.3 thousand kWh. The annual technical hydropower potential of the country is about 17.9 billion kWh, in which the share of small hydropower (HPPs up to 5 MW) is 1.5% or 260 thousand kWh.

The capacity of the energy sector of the republic in relation to the unit of GDP in 2022 is 11.9 billion soums. From this it follows that the share of hydropower generation in GDP is 77,147.7 billion soums or 8.7%. In 2023, all other things being equal, the added value created by hydroelectric power plants will increase GDP by about 3.8 trillion soums.

Hydropower rating of regions. During the study, a hydropower rating of regions was compiled (Table 2), based on the consideration of production indicators of 14 regions.

Table 2. Hydropower rating of regions of Uzbekistan

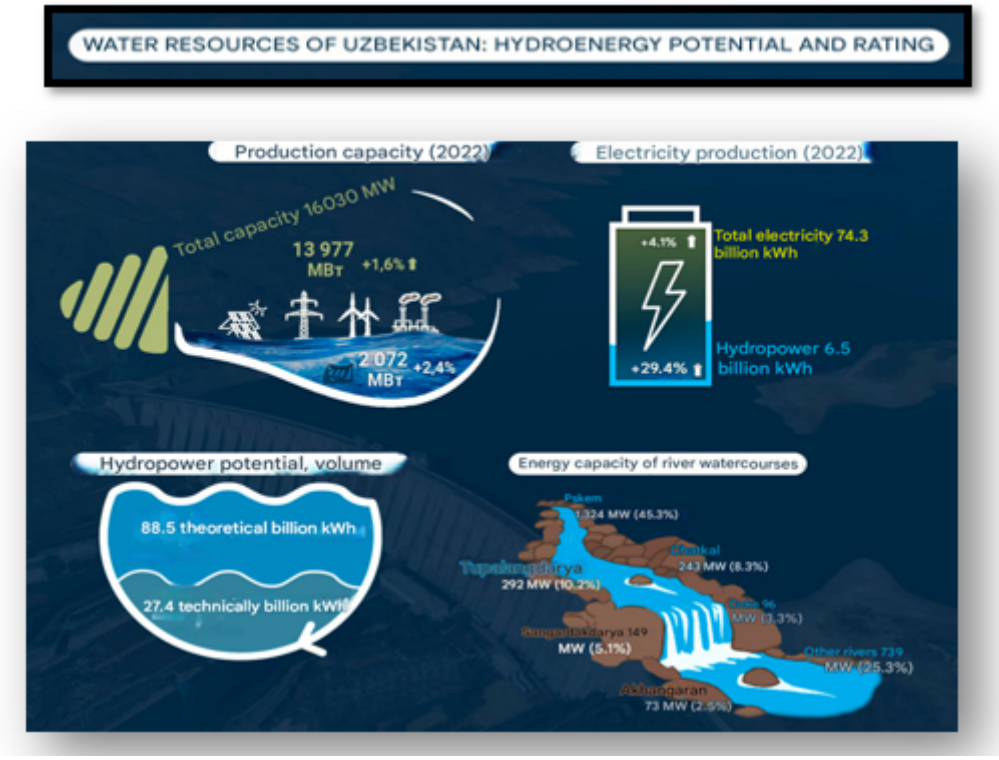
№	Territory	Index	Rating
1	Tashkent region	0.68	1
2	Andijan region	0.12	2
3	Syrdarya region	0.07	3
4	Surkhandarya region	0.04	4
5	Khorezm region	0.03	5
6	Tashkent city	0.02	6
7	Namangan region	0.02	7
8	Kashkadarya region	0.01	8
9	Samarkand region	0.01	9

Currently, there are hydroelectric power plants in 9 regions, with the Tashkent region taking first place in terms of production volume.

Bukhara, Jizzakh and Fergana regions, which do not have hydroelectric facilities, can be included in the rating due to the construction of a number of micro hydroelectric power plants with a capacity of up to 500 kW by private investors.

Investments. "Over the past 6 years, the population in the republic has grown by 13%, the number of industrial enterprises has increased from 45 thousand to 100 thousand. As a result, the demand for electricity has increased by 35%. President of the Republic of Uzbekistan Shavkat Mirziyoyev in his address to the Oliy Majlis and the people of Uzbekistan on December 20, 2022, said that the industry needs 25-30 billion dollars in investments.

In 2023-2025, USD 559.4 million in equivalent will be invested in the hydropower sector, including USD 165.9 million in 2023[5]. In 2023, two new automated hydroelectric power plants with a capacity of 13.6 MW will be commissioned and one hydroelectric power plant will be modernized.



Methodology

This study employs a qualitative research approach, analyzing statistical data, government reports, and academic publications on Uzbekistan's hydropower sector. Data on installed capacity, production trends, and regional distribution of hydroelectric power plants were examined. Additionally, policy documents and investment plans were reviewed to assess the future development of hydropower. Comparative analysis was conducted to evaluate the role of hydropower in the national energy balance and its potential contribution to sustainable energy goals.

Results and Discussion

The analysis reveals that hydropower contributes 14.5% of Uzbekistan's electricity generation, with 34 operational hydroelectric power plants and numerous projects under development. Despite its potential, only 24% of the country's technically feasible hydropower capacity is currently utilized. The Tashkent region leads in hydropower production, while other regions have untapped potential. Investments in small and large hydropower projects are expected to enhance energy security and reduce carbon emissions. However, challenges such as aging infrastructure and the need for advanced technologies remain. Expanding hydropower capacity through innovative solutions and policy support can significantly improve Uzbekistan's energy sustainability.

Conclusions and suggestions.

The hydropower potential of Uzbekistan takes into account the water flow in large and small rivers, canals, water gates and large irrigation ditches, which also determines the possibility of generating electricity using more than traditional innovative technologies (water waves, turbulent hydro turbines, screw turbines).

The report of the United Nations Industrial Development Organization (UNIDO) on the development of small hydropower demonstrated the efficiency of a micro hydroelectric power plant in Indonesia, with a turbulent flow of 13 kW. The new turbine is designed for a flow rate of 1.5 m3 / s and a height difference of 1.7 m. The cost of one kWh of local energy is $ 0.08, and the levelized cost of electricity - LCOE (levelized cost of energy) - is $ 0.04. The total investment cost of the turbine pays off in six years. According to the results of the expert assessment, approximately 230 thousand US dollars will be spent on purchasing the turbine, performing 300 m3 of reinforced concrete work in local conditions and launching a micro turbulent hydroelectric power station with a capacity of 100 kW. This device, when operating at maximum capacity, generates 864 thousand kWh of electricity per year, and when operating on a seasonal watercourse - 576 thousand kWh per year. The project, using "green" tariffs and exemption from all taxes and fees, will pay for itself in 5-7 years.

The installation of rotating hydro turbines at all water intakes (18.5 thousand units), on canals in agriculture can provide 1.1 million units or 15 percent of all households with environmentally friendly electricity. Using innovative technologies and the country's hydroelectric potential in the production of electricity, it is possible to significantly increase the share of GNP in the regions and more fully ensure the continuity of energy supply, reduce the energy intensity of GDP in the near future and bring it closer to the level of developed countries, and also serve the further development of the economy of our republic.

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