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### REGIONAL DEVELOPMENT AND ENVIRONMENTAL PROBLEMS IN THE FORMATION OF "GREEN ENERGY" IN UZBEKISTAN



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**Annotation:** The economic development of the Republic of Uzbekistan largely depends on traditional energy sources. Electricity generation is carried out by generation at thermal power plants, which account for 87.3% of the total installed capacity, and at hydroelectric power plants (12.7%). The growth of social tension in the world and the presence of deep-seated environmental problems cause great interest in the use of new energy sources. One of the key issues for solving the economic development of the Republic of Uzbekistan is the transition to "green energy".

**Keywords:** Energy, green economy, water resources, increase in capacity, electricity consumption.

### 1 INTRODUCTION

Central Asia, in particular Uzbekistan, is a developing country in all spheres. It is rich in various natural resources, but at the same time it has a shortage of resources in the field of energy, such as gas, hydropower and others. Today, providing all violence with electricity is an acute issue in our country. Since the infrastructure for the production and transmission of electricity was mainly built in Soviet times at least 30 years ago, and most of it needs to be repaired. Roughly three-quarters of electricity in Central Asia is generated by fossil fuel power plants. Until inefficient facilities are upgraded or replaced with cleaner ones, they are a source of air pollution that is harmful to human health.

Also, the problem of water resources is also very acute, especially in the regions of Central Asia, including Uzbekistan. 40% of water is wasted due to outdated infrastructure.

Uzbekistan ranks 25th among 164 countries and is among the 30 countries with increased water impact. Experts estimate that the country's freshwater deficit could

reach 7 billion cubic feet by 2030 — the size of four livestock reservoirs or nearly two Tuzkon Lakes. By 2050, the deficit will double.

In the face of growing scarcity, the demand for water is increasing every year. Over the past 15 years, the volume of water per capita in the country has decreased by 48 percent, from 3,048 cubic meters in 2008 to 1,589 cubic meters by the end of 2022.

Even with this decline, water consumption, among other countries, is much higher than in Egypt, Germany, Israel, Bahrain and the United Kingdom.

According to the Food and Agriculture Organization of the United Nations (FAO), Uzbekistan today consumes 169 percent of its water resources year-round, while other Central Asian countries have much lower consumption rates. In Kazakhstan, this figure reaches 33 percent, in Kyrgyzstan – 50 percent, in Azerbaijan – 54 percent, in Armenia – 56 percent, in Tajikistan – 62 percent.

According to FAO, the situation in the region will deteriorate and the country will face serious water shortages.

When the average temperature rises by 2°C, the glacier reserves in the country decrease by 50%, and when the average temperature rises to 4°C, by 78%. By 2100, the average temperature in the region is expected to rise to 5-6 degrees Fahrenheit [-6°C].

As we can see, the lack of water resources is also a problem in the energy sector of Uzbekistan. This problem is considered not only a problem of Central Asia, but of the whole world. Therefore, many countries have begun to switch to alternative electricity. As we know, by 2030, many developed countries have committed themselves to the transition to green energy.

We can also cite as an example the following facts on the installed capacity of power plants in the Republic of Uzbekistan.

1. The installed capacity of power plants in the Republic of Uzbekistan is more than 18 GW.
2. The available capacity is 16 GW.
3. The actual available capacity, taking into account fuel restrictions in the 2022-23 winter season, was only about 10 GW, which was not enough to cover the consumption of 11.5 GW.

There were reserves at thermal power plants, but due to a lack of gas or low pressure, the power units could not reach full load. At TashTPP and TKTPP, they were forced to shut down one highly efficient CCGT each, which did not have enough gas pressure.

At the Tashkent Thermal Power Plant and the SDTPP, where power units with traditional technology operate, they were forced to burn fuel oil due to a shortage of gas. Coal-fired power plants were not operating at full capacity due to a shortage of coal.

Also comment on all these conditions in power plants.

1. The development of the gas transmission system (GTS) lags behind the commissioning of generating capacities. It is necessary to modernize the GTS so that it operates according to the daily schedule of the power system, and not in the mode of wholesale supplies.

2. In Uzbekistan, with a sharply continental climate, a decrease in pressure in the GTS during sharp cold snaps is an objective fact. With this in mind, fuel oil storage facilities in the amount of 1 million tons were built and filled in the energy system, and coal reserves of up to 1 million tons were made during the autumn and winter season.

3. Power units that can operate on backup fuels cannot be dismantled. They should be kept to the minimum extent necessary.

What is green energy?

Renewable energy is energy obtained from natural sources that is replenished at a faster rate than it is consumed. The basic principle of using renewable energy is to extract it from processes that are constantly taking place in the environment and making it available for technical applications. resources such as sunlight, wind, rain, tides and geothermal heat, which are replenished naturally.

To date, many developed and developing countries have partially switched to green energy. Forecast data show that in developed countries, the consumption of renewable energy sources (RES) will increase by about 130% in the period up to 2040, mainly due to new renewable sources (solar, wind, etc.). Ultimately, the share of renewable energy sources in the energy mix will increase to 21%..

## 2 MATERIAL AND METHODS

In order to solve the problems associated with the lack of resources in the energy sector in Uzbekistan, a number of activities are also being carried out and planned. Taking into account the structure of the republic's economy as an industrial and agrarian one, the operation of power plants mainly due to the use of gas and coal, there are objective prerequisites for improving the structure of the energy balance at the expense of renewable energy sources.

The development of renewable energy sources in the republic will provide additional new jobs and give an impetus to the development of industry in the regions. Below are data on the construction of solar and wind power plants in the Republic of Uzbekistan.

Table 1

### Targets for the construction of solar power plants until 2030

Solar Stations	17
Total Capacity of Projects	7000 Mw
Total Cost of Projects	4,8 billion dollars
Annual Production	15,3 billion kW.
Annual Natural Gas Savings	4,5 billion cubic meters
Reduction of annual harmful emissions	6,0 million tons.

Table 2

### Wind farm construction targets until 2030

Number of projects	11
Total Capacity of Projects	5000 Mw
Total Cost of Projects	6,0 billion dollars
Annual Production	17,5 billion kW.
Annual Natural Gas Savings	5,2 billion cubic meters
Reduction of annual harmful emissions	6,7 million tons.

The construction of solar and wind power plants will increase the costs of energy companies for the construction of 500-220-110 kV power lines, through which the generated electricity will be transported, all this will affect the cost of electricity supplied to consumers. Based on the results of the study of the wind potential of the republic, national and foreign specialists revealed that on the territory of Uzbekistan there are two regions out of eleven where it is possible to build wind farms and receive solar energy (the Republic of Karakalpakstan, Navoi region).

The introduction of "green" technologies that save fuel (not to mention their role in reducing emissions into the atmosphere), as well as nuclear energy, is a necessity that the Uzbek energy system, the basic generation of which is thermal power plants, will inevitably face.

The transition to renewable energy sources will have certain problematic issues, the solution of which will need to be addressed by specialists in the energy industry.

Renewable energy sources have such properties as variability and discontinuity, and it is expected that they will significantly affect the modes of the power system. Until recently, the main feature of the electric power industry was that at any given time, electricity generation and consumption must be equal to each other. In recent years, various energy storage technologies have emerged that allow you to store excess energy and use stored energy when there is a shortage in the system. These technologies have not yet been used commercially in large volumes, primarily due to their high cost and negligible share.

Therefore, the dispatchers of the power system conduct the regime based on the requirements for maintaining the balance of generation and consumption.

With the intensified development of renewable energy sources, at the same time, at a faster pace, it is necessary to develop the electric grid facilities of the republic. The construction of wind and solar power plants without the construction of transmission lines and substations will lead to inevitable problems in the entire energy system.

It should be noted that the construction of 1 km of 500 kV overhead lines in Uzbekistan today is 400.0 thousand US dollars, 200 kV overhead lines - 150-180.0 thousand dollars, 500 kV substation - 80.0 million, substation -220 kV. - 45.0 million USD loans.

However, it is necessary to take into account environmental problems during the construction of solar and wind power plants, which have been especially acute in the country in recent decades, due to the drying up of the Aral Sea.

### 3 CONCLUSIONS AND SUGGESTIONS

Hydropower can also be referred to as green energy. In order to solve the problem of electricity shortage in Uzbekistan, we can propose to accelerate the solution of the issue of joint development of the significant hydro potential that exists in Tajikistan and Kyrgyzstan, participation in the construction of such large hydro facilities as the Rogun hydroelectric power plant (3,600 MW) or the Kambarata hydroelectric power station-1 (1,900 MW), as well as new pumped-storage power plants.

When transitioning to alternative energy sources, it is necessary to take into account all the existing environmental problems, the economic development of the country, and relations with the closest neighbors. In our opinion, instead of large solar power plants, it is necessary to build not large 10-15 MW stations in the republic, the energy of which will provide consumers in the surrounding areas. It is also necessary to take into account the issue of storage of generated energy (joint construction of battery stations) during the construction of solar and wind power plants.

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