

EXPANDING THE OPPORTUNITIES OF GREEN ENERGY AND ITS ROLE IN THE SUSTAINABLE DEVELOPMENT OF ENTERPRISES IN THE ENERGY SECTOR OF UZBEKISTAN

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Abstract. *Central Asia has abundant reserves of coal, natural gas, and hydropower, but these resources are very unevenly distributed across countries. The infrastructure for the production and transmission of electricity was mostly built during the Soviet era at least 30 years ago, and much of it needs repairs. About three-quarters of electricity in Central Asia, as well as in Uzbekistan, 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. Reducing emissions from the energy sector is a challenge for Uzbekistan, as it also prioritizes economic development, which can run counter to air quality goals. In many countries, the twin challenges of limiting greenhouse gas emissions and controlling emissions of other pollutants that have traditionally been regulated to protect public health. While some national strategies are able to reduce both types of emissions, other strategies achieve only one outcome.*

Keywords: *energy industry, green economy, water resources, power increase, electricity consumption.*

INTRODUCTION

Over the past few years, the economy and industry of various countries in the world have been developing quite rapidly. On the one hand, this contributes to the improvement of life in countries, but there are also disadvantages. For many years, they lived in the era of the brown economy, but for several years, countries such as America, Western Europe, China, the UAE and other countries began to switch to a green economy. What is the essence of the "green economy"? According to experts and scientists, it is proposed to define this phenomenon as a trend in economic science, which involves the simultaneous preservation and development of the biosphere and civilization, as well as a way of conducting economic activity that is aimed at improving the well-being of people without risks to the biosphere. Today, climate change is one of the main and real threats to our planet. One of the main problems is the lack of energy resources, as well as emissions from combustion products in the form of CO₂ into the atmosphere. For several years now, countries around the world have been smoothly transitioning to a green economy.

At the same time, the energy industry plays a major role. The economic development of the Republic of Uzbekistan largely depends on traditional energy sources (gas, coal, water) with the help of which electricity is produced. 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. The supply of electricity to the country's economy and population is particularly acute. 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.

Literature review. The article provides an overview of the development of renewable energy sources in the Republic of Uzbekistan. The paper shows the mechanisms for supporting and stimulating renewable energy sources, provides tables on the state of the installed capacities of the country's energy system, as well as the number of power plants with their grouping by installed capacity. The ways of development in Uzbekistan for the use of renewable energy sources and the use of new technologies in the field of alternative energy are presented.

Research methodology. The methodology of the study consists of studying the data of the Ministry of Energy and the CDC "Energy" of Uzbekistan. Based on the studied data, tables were formed and proposals were made to eliminate problems in the country's energy system.

Analysis and results. Electricity consumption in the republic in 2023 amounted to 77.1 billion kWh, which is 3.5% higher than in 2022. Electricity generation amounted to 74.3 billion kWh, which is 4.6% higher than in 2022, mainly due to an increase in production at thermal power plants and the introduction of new equipment.

During 2022-2023, the export of electricity to Afghanistan continued. In 2023, 1425.6 million kWh were exported, against 2151.3 million kWh. (33.7% decrease) in 2022.

Expanding the opportunities of green energy and its role in the sustainable development of enterprises in the energy sector of Uzbekistan.

The energy sector of the republic faces large-scale tasks to increase electricity generation through renewable energy sources. The specific task is related to the reduction of the reserves of natural gas and coal currently used in the production of electricity.

Until recently, some countries (especially European states) have actively switched to a "green economy", where the use of oil, gas, coal in the production of electricity was rejected and the force of nature (wind, sun, water) was actively used.

However, against the backdrop of the deepening global economic crisis, many countries have begun to reopen coal mines and thermal power plants to generate electricity.

Of the world powers, Russia and China are moving in two directions of energy development. In our opinion, the Republic of Uzbekistan should also move in this direction.

According to the concept for the development of the energy sector of Uzbekistan, the total demand for electricity by 2030 will increase to 120.8 billion kWh or 1.86 times compared to 2019 (65.0 billion kWh), an average of 5.8% per year.

By 2024, it is planned to introduce in the republic:

9- CCGT (combined-cycle plants) with a total installed capacity of 6010 MW;
5-GTU (gas turbine unit) with a total capacity of 844 MW;
coal-fired units with a total capacity of 620 MW;
HPPs with a total capacity of 613 MW;
Renewable energy sources with a total capacity of 4000 MW, including solar 2400 MW, wind - 1600 MW.

By 2030, it is planned to increase the capacity of solar power plants to 5 GW and to wind farms to 3 GW. [1]

Is there really a need for such an aggressive expansion of renewable energy sources in the republic?

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.

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.

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.

Basically, it is planned to build 100-250 MW of solar power plants in Uzbekistan, which will occupy significant territories. Climate change will have a negative impact on the efficiency of such plants. The increase in "dust storms" in recent years, the settling of dust on the panels will ultimately affect the quantity and quality of electricity generated.

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 wind energy (the Republic of Karakalpakstan, Navoi region).

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 line in Uzbekistan today is 400.0 thousand US dollars, 200 kV overhead line - 150-180.0 thousand dollars, 500 kV substation - 80.0 million, substation -220 kW - 45.0 million US dollars.

Over the past decade, the cost of building these facilities in the country has increased by 1.5 times, and it should also be noted that the cost of installing wind farms in European countries has also increased by 1.5 times.

The service life of renewable energy sources is not long enough, no more than 20-25 years. The installed capacity factor of the power system depends on this. This coefficient is as follows:

Nuclear power plants – 90%

TPP - 75%

Wind farms-24%

Solar power plants - 22%, in connection with which a new solar station with a capacity of 100 MW actually has a capacity much less.

It is also necessary to take into account the fact that new wind and solar power plants in the republic are being built near 500-200 kW overhead lines, through which electricity will be transported in the future, which has obvious drawbacks, therefore, in order to deliver the generated electricity to consumers, it is necessary to build new wind and solar stations near the overhead line -110-35 kW and the transmission of generated electricity to consumers through these networks.

The energy system of the Republic of Uzbekistan during 2023 developed dynamically and provided supply to industrial, agricultural, and household consumers of the country. According to the Ministry of Energy of Uzbekistan, the installed capacity of the country's energy system is as follows.

Table-1

Indicators	Units. Measure.		Growth
Installed capacity as of 01.01.2023	Mw	18089,0	
Installed capacity as of 01.01.2022	Mw	16531,8	
Power Generation	Million. Kwh	74287,4	
Growth (+) Decline (-) by 2021	%		+ 4,6
Electricity consumption	Million. Kwh	77176,2	
Growth (+) Decline (-)	%		+ 3,5
Length of 220-500 kV overhead lines as of 01.01.2023	km	10053,4	
Growth as of 01.01.2021	%		1,6

Table number 2 shows the installed capacity of power plants and the commissioning of new capacities in Uzbekistan.

Table-2

	As of 01.01.2023	Power Changes		As of 01.01.2022	Growth (+) Reduction (-)
		Introduction of new	Inference Old		
Uzbekistan	18089,0 MW	+1767,2	-210,0	16531,8 MW	+1557,2

The increase in the capacity of the power system is due to the commissioning of new power equipment at the facilities of Thermal Electric Networks JSC (TPP).

A comparative table of the installed capacity of the energy system of Uzbekistan for the year is given in 3 tables.

Table-3

	As of 01.01.2023	As of 01.01.2022	Increase
Total: incl.	18089,0 MW	16531,8 MW	1557,2
TPP (thermal power plants)	15670,6	14379,8	
Hydroelectric Power Plants (Hydroelectric Power Plants)	2217,7	2051,2	
Wind farm (wind turbine-750) (wind turbine)	0,7	0,7	
PV (solar stations) incl.	200,0	100,0	
«Tutly Solar»	100,0	-	

Solar power plant "Karmana"	100,0	100,0	
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Number of power plants with their grouping by installed capacity (as of 01.01.2023).

Table-4

Republic Uzbekistan	Altogether	Number of power plants			
		TPP	Hydroelectric power plant	Wind farm	SES
	74	20	51	1	2

Structure of the installed capacity of the power system of Uzbekistan (as of 01.01.2023)

Table-5

Altogether	Total installed capacity of power plants							
	TPP	%	Hydroelectric power plant	%	Wind farm	%	SES	%
18089,0 MW	15670,6	86,6	2217,7	12,3	0,7	-	200	1,1

Science-based proposals: What is the need for renewable energy sources? In the Uzbek energy system, the available fuel capacity in the 2020-2023 ECO was only about 10 GW, which was not enough to cover the consumption of 11.5 GW (the capacity of the Uzbek energy system is more than 18 GW). Despite the fact that there were reserves at the thermal power plants, due to a lack of gas or its low pressure, the power units could not reach full load. For example, the Tashkent and Turkkurgon TPPs were forced to reject one highly efficient combined-cycle gas turbine unit (CCGT) each. At the TashTPP and the Syrdarya TPP, where the power units operate on gas, they were forced to burn fuel oil due to a gas shortage. The same fate befell coal-fired power plants due to a shortage of coal.

Given that there are only 2 GTS power centers in the republic, where there are stable problems with gas supply in the winter season. To do this, you need to:

- (a) To construct additional gas storage facilities.
- B. To create a reserve of fuel oil and coal.

According to the Ministry of Energy, in connection with the development of renewable energy sources in the future, it is planned to commission 5.6 GW of capacity, it is planned to dismantle power units operating on traditional fuel. It is proposed to keep them in the minimum necessary amount. Due to the lack of generating capacity in the republic, it is planned to increase the share of renewable energy sources to 30% of the total electricity production by 2030.

World experience shows that an increase in the share above 10%, which are characterized by variability (renewables, PV) and discontinuity (PV), requires the adoption of special measures to compensate for their imbalances.

Integration of renewable energy sources is an objective necessity, but this process should be approached with extreme caution:

the introduction of renewable energy sources must be accompanied by the commissioning of energy storage devices;

to avoid the construction of large renewable energy facilities in one place, to put more emphasis on distributed one.

Wind speed is more than 25-30 m/s. It can have a negative impact on wind farms and lead to a system accident. For example, in 2023, the UK limited the connection of renewable energy

sources to the power system due to their negative impact on reliability and safety. These problems have also arisen in the Scandinavian countries in recent years.

Taking into account the problematic issues in water resources in the countries of Central Asia, it is necessary to solve the need for the construction of nuclear power plants, especially in the Republic of Uzbekistan and the Republic of Kazakhstan. This issue is currently being delayed for objective and subjective reasons. It should be taken into account that the construction of a nuclear power plant will take at least 10 years, which may lead to a shortage of capacity in the future.

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