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OPPORTUNITIES USING OF RENEWABLE ENERGY SOURCES IN UZBEKISTAN

Abstract: *Given the importance of renewable energy sources (RES) in saving hydrocarbon resources, ensuring the country's energy security, as well as in providing electricity, heat and drinking water to people living in remote areas from the central energy supply settlements, mountain and steppe regions in the Republic, more and more attention is given to the development of this direction.*

Key words: *Renewable energy sources (RES), natural gas, oil, coal, electricity, solar power, wind power.*

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ВОЗМОЖНОСТИ ИСПОЛЬЗОВАНИЯ ВОЗОБНОВЛЯЕМЫХ ИСТОЧНИКОВ ЭНЕРГИИ В УЗБЕКИСТАНЕ

Аннотация: *Учитывая важное значение возобновляемых источников энергии (ВИЭ) в экономии углеводородных ресурсов, обеспечении энергетической безопасности страны, а также в обеспечении электроэнергией, теплоснабжением и питьевой водой населения, проживающего в отдаленных от центрального энергоснабжения населенных пунктах, горных и степных районах в Республике все большее внимание придаётся развитию этого направления.*

Ключевые слова: *Возобновляемых источников энергии (ВИЭ), природный газ, нефть, уголь, электроэнергия, солнечная энергия, ветровая энергия.*

Uzbekistan is among those states that have achieved energy independence. In the country, sources of electricity are natural gas and petroleum products. Given the importance of renewable energy sources (RES) in saving hydrocarbon resources, ensuring the country's energy security, as well as in providing electricity, heat and drinking water to people living in remote areas from the central energy supply settlements, mountain and steppe regions, as well as seasonal workers and expedition members in the republic, more and more attention is given to the development of this direction.

Uzbekistan is rich in traditional energy resources: natural gas, coal, oil, oil shale, uranium, and resources for hydropower. In addition to uranium and oil shale, all other sources of energy resources are actively used in the energy balance of the country (table 1).

According to expert estimates, the potential of renewable energy sources in Uzbekistan is about 51 billion tons of oil equivalent, technical potential - 182.32 million tons of oil equivalent, which is more than 3 times higher than the current annual primary energy production (table 2).

As can be seen from the calculations, about 97% (176.8 million tons of oil equivalent) of the potential is accounted for by solar energy.

Table 1. The structure of consumption of primary energy resources of Uzbekistan 2000–2010 yy.*

Types of primary energy resources	2000 year		2005 year		2010 year	
	th. t.o.e.	%	th. t.o.e.	%	th. t.o.e.	%
<i>Total</i>	53765,1	100	55344,2	100	58282,6	100
<i>Natural gas</i>	45752,5	85,1	49091,2	88,7	53499,5	91,8
<i>Oil and gas condensate</i>	7575,2	14,1	5611,1	10,1	4058,2	7,0
<i>Coal</i>	0,831	0,002	0,846	0,002	0,793	0,001
<i>Large hydropower</i>	365,242	0,7	519,4	0,9	563,1	1,0
<i>Small hydropower</i>	69,316	0,1	119,9	0,2	159,238	0,3
<i>Other sources</i>	2,064	0,004	1,720	0,003	1,720	0,003

* Conversion factors to the oil equivalent for Uzbekistan: oil - 1.005; natural gas - 0.8112; brown coal - 0.3007; coal - 0.594; electricity - 0.86. (t.o.e., a tons of oil equivalent, t.e.f., a tons of equivalent fuel, 1 t.o.e. = 10 Gcal = 41.86 GJ = 11, 63 MWh = 1.43 t.e.f.).

Other types of renewable energy sources account for only 3 percent of the technical potential. However, the most developed is the potential of small hydropower (31.3% of the technical potential and 13.3% of the gross potential), which is associated with higher economic efficiency of this type of alternative energy [1].

Given the economic efficiency of the projects, Uzhydroenergo JSC has developed a small hydropower development program with the construction of 140 small hydropower plants, including the first stage - the most profitable 20 hydropower plants. The implementation of the industry program will increase the generating capacity of the Ministry of Agriculture and Water Management to 613 MW and bring electricity generation at small hydropower plants to 2.19 billion kWh.

The gross potential of solar energy, which annually enters the territory of Uzbekistan, is significant and exceeds the energy potential of all the explored reserves of hydrocarbons in the country (table 3).

Thus, the total technical potential for using solar energy at the present stage is 176.8 million t.o.e., or only 0.34% of its gross potential. However, even this indicator is 3 times higher than the annual production of hydrocarbons in the country [2].

The distribution over the territory of the total duration of energy-active (3 m/s or more) wind speeds is similar to the distribution of average speeds. The maximum duration (6–8 thousand hours per year) is characteristic of the coasts and ridges of mountain ranges. In desert areas, such speeds are observed for 3-4 thousand hours, in the Fergana Valley about 1500 hours (table 4).

The gross potential of wind energy, estimated on the basis of long-term weather observations (more than 10 years) of wind speed at weather stations in Uzbekistan, is 2.22 million t.o.e. per year. The technical potential of wind energy in the republic is estimated at 0.43 million t.o.e. per year [3].

In conclusion, it can be noted that studying international experience and comparing it with the conditions of Uzbekistan shows that at present all developed countries and individual developing countries have developed and are implementing strategies and programs in the field of alternative energy.

Table 2. Potential of renewable energy sources in Uzbekistan (million t.o.e.)

Types of RES	Gross	Technical	Mastery
<i>Hydropower, total</i>	9,2	2,32	0,72
<i>including large rivers</i>	8,0	1,81	0,56
<i>Small rivers, reservoirs and canals</i>	1,2	0,51	0,16
<i>Solar power</i>	50973	176,8	
<i>Wind power</i>	2,2	0,4	
<i>Biomass</i>		0,5	
<i>Geothermal waters</i>	0,2	0	0
<i>Petrothermal resources *</i>	6700000	0	0
Total	50993,8**	182,32	0,72

* *The heat of dry stones.*

** *Excluding petrothermal resources for which there is no technology for use.*

Source: UNDP Final Report "Prospects for the Development of Renewable Energy in Uzbekistan", Tashkent, 2007 y.

Table 3. Gross potential of solar energy by regions of Uzbekistan

№	Region	mln. t.o.e.
1.	<i>Andijan</i>	129
2.	<i>Bukhara</i>	4747
3.	<i>Fergana</i>	215
4.	<i>Jizzakh</i>	2090
5.	<i>Kashkadarya</i>	3027
6.	<i>Khorezm</i>	542
7.	<i>Namangan</i>	241
8.	<i>Navoi</i>	14388
9.	<i>Samarkand</i>	1703
10.	<i>Syrdarya</i>	327
11.	<i>Surkhandarya</i>	2554
12.	<i>Tashkent</i>	1462
13.	<i>Karakalpakstan</i>	19548
	Total:	50973

The gross potential of solar energy was estimated taking into account the data of each actinometrical station, representative for territories with the same physical and geographical conditions, and solar radiation in real cloud cover.

Source: Appendix A to the Final Report of the Asian Development Bank, Department of East and Central Asia and the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan, "Development of Renewable Energy Sources in the Republic of Uzbekistan" 2005 y.

Table 4. Total duration (h) of energy-active wind speeds at some Central Asian stations

Stations	Wind speed, m/s		
	>3	>5	<3
<i>Andijan</i>	1760	790	7000
<i>Karakul</i>	3960	1760	4800
<i>Muynak</i>	5540	2960	3220
<i>Nurata</i>	3170	1320	5590
<i>Tamdy</i>	5010	2550	3750
<i>Toytepa</i>	1320	880	7440
<i>Chimbay</i>	4400	1760	4360
<i>Yangier</i>	4660	2730	4100
<i>Naryn</i>	1670	400	7090
<i>Khaidarkan</i>	2630	980	6130

The main factors encouraging these countries to engage in the introduction of alternative energy are: the growing shortage of non-renewable energy resources; awareness of the high risk of replacing traditional energy sources with nuclear energy; raising the technological level of equipment for alternative energy sources; for Uzbekistan, the development of solar power is also important as an example of an alternative to the construction of giant dams in a region rich in solar energy and poor water resources.

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