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SOLAR RESOURSES OF UZBEKISTAN'S SAMARKAND REGION

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Abstract

It is considered highly accurate modern solar resource measuring sensors operating in six regions of the Republic of Uzbekistan. We analyze the solar energy data obtained by terrestrial and satellite stations.

Key words: solar resource; actinometric; pyranometer; solar radiation

INTRODUCTION

In economically developed and developing countries there have being rapidly conducted works for the practical use of alternative energy sources, including solar energy, as a key factor of sustainable development and for increasing competitiveness of economies in conditions of reducing the world's hydrocarbon reserves. Thus, for example, researches in the sphere of using the solar energy in a number of countries are being conducted at the level of major national programs aimed for a long period.

Currently in Uzbekistan there being developed a draft of the law on development of alternative energy, as well as a number of legal documents in this sphere. The first major steps in the practical use of solar energy were initiated. In the Republic's six regions automatic weather stations measuring data collection on solar resources had been installed by CSP Services (Germany) company with the technical assistance of the Asian Development Bank (ADB). Five measuring stations were installed on meteorological plots of the Uzhydromet: Dagbit (Samarkand region), Karmana (Navoi region) Guzar (Kashkadarya region) Sherabad (Surkhandarya region), Pap (Namangan region), as well as on the territory of the SPA "Physics-Sun" in Parkent (Tashkent region). [1] In these regions in the coming years it is planned to build five commercial and one solar energy station for demonstration.

This year, in Samarkand region, there will start building of photovoltaic plant with capacity of 100 MW. ADB experts also developed preliminary feasibility studies for the construction of 100 MW

of photovoltaic power plants in Guzar, Sherabad and Pap, integrated solar energy plant with the capacity of 130 MW with combined cycle in Karman and demonstration solar thermal plant with capacity of 10 MW in Tashkent region.

Systematic measuring of solar radiation in Uzbekistan was launched more than sixty years ago in eight meteorological stations. However, since the early nineties actinometric observations in Uzbekistan were suspended. At the moment, as indicated above - in Dagbit where previously conducted actinometry, in 2013 an automatic measuring station was installed. As previously noted, the new metering stations were set in relation to the construction site for their future solar power. Plots for construction of solar energy plants have been identified in accordance with the technical, social and environmental criteria for selection of the places accepted in international practice.

To date, processed, assembled automatic station, a one-year information on solar resources.

Table 1 and Table 2 presents data on the solar radiation on the Dagbit meteo station obtained directly by counting solar radiation observations for many years [2] for different time intervals - hour, day, month and year. With many years of daily travel schedules of radiation to the middle of each hour interval filmed irradiance value at which hour, and calculates the amount of radiation, and then the daily and monthly.

Here, in Table 1 and Table 2 data on the solar radiation measured during the period 2013 to January 2014 directly by pyranometer RSP automatic measuring stations installed by CSP Services presented.

Also in the table are averaged data for 12 years on solar radiation measured by the satellite in Dagbit area.

Table 1. Average, monthly, annual global and direct normal radiation in Dagbit area.

Months	Global radiation on horizontal surface (kWth/m^2)			Direct normal radiation (kWth/m^2)		
	Refe-rence data	Measured February 2013 January 2014	Averaged satellite data over the period of 12 years	Referen ce data	Measured February 2013 January 2014	Averaged satellite data over the period of 12 years
January	98,3	61,02	52,8	207,8	59,5	56,9
February	121,7	76	69,3	216,9	88,7	71,5
March	188,3	116	115,1	265,3	98,6	108,5
April	220,5	158	154,6	276,4	140,3	141,8
May	258,1	233	200,3	307,2	249,4	184,3
June	254,2	232	229,0	296,4	235,2	227,5
July	258,1	244	237,8	293,1	265,4	246,6
August	231,6	203	214,6	272,8	225,1	233,6
September	185,0	173	167,6	238,9	224,8	201,2
October	147,8	120	112,9	221,1	164,7	134,2
November	100,8	76,29	66,4	201,9	110,3	82,5
December	84,72	54,75	48,9	195,6	75,4	60,3
Total annual	2147	1747,06	1670	2988,9	1937,4	1749,0

Table 2. Average, monthly, annual diffused radiation in Dagbit area.

Months	Diffused radiation on horizontal surface (kWth/m^2)		
	Reference data	Measured over the period February 2013 January 2014	Averaged satellite data over the period of 12 years
January	32,8	31,9	31,2
February	40	37	35,9
March	57,8	59	52,2
April	68,9	70	60,6
May	71,9	56	68,8
June	66,1	58	66,3
July	61,7	51	63,9
August	54,4	51	58,6
September	50,3	40	46,4
October	42,8	37	44,4
Noveber	29,2	30,54	32,5
December	28,6	25,87	27,6
Total annual	604,4	547,31	588,0

As it can be seen from the Table 1 and Table 2 data for global, direct normal and diffuse radiation, obtained by different methods of data collection and processing are substantially different from each other.

Firstly, solar radiation data submitted under the directory and satellite observations are processed and averaged over the long-term observations. RSP sensor measurement data - annual.

Second, the data directory, calculated on the basis of measurements carried out Resolution: 6^{30}, 9^{30}, 12^{30}, 15^{30}, 18^{30}, and calculations have been taken certain assumptions. According to [3], the error data calculated by the solar resource measured in discrete mode is ± 10% or more.

Thirdly, it is known that the satellites transmitting weather information functioning at different heights, and also used solar sensors and spectrometers from different manufacturers. In this regard, data received from different satellites are also different from each other.

It is known that the measurement of the solar resource is based on satellite measurements of the reflected solar radiation from the Earth surface. The data on the reflection of solar radiation by the various constituents of the underlying surface of the earth (various vegetation, sand, water, snow, ice, etc.), the measured ground-based measurements are known.

During measurements from satellites reflected radiation from the underlying surface of the earth it is taken into account the dependence of the reflectance when the sun's rays passing between the earth and the satellite. Given that satellites carrying meteorological observations operate on different heights (geostationary height of 36,000 km polar orbit, 830 km altitude; solar-synchronized, the height

of 800 km), and also have different measurement tools, so the data on a sunny resources differ from each other, as can be seen from Fig. 1.

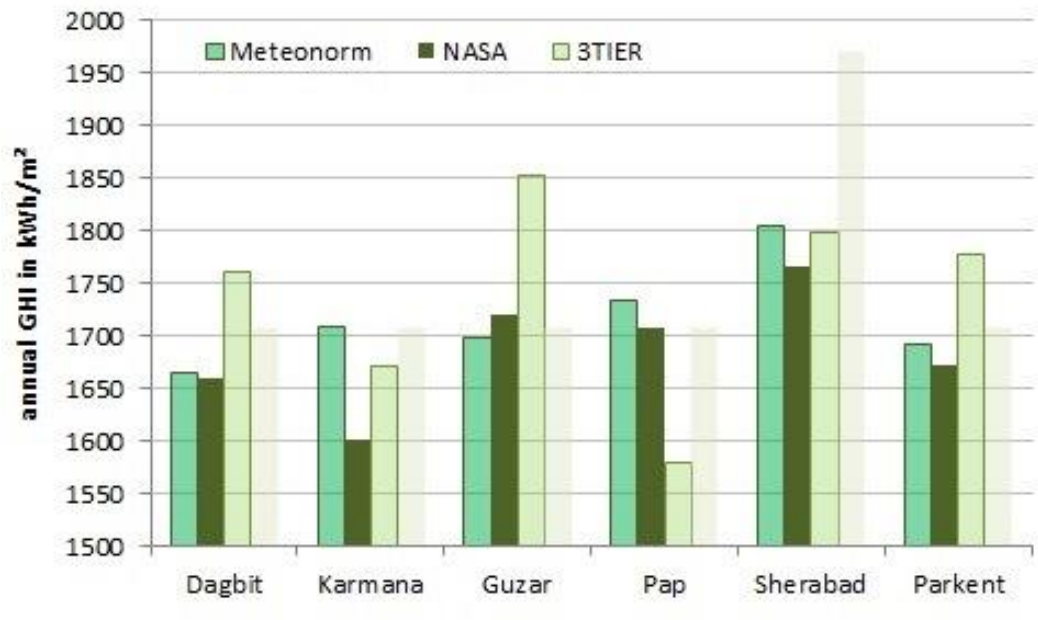

Figure 1. Data on the solar resource produced by different satellites.

In this regard as basic solar data were taken yearly data, measured by the sensor RSP in conjunction with the satellite data.

CONCLUSION

At the present time to collect complete information on the solar resources of modern measuring devices operating in automatic mode the whole day. As noted earlier, information on solar resources needed not only the energy sector, hydrometeorology, and many branches of the economy. There is much work to expand the country's network of measuring stations for solar resources, effectively, taking into account many factors, use of solar energy.

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