

Uzbekistan

Country Profile

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1. Overview of Electricity Supply

Uzbekistan achieved energy self-sufficiency after gaining independence in 1991, and is currently the largest producer of electricity among the Central Asian republics with a total installed generation capacity of around 12,600 MW. However, much of the nation's power generation, transmission and distribution systems are outdated and inefficient, and maintenance of its power systems has deteriorated in recent years. Significant renovations and upgrades are required if the power industry in Uzbekistan is to meet growing demand.

Electricity production is dominated by natural gas thermal power plants, with smaller amounts of power produced from heavy oil and coal thermal power plants. Large natural gas facilities include the Syrdarya (3,000 MW), Tashkent (1,860 MW), and Navoi (1,250 MW) plants. Many of the units for these plants were commissioned in the 1960's and 1970's (UDI, 2009). The largest coal facilities, including Novo-Angren (2,100 MW), are in the vicinity of the Angren mine near Tashkent.

In addition to these thermal plants, approximately 13 percent of Uzbekistan's electricity is produced at approximately 30 hydroelectric power plants, the largest of which is the Charvak plant (600 MW).

In total, Uzbekistan produces approximately 45,100 GWh of electricity. The vast majority of this electricity is consumed domestically; about 11,520 GWh of electricity is exported to neighboring nations. It is more common for Uzbekistan to export raw materials, such as natural gas, to neighboring nations for use in their own thermal power plants.

The renewable energy potential for remote off-grid areas of Uzbekistan is high, particularly for small hydropower, but only 30 percent of that potential is currently used. The government of Uzbekistan has developed a small-scale hydroelectric plants construction program in order to increase utilization effectiveness of the hydro energy potential of the rivers and irrigation channels of the country.

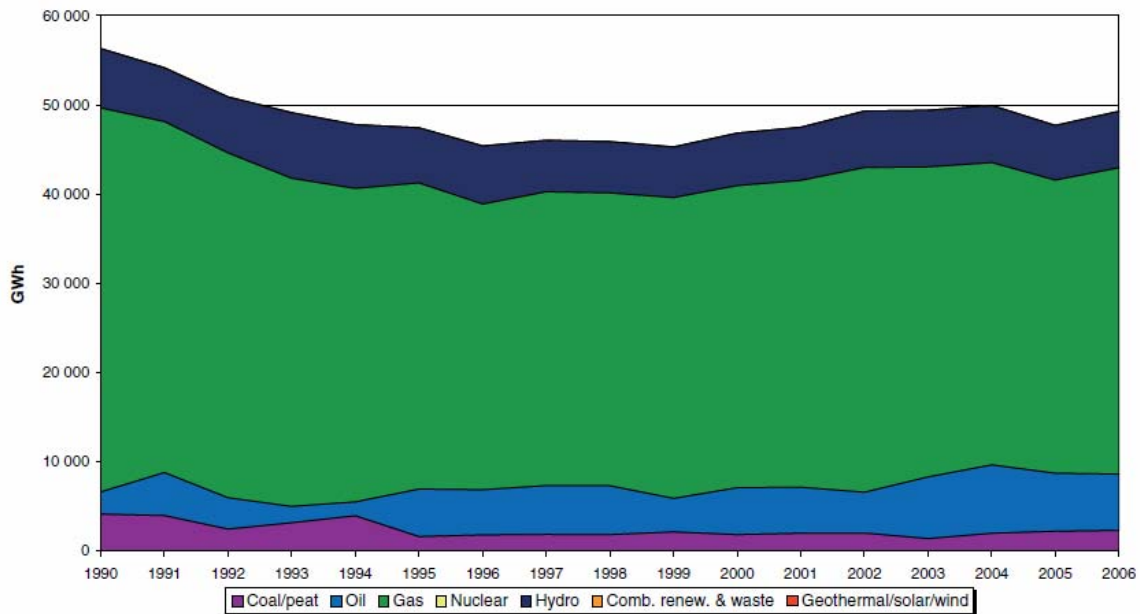
The table below provides summary information about Uzbekistan.

Demographical Information	
Population, millions (2009)	27.61
Land area, thousand sq km (2009)	447.4
Macroeconomic Information (2008)	
GDP, billion US\$	71.6
Real GDP growth rate, percent	8.9
Foreign direct investment (net), million US\$	262
Electricity disposition, billion kWh (2006)	
Generation	46.66
Consumption	42.23
Exports	11.52
Imports	11.44
Generation capacity, GW (2005)	
Nuclear	0.00
Thermal	10.84
Hydro	1.71
Other renewables	0.00
Total	12.55
<i>Sources: CIA World Factbook, U.S. Energy Information Administration, United Nations Conference on Trade and Development.</i>	

Uzbekistan Country Summary Table

The figure below displays the electricity generated in Uzbekistan by different fuels. As shown, a majority of the electricity produced in the country is generated from natural gas. The figure also shows that electrical generation in the country has not increased above 1990 levels.

Uzbekistan Evolution of Electricity Generation by Fuel from 1990 to 2006 Source (IEA)



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2. Energy Policy, Barriers and Incentives

Uzbekistan adopted a resolution on "Deepening Reforms in the Energy Sector" in February 2001, which likely indicates a more favorable investment climate. The resolution called for turning various state-owned energy organizations into partially privatized corporations (GlobalSecurity, 2001).

The resolution also presented a 10 year plan for reconstruction of electric generating and transmission facilities that will require major foreign investment. Information regarding the current status of this plan could not be located.

Uzbekistan still needs to further refine a national energy strategy or policy.

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3. Wind

Uzbekistan is generally characterized by weak winds. Average annual wind velocities are less than 3 m/s. However, there are small territories with average annual velocities 5 m/s and higher. These territories are the Aral Sea coast, Plato Ustyurt, some areas of steppe zone of Kyzylkums, zone of winds near Bekabad alternately in Eastern and western direction and a number of areas of mountain and foothill valleys-Pskem, Ahangaran, Boysun etc.

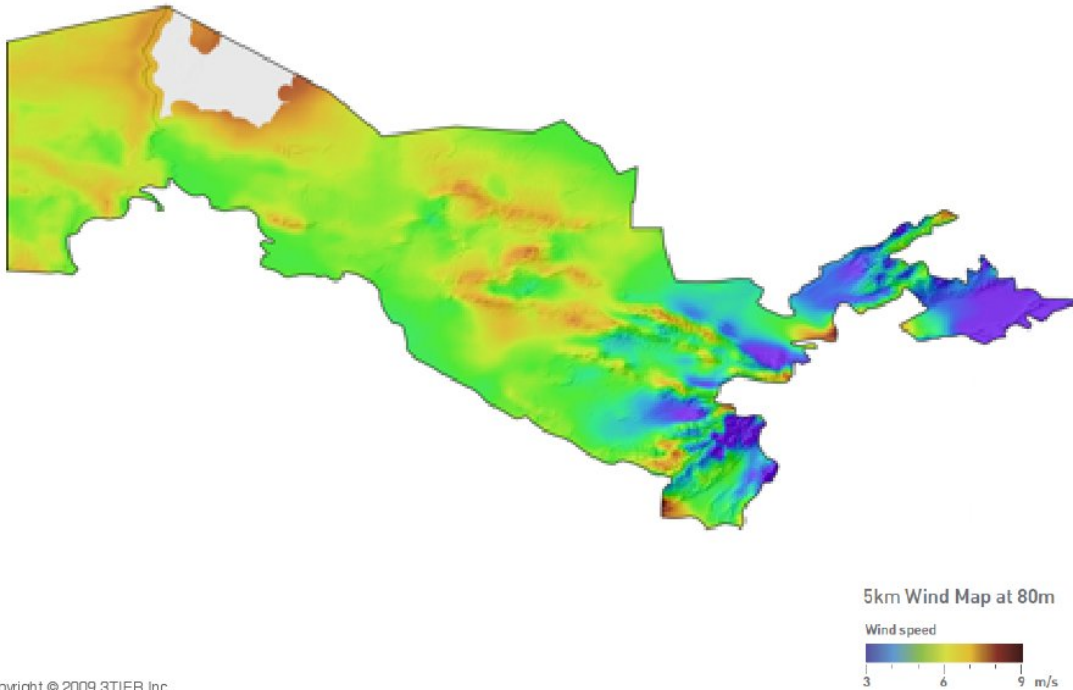
The wind energy potential of Uzbekistan is fair, with a potential generating capacity of around 100 MW. Although this is small relative to the generating capacity of

existing power plants, environmental concerns and needs of remote locations may drive development of this potential. At present there are no operational or planned wind power plants in Uzbekistan (UDI, 2009).

The most promising sites are the Aral Sea region, Karakalpakiya, and the Central region of the country. A more in-depth study of the east coast of the Aral Sea would be worth performing.

Uzbekistan Wind Resource Map (Source: 3Tier)

Uzbekistan Wind Map at 80m



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4. Biomass

Uzbekistan has been using biomass practices for years in homes and on family farms. The country has used livestock manure in many traditional practices such as aerobic digestion (composting), anaerobic digestion (biogas), and as a direct application as organic fertilizer. Biomass has also been a traditional energy source for the production of biogas. Uzbekistan has a biomass potential of approximately 3,500 MWh (IDEAS, 2008).

Biogas installations have been tested at the cattle farm, Milk Agro, in the Zangiota village of the Tashket region. The farm has been able to use biogas for its electricity

and heating needs (IDEAS, 2008). The "Training Center for Biogas Technologies" was also established to analyze the project's results (TTA, 2007).

The area of forests in Uzbekistan is 33,199 km² or 7.4 percent from the overall territory. Uzbekistan is the first amongst former Soviet Union countries and fifth in the world in the production of raw cotton. Uzbekistan produces about 15 percent of the world's cotton. As a result, the country produces between 7-10 million tons of cotton cellulose waste products. Currently, the population of Uzbekistan uses the waste from cultivating cotton and cereal crops as a fuel in private household equipment. However, processing cotton waste products could be important for commercial renewable energy development in Uzbekistan (TTA, 2007).

Biomass resource type	Total production	Production density
Total land area covered by	(avg. 2006–2007, km ²)	(avg. 2006–2007, %)
Arable Land	43,250	10
Permanent Crops	3,400	1
Permanent Meadows and Pastures	220,000	49
Forest Area	33,199	7
Other Land	125,551	28
Inland Water	22,000	5
Primary crop production	(avg. 2006–2007, tonne)	(tonne / 100 km ²)
Total primary crops (rank among COO)	17,236,605 (20)	3,853 (10)
Top 10 primary crops		
Wheat	5,948,153	1,329
Seed cotton	3,450,150	771
Tomatoes	1,455,286	325
Potatoes	955,495	214
Grapes	696,973	156
Vegetables fresh nes	674,080	151
Watermelons	671,549	150
Onions, dry	563,557	126
Carrots and turnips	555,789	124
Apples	480,771	107
Animal units, number	(avg. 2006–2007, number)	(number / 100 km ²)
Cattle	7,043,550	1,574
Poultry	24,559,000	5,489
Pigs	92,700	21
Equivalent animal units	7,326,220	1,638
Annual roundwood production	(2006–2007, m ³)	(m ³ / 100 km ²)
Total	31,000	6.9
Fuel	22,000	4.9
Industrial	9,000	2.0
Wood-based panels	NA	NA
	(2006–2007, tonne)	(tonne / 100 km ²)
Paper and paperboard	11,000	2.5
Recovered paper	NA	NA

Source: Food and Agriculture Organization of the United Nations

Uzbekistan Biomass Resource Data

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5. Solar

Uzbekistan has great solar energy potential. Solar experimentation has been going on in the country for decades, but a solar energy market has never been fully established. In 2003 the Technology Transfer Agency of Uzbekistan (TTA) and United Nations Development Program's (UNDP) solar-power initiative started a pilot project for the installation of solar energy units in remote villages. An American

company supplied main solar cells for this project. UNDP has focused on Karakalpakstan as it is one of the most underdeveloped regions of Uzbekistan, and tends to get overlooked by development agencies, the government and foreign donors.

Solar energy can benefit over 900 remote villages and 4,500 sheep farms in areas where energy and water supply by conventional means is not feasible. The Technology Transfer Agency hopes that development of solar energy will receive more support in the future.

The use of solar energy in Uzbekistan currently consists mainly of use for solar hot water heaters.

Active scientific researches in the field of solar energy are carried out in Academy of Sciences of Republic Uzbekistan, in particular, in Scientific-Production Association "Physics-Sun."

The climatic conditions of Uzbekistan for solar energy are some of the best among CIS states. However the material for compiling the maps of distribution of solar radiation incident is insufficient because of a small number of points where the measurements of solar radiation are carried out. Solar energy resource potential in Uzbekistan is characterized by the data presented in tables below. They show the monthly and annual incidence of total solar radiation on horizontal surface and direct solar radiation on a surface normal to beams. The data represents three areas: Tashkent, Samarkand and Termez.

	Tashkent	Samarkand	Termez
Jan	212	248	260
Feb	267	286	322
Mar	402	421	468
Apr	547	548	608
May	751	780	817
Jun	850	874	878
Jul	874	889	886
Aug	777	812	813
Sep	599	629	649
Oct	398	431	498
Nov	233	272	318
Dec	166	208	238
Yearly	6076	6396	6755

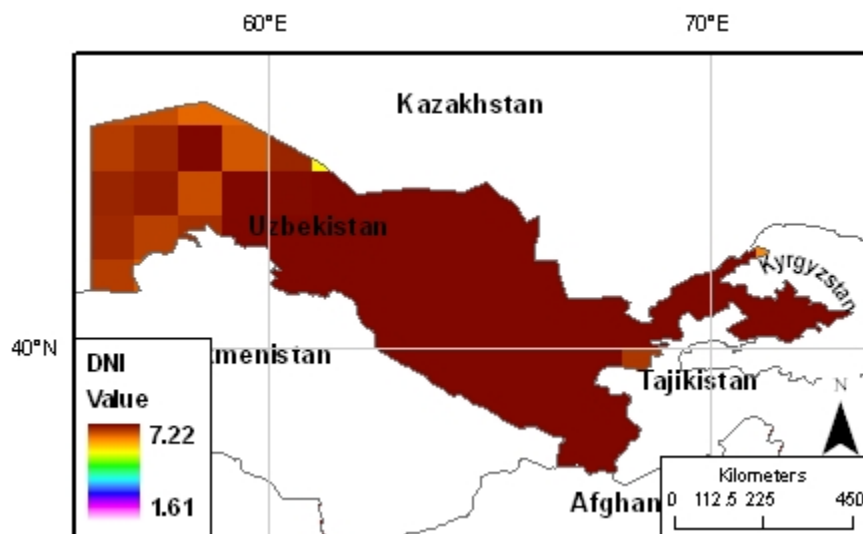
**Monthly and annual total solar radiation
incident on horizontal surface, MJ/m²**

	Tashkent	Samarkand	Termez
Jan	270	339	334
Feb	291	304	337
Mar	387	351	402
Apr	519	460	484
May	749	728	784
Jun	914	909	894
Jul	1001	940	898
Aug	953	919	844
Sep	779	717	754
Oct	537	517	583
Nov	355	396	420
Dec	240	293	323
Yearly	6995	6873	7048

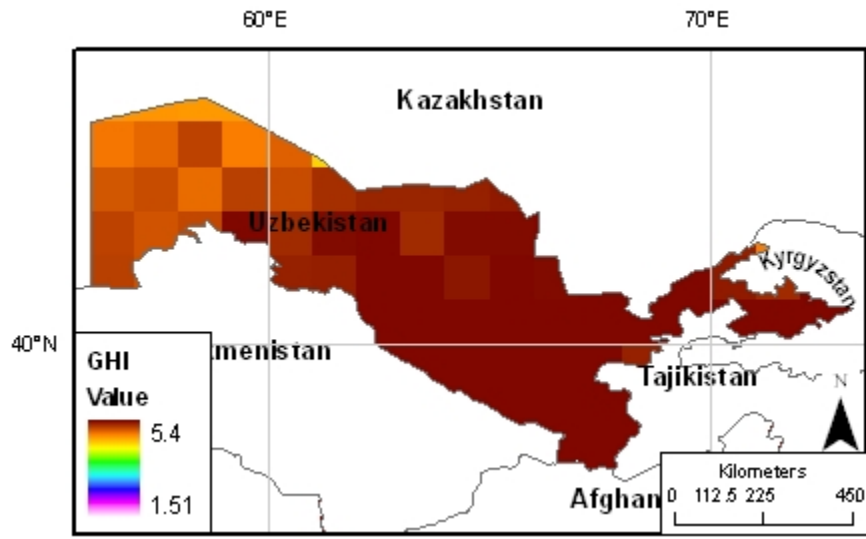
Monthly and annual direct solar radiation incident on surface normal to sunlight beams, MJ/m²

Uzbekistan adopted the "National program of using solar energy in Uzbekistan for the period up to 2010." The program foresees the development of R&D in this field, the organization of production of flat solar collectors and other solar equipment, the organization of staff training, and the development of a legal and normative base. Investments are required for realization of this program, and Uzbekistan can carry out only a small amount of these investments itself.

Uzbekistan Solar Direct Normal Insolation (Source: NASA)



Uzbekistan Solar Global Horizontal Irradiance (Source: NASA)



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6. Geothermal

Geothermal resources of Uzbekistan consist of thermal waters with temperatures in the range of 60-120 °C. Despite the good degree of examination of geothermal reservoirs, the use of thermal water is still in the initial stage. The mastering of geothermal resources is foreseen by the national energy program; however, at this time there is no generating capacity in the country.

Geothermal reservoirs were discovered due to the test of wells drilled for oil and gas exploration and production in the central part of Turan Plate. Main thermal water areas are:

- Amu Darya Basin; geothermal gradient 38 °C/km, reservoir depth 12950 m, temperature 122 °C.
- Surkhan Darya Basin; an aquifer produces 830 l/s of thermal water (65 °C).
- Taskent Basin; Lower Cretaceous reservoirs (2000-2500 m) contain thermal water, temperature 75-80°C, TDS 1 g/l, total flow rate 500 l/s
- Fergana Valley; aquifers in Neogene sediments produce thermal water, temperature 70-90°C, flow rates ranging from 30 to 500 l/s.
- Total thermal water resources are estimated as 135 MWt (free flow operation) or 1150 MWt (pumping operation).

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7. Hydroelectric

Uzbekistan lies between the two largest rivers of Central Asia, the Amu Darya and Syr Darya. The Amu Darya is Uzbekistan's largest river, formed by the confluence of the Panj and Vakhsh Rivers near the southeastern tip of Uzbekistan. The Amu Darya's course is generally parallel to the southern border of the country. The Syr Darya is formed in the Fergana Valley by two rivers flowing east, the Naryn and Qoradaryo (Encarta, 2009).

The average annual hydropower generation in Uzbekistan amounts to 6.3 billion kWh (EIA, 2007). Hydroelectric installed capacity totals 1,815 MW, and hydropower accounts for almost 14 percent of total generating capacity. Uzbekistan maintains significant hydroelectric generation with about 20 facilities in operation and another 5 large facilities planned. Uzbekistan has a total of 610 MW planned, with a majority of that capacity coming from the Pskem power plant (459 MW). That plant is planned for the Pskem River in the Tashkent Province (UDI, 2009).

Most of small hydropower potential is concentrated in the southern and eastern regions of the Republic.

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8. Relevant Links

Please see webpage for relevant links.

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9. References

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10. Country Contacts

Contacts made in the preparation of this assessment are gratefully thanked for their contribution to this report. Please see webpage for contacts listing.

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