

# Turkmenistan

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### 1. Overview of Electricity Supply

Turkmenistan has the largest proven gas reserves of any of the former Soviet republics, apart from the Russian Federation. In fact, it is believed that the country has the fourth largest gas deposits in the world. Turkmenistan's total gas resources have been evaluated at 22.9 trillion m<sup>3</sup>. Many gas fields have been discovered in the west of the republic, near the Caspian Sea, but the most significant resources have been located in the Amu-Daria Basin in the east. The natural gas deposits have proven to be too risky for international oil and gas companies to exploit (IEA, 2008).

Gas deposits were first discovered in 1951, and by 1980 production reached 70 bcm/year. Production continued to rise throughout the 1980's, but by 1992 a serious contraction of the republic's export markets had set in and output fell sharply. Natural gas output recovered in 1999, with sizeable exports to Ukraine and Iran being achieved.

Despite significant efforts, no independent oil and gas export routes have recently emerged apart from a line to Iran. Turkmenistan has invested in the rehabilitation and replacement of their Soviet infrastructure rather than stimulating foreign investment in its upstream production and export markets (IEA, 2008). A gas pipeline to China however is planned to come online in late 2009 or 2010, which should increase Turkmenistan's export market (CIA, 2008).

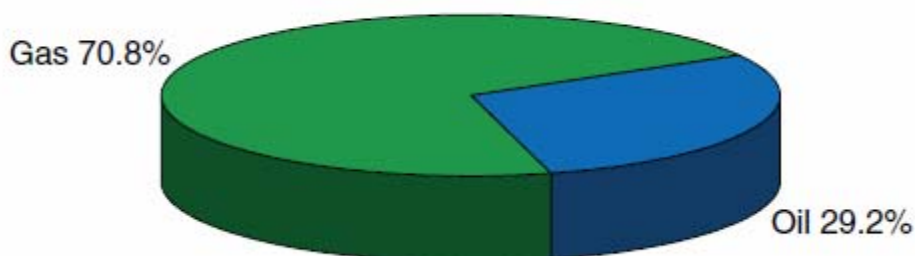
The following table displays summary information about Turkmenistan.

<b>Demographical Information</b>	
Population, millions (2009)	4.88
Land area, thousand sq km (2009)	488
<b>Macroeconomic Information (2008)</b>	
GDP, billion US\$	29.7
Real GDP growth rate, percent	10.0
Foreign direct investment (net), million US\$ (2007)	804
<b>Electricity disposition, billion kWh (2006)</b>	
Generation	12.83
Consumption	9.58
Exports	1.34
Imports	0.00
<b>Generation capacity, GW (2005)</b>	
Nuclear	0.00
Thermal	3.11
Hydro	0.00
Other renewables	0.00
<b>Total</b>	<b>3.11</b>
<i>Sources: CIA World Factbook, U.S. Energy Information Administration, United Nations Conference on Trade and Development.</i>	

### Turkmenistan Country Summary Table

The pie chart below illustrates Turkmenistan's dependence on fossil fuels. As of 2006, the entirety of the country's energy supply is comprised of oil and gas.

#### Share of Total Primary Energy Supply in 2006



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## 2. Energy Policy, Barriers and Incentives

The main efforts with regard to policy in the energy sector focus on greenhouse gas (GHG) mitigation measures. The following political priority measures in the energy and power production sector have been determined

- Increase of efficiency of fuel utilization at power plants by means of modernization of fossil combustion systems.
- Increase of natural gas share in the energy balance.
- Increase of renewable non-fossil sources of energy in the energy balance.

In electric and heat energy consumption sector the following priority measures were determined:

- Increase the energy efficiency in municipal services and in industry, modernization of heating systems.
- Carry out measures on energy saving in the residential sector and industry.
- The Law of Turkmenistan on Energy Saving is at the stage of preparation at present. This law declaratively covers all the aspects of energy saving in both energy production and consumption sectors. The law defines the framework for governing the energy saving policies at the national level. One of priority measures on GHG emission reduction in the energy production and consumption sector is to design enabling mechanisms to implement the Law on Energy Saving.

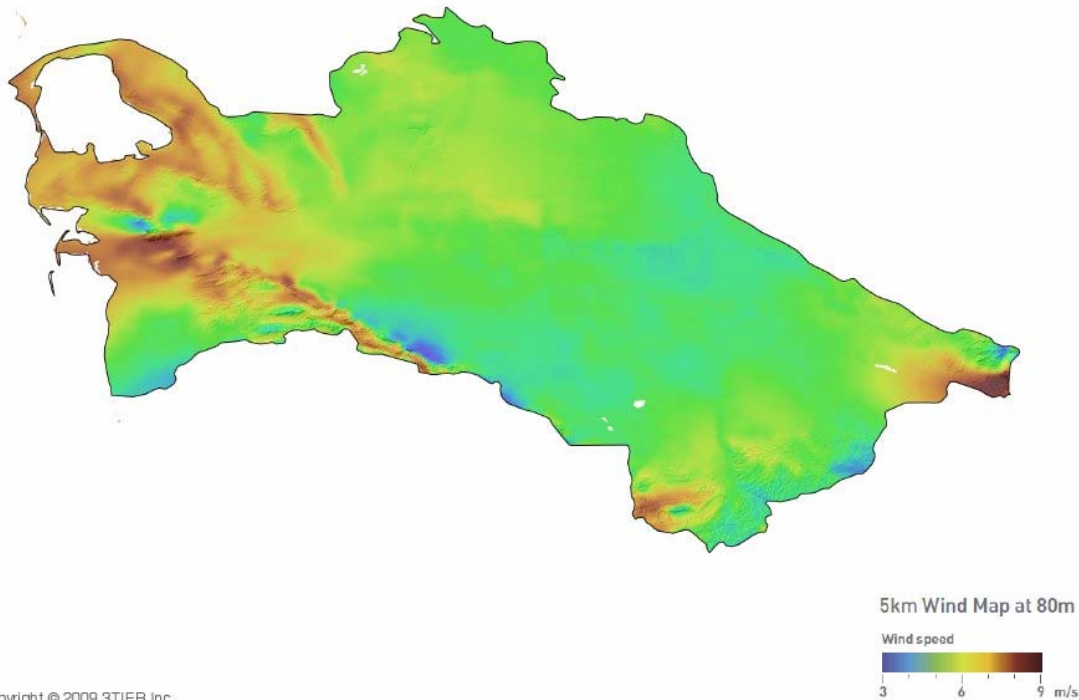
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### *3. Wind*

Turkmenistan is characterized by high wind potential, though there is currently no operational wind energy capacity in the country. A country-wide wind atlas is available for Turkmenistan, and it indicates wind speeds of 4 - 5 m/s at 30 m height in three areas. The map also indicates one area with wind speeds of 5 - 6 m/s at 30 m. The wind resource distribution is dependent on the topography of the country, with the highest potential near the Caspian Sea. The large desert zone also has high wind energy potential. In total, wind energy potential is suitable for power utilization on more than 40 percent of the territory. Turkmenistan has one of the highest wind energy resource potentials in this region.

Specialists in the development of solar and wind resources for energy and water supply in desert regions of Turkmenistan state that the potential for renewable energy production in the region is very high. However, Turkmenistan possesses huge natural gas reserves and one of the lowest electricity prices world wide which hampers the development of renewable energy technologies.

## Turkmenistan Wind Map at 80m



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### 4. Biomass

Biomass opportunities in Turkmenistan have not been well studied. As of 2007, no electricity is produced using biomass (EIA, 2007). Traditionally Turkmenistan has used animal manure for fertilizing its crops.

According to official statistics the area of forests in Turkmenistan constitutes 41,270 km<sup>2</sup>, corresponding to 8.5 percent of Republic territory. Approximately 95 percent of this forested territory is occupied by saxaul (a tree native to Central Asia). At present the decree of Republic government forbids the cutting of forests.

All thermal power plants in Republic are operating with natural gas. The housing, public utilities, and the rural populated settlements are fully gasified, and the natural gas is practically free of charge for the population.

<b>Biomass resource type</b>	<b>Total production</b>	<b>Production density</b>
<b>Total land area covered by</b>	(avg. 2006–2007, km <sup>2</sup> )	(avg. 2006–2007, %)
Arable Land	18,650	4
Permanent Crops	630	0
Permanent Meadows and Pastures	307,000	63
Forest Area	41,270	8
Other Land	102,380	21
Inland Water	18,170	4
<b>Primary crop production</b>	(avg. 2006–2007, tonne)	(tonne / 100 km <sup>2</sup> )
Total primary crops (rank among COO)	5,495,150 (15)	1,126 (4)
<b>Top 10 primary crops</b>		
Wheat	2980000	611
Seed cotton	823000	169
Tomatoes	269000	55
Watermelons	245000	50
Sugar beet	234500	48
Grapes	177500	36
Potatoes	167000	34
Rice, paddy	122950	25
Onions, dry	92050	19
Barley	68350	14
<b>Animal units, number</b>	(avg. 2006–2007, number)	(number / 100 km <sup>2</sup> )
Cattle	2006500	411
Poultry	7450000	1527
Pigs	29400	6
Equivalent animal units	2092760	429
<b>Annual roundwood production</b>	(2006–2007, m <sup>3</sup> )	(m <sup>3</sup> / 100 km <sup>2</sup> )
Total	3400	0.4
Fuel	3400	0.4
Industrial	0	0
Wood-based panels	NA	NA
	(2006–2007, tonne)	(tonne / 100 km <sup>2</sup> )
Paper and paperboard	NA	NA
Recovered paper	NA	NA

*Source: Food and Agriculture Organization of the United Nations*

### Turkmenistan Biomass Resource Data

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## 5. Solar

The climatic conditions in Turkmenistan are extremely favorable for using solar energy. The solar energy resource potential is very high and is characterized by the data presented in the tables below for three areas of Turkmenistan: Gasan-Kuli, Ashkhabad (the capital) and

Chardzhou. The first area is located at Southwest of the country, the second in the southern portion of the central region and the third in the East near the border with Uzbekistan.

	<b>Gasan-Kuli</b>	<b>Ashkhabad</b>	<b>Chardzhou</b>
<b>Jan</b>	264	226	249
<b>Feb</b>	332	284	324
<b>Mar</b>	453	395	474
<b>Apr</b>	560	536	607
<b>May</b>	744	722	812
<b>Jun</b>	796	818	904
<b>Jul</b>	774	839	920
<b>Aug</b>	707	777	845
<b>Sep</b>	579	623	668
<b>Oct</b>	454	449	490
<b>Nov</b>	319	275	310
<b>Dec</b>	244	195	213
<b>Yearly</b>	6226	6139	6816

**Monthly and annual total solar radiation incident on horizontal surface, MJ/m<sup>2</sup>**

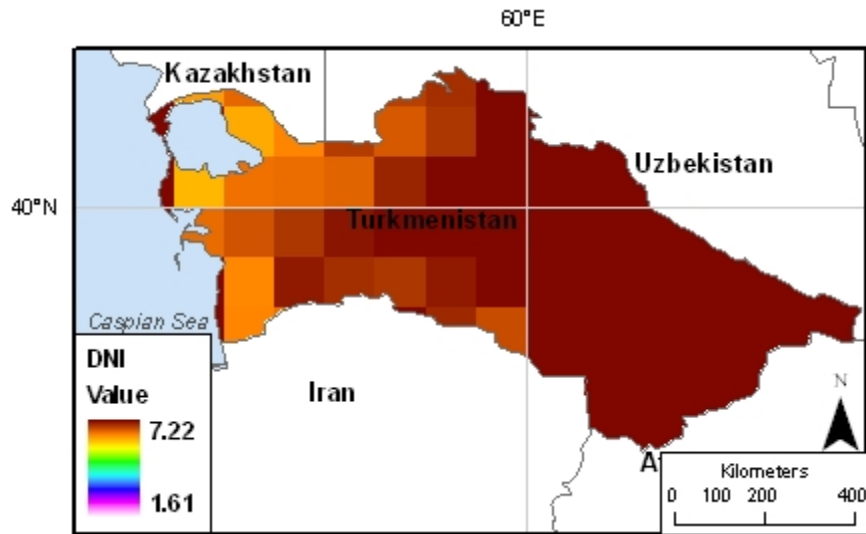
	<b>Gasan-Kuli</b>	<b>Ashkhabad</b>	<b>Chardzhou</b>
<b>Jan</b>	387	285	306
<b>Feb</b>	392	305	366
<b>Mar</b>	405	340	433
<b>Apr</b>	451	454	520
<b>May</b>	652	648	776
<b>Jun</b>	722	818	965
<b>Jul</b>	659	848	1010
<b>Aug</b>	626	850	985
<b>Sep</b>	584	730	845
<b>Oct</b>	546	543	680
<b>Nov</b>	458	402	469
<b>Dec</b>	378	264	276
<b>Yearly</b>	6260	6487	7631

**Monthly and annual direct solar radiation incident on surface normal to sunlight beams, MJ/m<sup>2</sup>**

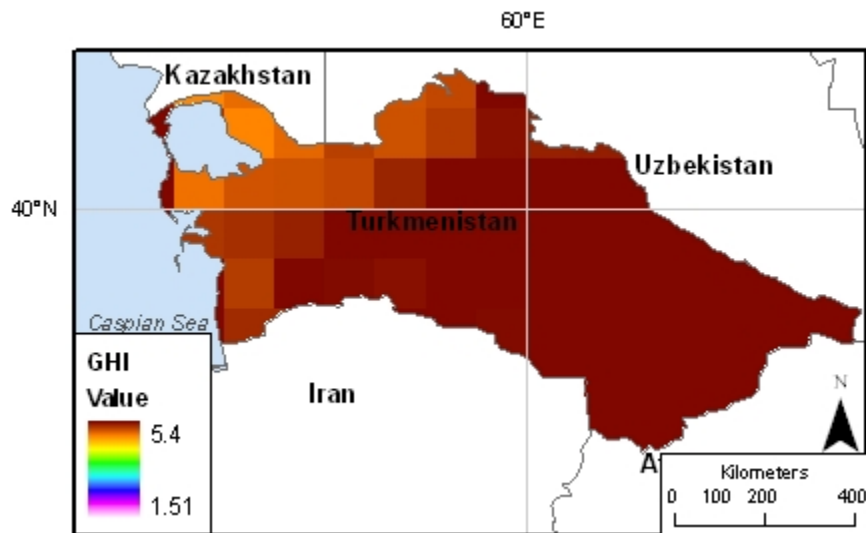
The high overall solar energy resource potential in Turkmenistan increases from west to east. The eastern and south-eastern territory along with the southern regions of Uzbekistan possesses the record solar energy resource potential for all territory of the former USSR.

The maps below display the direct normal insolation and global horizontal irradiation values for Turkmenistan. As previously stated and as shown in the map, Turkmenistan has significant solar resource.

Turkmenistan Solar Direct Normal Insolation (Source: NASA)



Turkmenistan Solar Global Horizontal Irradiance (Source: NASA)



Despite having high solar energy resource potential, Turkmenistan does not utilize many solar power technologies. A few solar experimentation centers have been used for food drying and water desalination purposes.

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## 6. Geothermal

The geothermal resources of Turkmenistan are poorly studied. Current information on geothermal potential in the area is only due to the tests of numerous exploration and production oil and gas wells. In Turkmenistan thermal water is not used for heat supply or

electricity generation. The geothermal brines are used at Peninsula Cheleken (Caspian Sea) for extracting halogens (iodine, bromine), lead, zinc and copper.

Geothermal reservoirs have been discovered in Upper and Lower Cretaceous formations at the Kara-Kum Basin and the Caspian Sea Coast. Convective hydrothermal systems have been investigated in the foothills of Kopet-Dag (South-West of Turkmenistan). The main geothermal areas are:

- Caspian Coast; thermal brines with temperature 80 °C, TDS 50-100 g/l, high flow rates 250-1400 l/s
- Darvaza Region (Central Kara-Kum); depth 3000-3500 m, temperature up to 100 °C, TDS 150 g/l
- Kopet-Dag Foothills; depth 2000-2500 m, temperature 70-80 °C, flow rates 15-55 l/s.

Total theoretical heat capacity of reservoirs in Upper and Lower Cretaceous formations have been estimated as 6,600 MWt for pumping operation.

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## 7. Hydroelectric

Most of Turkmenistan's hydropower potential is concentrated in Murgab and Amu-Daria river basins. The largest small hydropower potential is concentrated in the southern part of the Republic on the Murgab and Tejen rivers and Karakumy canal.

Turkmenistan has little operating capacity, approximately 5 MW. No hydroelectric power plants have been planned for the near future (UDI, 2009).

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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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