

Azerbaijan

Country Profile

- [1. Overview](#)
- [2. Policy and Incentives](#)
- [3. Wind](#)
- [4. Biomass](#)
- [5. Solar](#)
- [6. Geothermal](#)
- [7. Hydroelectric](#)
- [8. Links](#)
- [9. References](#)
- [10. Country Contacts](#)

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1. Overview of Electricity Supply

Azerbaijan is an independent country with vast potential energy resources. Slightly smaller than the state of Maine, Azerbaijan is a republic with a presidential form of government, and became an independent country in 1991. Azerbaijan is at the geographical crossroads of the Middle East, Europe and Asia – an element that is reflected in its political, economic, and commercial development. It has vast oil and gas resources from the Caspian Sea that are largely untapped and which have become attractive to other countries since its independence. This has been fueling its economy, which has been one of the fastest growing economies in the world for several years in a row. Unfortunately, the gas and oil resources have also acted to discourage more expensive renewables.

The Azerbaijan power system is the oldest and most developed in southern Caucasus region. It has an installed generating capacity of about 7,100 MW, of which thermal power stations contribute 6,100 MW and hydropower stations make up most of the balance.

Currently, 80 percent of Azerbaijan's generating power is located in the west. However, 70 percent of the power consumption is massed in the east, north-east and south-east. Therefore, fuel is transported hundreds of kilometers from the Absheron Peninsula to thermal power stations, Azerbaijan GRES and Ali Bayramli GRES. The energy produced is then transmitted to the Absheron Peninsula and from there is distributed to the northern and southern regions. As the west and east of Azerbaijan are connected by two transmission lines of 500 kV (one of which is energized at 330 kV), huge transmission losses take place. In 2008, the Asian Development bank approved a \$160 million loan to rehabilitate these transmission lines.

Though the installed design capacity of Azerbaijan Power System is approximately 7,100 MW, a significant portion of it is not actually available. The old infrastructure, deficiency of spare

parts, and lack of scheduled maintenance is the main reason for the lack of full utilization. More than 35 percent of Azerenerji power stations have been operating for more than 30 years. Many areas of the country only have electricity for limited times during the day.

Because of Azerbaijan's economic growth, the demand for electricity is expected to increase by 4.7% each year until 2015. The Asian Development Bank is working to improve the aging transmission system to prepare for this growth, including rehabilitating existing lines, as well as building new lines and substations. Over the past several years there has been some interest in renewables other than hydropower, and a few studies have been performed, but actual projects have focused on infrastructure.

Basic information about Azerbaijan and its energy sector can be found below.

Azerbaijan Country Summary Table

Demographical Information	
Population, millions (2009)	8.24
Land area, thousand sq km (2009)	86.6
Macroeconomic Information (2008)	
GDP, billion US\$	73.7
Real GDP growth rate, percent	11.6
Foreign direct investment (net), million US\$ (2007)	5,103
Electricity disposition, billion kWh (2006)	
Generation	19.19
Consumption	19.55
Exports	0.80
Imports	0.50
Generation capacity, GW (2005)	
Nuclear	0.00
Thermal	4.19
Hydro	1.03
Other renewables	0.00
Total	5.21
<small>Sources: CIA World Factbook, U.S. Energy Information Administration, United Nations Conference on Trade and Development.</small>	

A wave of privatization took place in the mid-1990s, but was then continually deferred until new privatization legislation could be passed spelling out all the regulations and possible methods and establishing a monitoring commission. The law was approved in 2000. The law allows privatization to take place by auction, preferential share sale to employees and after bankruptcy declaration. The law still allows individual privatization plans to be drawn up for strategic enterprises. It also stipulates more clearly what liabilities will be taken on by the new owner of a privatized company - economic liabilities, such as already-existing environmental damage, will not be transferred.

[\(return to top\)](#)

2. Energy Policy, Barriers and Incentives

The main energy policy objectives of Azerbaijan are:

- Modernization
- Maintaining state control

In a November 2003 decree, the President of the Republic of Azerbaijan assigned the Cabinet of Ministers of the Republic of Azerbaijan in collaboration with related state bodies to prepare and submit to the President of the Republic of Azerbaijan relevant proposals on use and development of alternative energy resources put in global practice (solar energy, wind energy, thermal waters' energy and small hydroelectric stations).

In 2009, the Tariff Council of Azerbaijan developed a wind tariff model that would make wind more attractive to investors.

Otherwise, there is a lack of interest and governmental support of renewable energy development due to favorable status of the power lobby in the country, and the dominance of the oil and gas industry. Currently, investments in pilot and demonstration projects are low, but some have expressed interest. However, a lack of technical capacity to act on these investment interests have prevented further action. Finally, the electrical infrastructure is in poor condition. Investment is currently being focused on improving the electrical infrastructure, which may make future development of renewables more accessible.

[\(return to top\)](#)

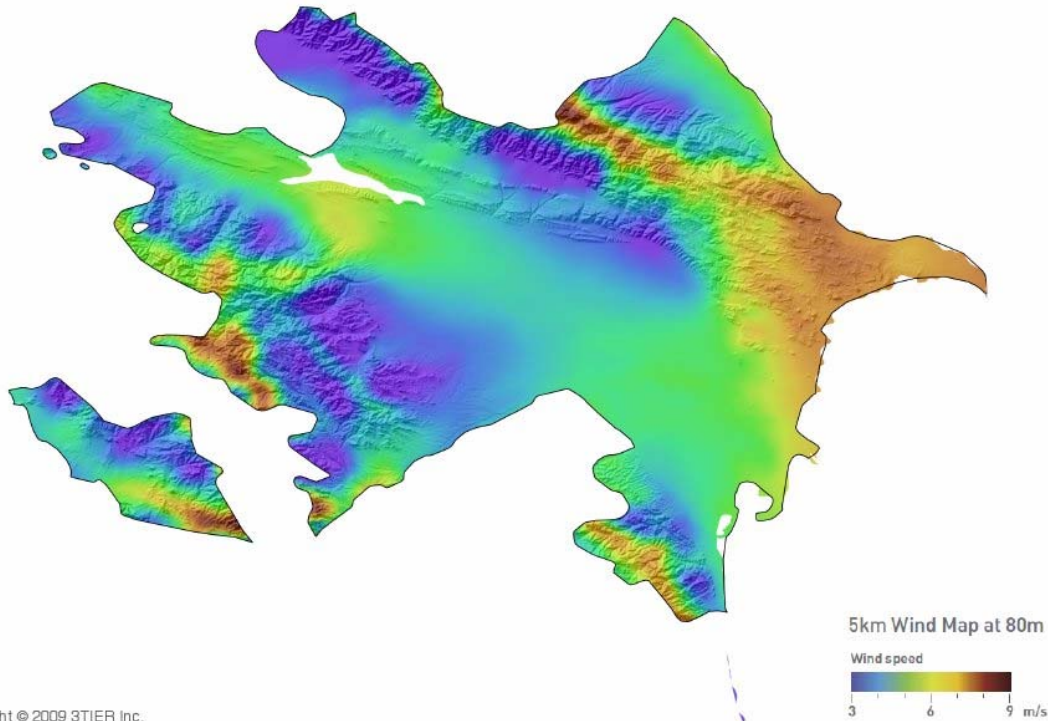
3. Wind

Although there has been little implementation of wind energy in Azerbaijan to this point, interest has been growing. In 2009, the USAID TIRSP program aided the Tariff Council in developing a wind tariff model to incentivize wind development. There are a couple of projects that have been planned, including a 20 MW farm in Gobustan that could be online in 2009, and possibly a 1-14 MW farm in the Khizi District, about 100 km west of Baku. In 2009, two 850 kW turbines went online in the Khizi region, and a third is planned. Additionally, a 105 MW farm is being developed along the highway from Baku to Guba.

The most promising sites are on the Apsheron Peninsula in the east along the Caspian Sea. Caspian Sea zone and the Kura River lower reaches and Nakhichevan Autonomous Republic also seem to have a good potential.

Below is a wind resource map of the country.

Azerbaijan Wind Map at 80m



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[\(return to top\)](#)

4. Biomass

Only a few small pilot projects using biomass have been developed in Azerbaijan. The area of forests in the country is 14,400 km², equivalent to 3.2 percent of the overall territory. There are significant agricultural operations in the country, which could provide residues for biomass combustion or gasification, as well as wastes for biogas production from animal manures. There may also be potential for methane production from landfills.

Azerbaijan is the largest amongst Republics of the former USSR and fourth in the world in production of raw cotton. The population of Azerbaijan is using the waste of cultivating cotton and cereal crops as a fuel in private household equipment. No large scale projects were identified, although it is feasible to further utilize these residues in a larger application.

The Ministry of Environment and Natural Resources of Azerbaijan has expressed interest in developing biogas energy use, and has sponsored pilot projects in Lerik, Guba, and Ismayilly, Siyaku, Nakhchivan and Piran using solar energy.

Azerbaijan Biomass Resource Data

Biomass resource type	Total production	Production density
Total land area covered by	(avg. 2006–2007, km ²)	(avg. 2006–2007, %)
Arable Land	18,477	21
Permanent Crops	2,229	3
Permanent Meadows and Pastures	26,857	31
Forest Area	9,360	11
Other Land	25,711	30
Inland Water	3,967	5
Primary crop production	(avg. 2006–2007, tonne)	(tonne / 100 km ²)
Total primary crops (rank among COO)	5,687,438 (17)	6,581 (16)
Top 10 primary crops		
Wheat	1,397,114	1,617
Potatoes	1,161,170	1,344
Tomatoes	444,085	514
Barley	439,434	509
Watermelons	386,460	447
Vegetables fresh nes	219,982	255
Onions, dry	187,545	217
Apples	179,014	207
Cucumbers and gherkins	177,052	205
Maize	152,054	176
Animal units, number	(avg. 2006–2007, number)	(number / 100 km ²)
Cattle	7,068,475	8,179
Poultry	6,355,281	7,354
Pigs	14,922	17
Equivalent animal units	2,286,861	2,646
Annual roundwood production	(2006–2007, m ³)	(m ³ / 1000 km ²)
Total	6,510	7.5
Fuel	3,200	3.7
Industrial	3,300	3.8
Wood-based panels	20	0
	(2006–2007, tonne)	(tonne / 1000 km ²)
Paper and paperboard	1,600	1.9
Recovered paper	0	0

Source: Food and Agriculture Organization of the United Nations

[\(return to top\)](#)

5. Solar

Although no large scale solar power has been installed in Azerbaijan, the solar energy potential is very high due to the favorable climatic conditions. However, due to the high cost

of solar compared to Azerbaijan's other energy resources, adoption has been slow. The Ministry of Industry and Energy envisions commissioning solar stations in the Absheron Peninsular, as well as the Nakhchivan Autonomous Republic and Mil-Mughan region.

The data below references three locations in Azerbaijan: Artem-Island, Minguechaur and Nakhichevan. The first is located near Apsheron at Caspian Coast, the second, in the Northwest part of the country, and the third is located in the Azerbaijan enclave between Armenia and Iran.

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

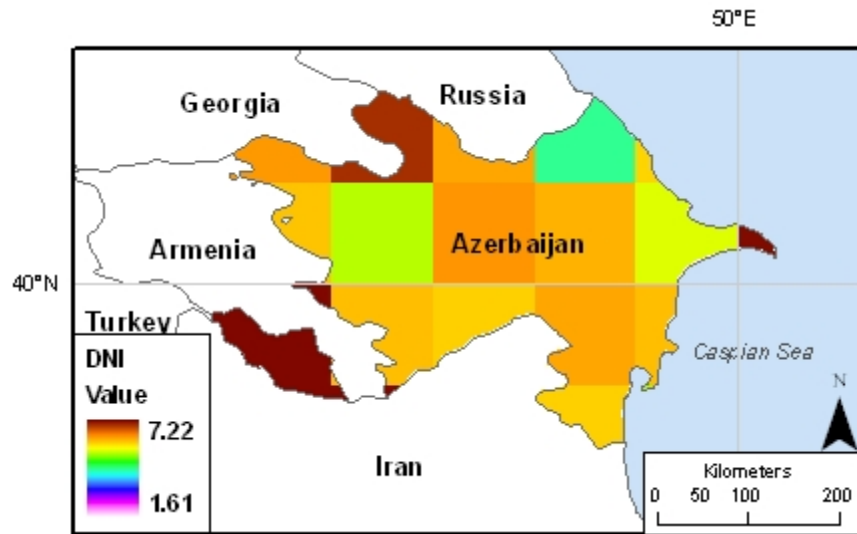
Location	Artem- Island	Minguechaur	Nakhichevan
Jan	176	178	221
Feb	228	234	297
Mar	378	361	456
Apr	552	503	565
May	737	667	714
Jun	804	712	812
Jul	801	722	850
Aug	707	632	769
Sep	512	458	609
Oct	403	345	439
Nov	222	196	279
Dec	159	150	193
Yearly	5679	5158	6204

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

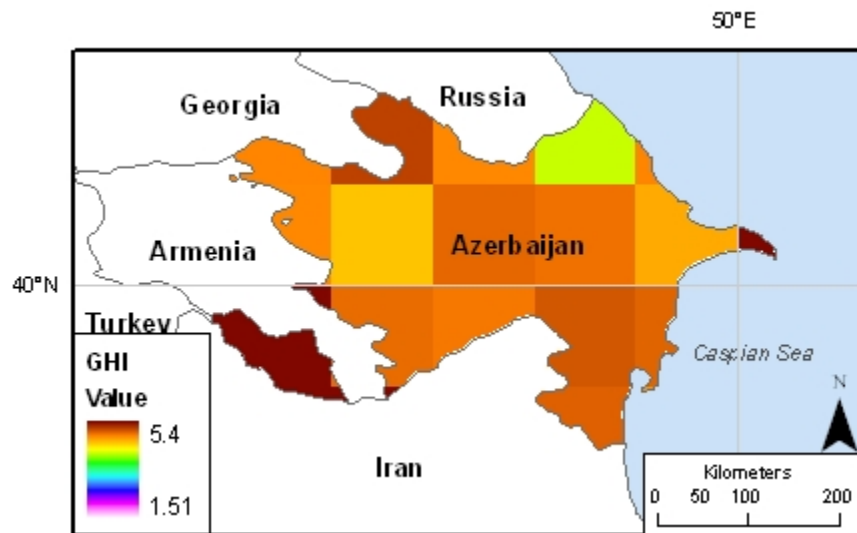
Location	Artem- Island	Minguechaur	Nakhichevan
Jan	177	210	209
Feb	181	246	265
Mar	251	292	430
Apr	433	395	469
May	630	534	643
Jun	774	622	842
Jul	745	632	895
Aug	662	573	838
Sep	506	444	756
Oct	337	391	579
Nov	206	236	383
Dec	162	193	232
Yearly	5064	4760	6541

The solar energy resource potential is high throughout practically the entire territory of Republic. It is especially high in the areas of Apsheron and Nakhichevan. The figures below display the direct normal and global horizontal irradiation values for Azerbaijan.

Azerbaijan Solar Direct Normal Insolation (Source: NASA)



Azerbaijan Solar Global Horizontal Irradiance (Source: NASA)



[\(return to top\)](#)

6. Geothermal

The exploration and evaluation activities in Azerbaijan indicate a high potential for geothermal development. Prospective sources are recommended for therapeutic baths, industrial, and energy applications. Current use of geothermal energy in Azerbaijan is entirely thermal, as there are no geothermal power plants. Use of thermal waters for greenhouse heating in the Lenkoran region, Kuraside zone (Djarly, Muradkhanly, Sor-Sor), Gandja, and Yalama-Khudat regions are found to be promising; the high mineral content of these waters (more than 15 g/l) is typical.

The production capacity of the Lenkoran, Massaly, and Astara regions is estimated to be about

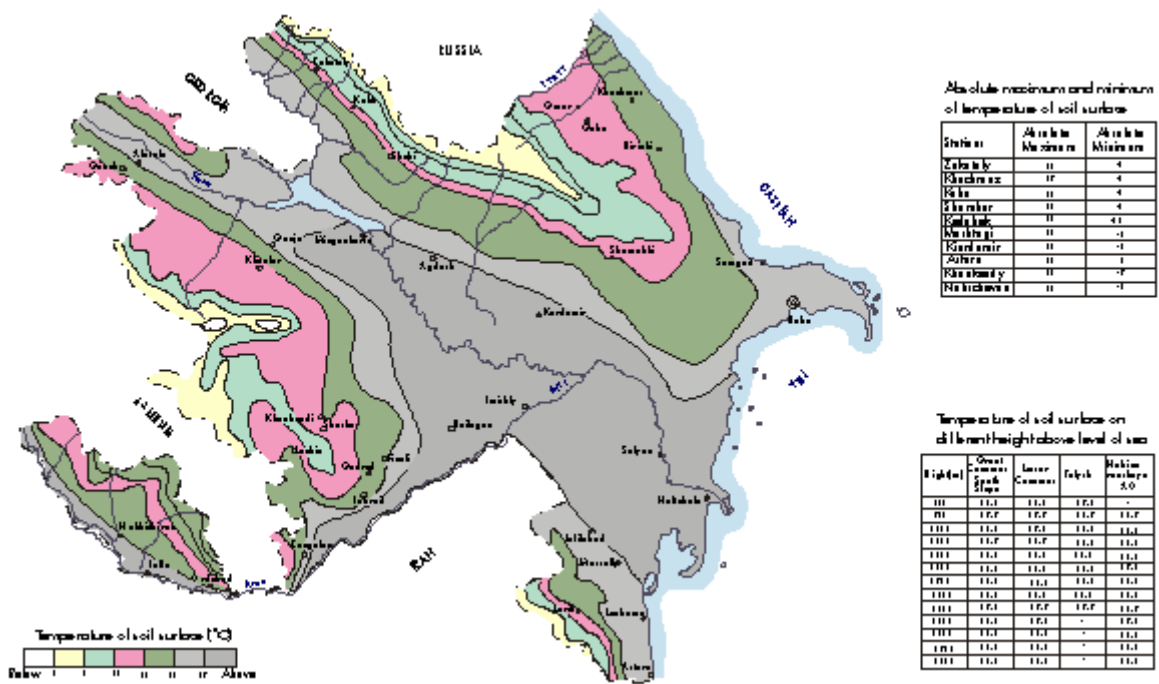
25,000 m³ day. Wells have produced waters with wellhead temperatures of 40°C and rates of 40 l/s.

Geothermal resources of Azerbaijan are represented by thermal water of low and middle temperature (35-65°C). The thermal water is extracted from natural sources. It is used for heating greenhouses and in balneology (settlement Istisu at west of the country and in the area of Lenkoran lowland). It is planned to use thermal water in city Gandzha for heating the rooms. There is no data on overall used thermal power.

The reserves of thermal water were discovered and partially studied with exploration drilling for oil and gas. The generalization of these data in Atlas of thermal water resources in the USSR allowed to allocate the prospective water-containing complexes in Kura and Kusaro-Divichinsk troughs.

In addition at Apsheron Peninsula the inflows of thermal water were obtained with temperatures of 60°C from exploration oil wells.

[insert image of new geothermal map]



Geothermal Resource Map for Azerbaijan

[\(return to top\)](#)

7. Hydroelectric

Azerbaijan has about 1000 MW of operating hydropower, and an additional 62 MW of planned hydropower (Source: UDI, June 2009). The largest hydroelectric power plant is the 402 megawatt (MWe) Mingachevir facility on the Kura River. There are presently three hydroelectric power plants of more than 100 MWe capacity in Azerbaijan, all of which are on the Kura.

Average annual hydropower generation in Azerbaijan amounts to 2.5 kWh (2006), about 1.5% of the energy supply. The developed hydro potential accounts for one tenth of gross theoretical value.

Potential hydro resources of Azerbaijan are rather scarce, but by concentration of hydro resources on the territory the potential is significant as compared to other CIS countries.

Water resources of Azerbaijan are presented by:

- the lower reaches of the Kura River with its multiple tributaries
- the Aras River (the Kura tributary), which is on the border
- a group of creeks inflowing into the Caspian Sea

Small hydropower development is the most promising in power sector. Under existing conditions it is technically and economically feasible to develop vast potential of small creeks, use drops on the irrigation canals, water releases from reservoirs, which will permit construction of small HPPs on the territory of the Republic with combined capacity of about 240 thou.kWh. The UNDP is promoting small hydro development in Azerbaijan with a project from 2007-2010 that has a budget of around \$1.5M, provided by Norway.

Further hydro development of the Republic is connected with significant available economically feasible hydropower capability. There is a Master Plan of hydropower development of the Republic.

Nakhchivan Autonomous Republic has been in an energy deficit since 1990. At present the Nakhchivan local power system is isolated from the rest of Azerbaijan and it is feasible to start small hydro development on the territory.

Favorable Factors for Development of Hydro Potential

- Deficit of fuel and escalation of organic fuel prices.
- Yearly growth of electricity consumption in the country.
- Azerbaijan Ministry of Economic Development is working at privatization of small hydro.

[\(return to top\)](#)

8. Relevant Links

Please see webpage for relevant links.

[\(return to top\)](#)

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[\(return to top\)](#)

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.

[\(return to top\)](#)