

Solar Power Potential of the Central Asian Countries

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ABSTRACT

This data compilation surveys the solar energy potential of the five Central Asian countries: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. It also provides data on installed and planned solar power capacity in these countries.

Keywords: solar power, renewable energy, Central Asia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan

Background

Even with a photovoltaic (PV) solar conversion efficiency rate of less than 10%, the total amount of solar irradiation received by the Central Asian countries of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan, is sufficient to generate 20 times more electricity than these countries currently generate.

While the world is facing a transition from fossil fuels to renewables,¹ the renewable energy power potential of the Central Asian countries has received little attention in the academic literature and the media. Therefore, the Central Asia Data-Gathering and Analysis Team (CADGAT) is producing a series of datasets on renewable energy in Central Asia to help provide a basis for further research in this area. These data are also available in a unified database in Excel format from:

<http://osce-academy.net/en/research/cadgat/>

Data collection

The empirical work for this data article was carried out between September 2018 and January 2019, and the figures presented here reflect the data available during that period. Data were obtained and prepared based on the National Renewable Energy Laboratory (NREL) data on Direct Horizontal Irradiation. Installed and planned solar power facilities are collected from various national and international sources.

Key findings

To date, there have been more solar than wind power developments in Central Asia. Kazakhstan leads on installed capacity, followed by Uzbekistan.

Due to its vast territory, almost two thirds of Central Asia's theoretical solar power potential is in Kazakhstan. However, Turkmenistan and Uzbekistan have significantly more intense solar irradiation, with the largest areas categorized as the highest possible level, class 10.

¹ O'Sullivan et al. (2017) *The Geopolitics of Renewable Energy*. Working Paper. Harvard University, Columbia University and Norwegian Institute of International Affairs (NUPI).

https://www.researchgate.net/publication/317954274_The_Geopolitics_of_Renewable_Energy

Theoretical solar power potential in Central Asia (in kWh/year and TWh/year)

Aggregate solar power potential of the Central Asian countries		
	kWh/year	TWh/year
Kazakhstan	6684.3×10^9	6684.3
Kyrgyzstan	537.3×10^9	537.3
Tajikistan	410.1×10^9	410.1
Turkmenistan	1483.7×10^9	1483.7
Uzbekistan	1195.0×10^9	1195.0

Breakdown of aggregate solar power potential into classes according to level of solar irradiation				
	Class	kWh/m ² /day	kWh/year	TWh/year
Kazakhstan	7	3.5 - 4.0	989.6×10^9	989.6
Kazakhstan	8	4.1 - 4.5	3723.8×10^9	3,723.8
Kazakhstan	9	4.6 - 5.0	1875.1×10^9	1,875.1
Kazakhstan	10	5.1 - 5.5	95.2×10^9	95.2
Kazakhstan	11	5.6 - 6.0	0.6×10^9	0.6
Kyrgyzstan	8	4.1 - 4.5	54.6×10^9	54.6
Kyrgyzstan	9	4.6 - 5.0	268.4×10^9	268.4
Kyrgyzstan	10	5.1 - 5.5	210.9×10^9	210.9
Kyrgyzstan	11	5.6 - 6.0	3.4×10^9	3.4
Tajikistan	9	4.5 - 5.0	124.9×10^9	124.9
Tajikistan	10	5.0 - 5.5	200.7×10^9	200.7
Tajikistan	11	5.5 - 6.0	84.2×10^9	84.2
Tajikistan	12	6.0 - 6.5	0.4×10^9	0.4
Turkmenistan	8	4.0 - 4.5	50.2×10^9	50.2
Turkmenistan	9	4.6 - 5.0	791.5×10^9	791.5
Turkmenistan	10	5.1 - 5.5	642.0×10^9	642.0
Uzbekistan	8	4.0 - 4.5	35.4×10^9	35.4
Uzbekistan	9	4.6 - 5.0	916.1×10^9	916.1
Uzbekistan	10	5.1 - 5.5	243.5×10^9	243.5

Note: The data represent total potential solar energy per year as a function of land area per solar irradiation class (kWh/m²/day). Each solar class correlates to a specific 0.5 kWh/m²/day range. Energy is calculated by multiplying the productive land by the class, conversion efficiency and number of days per year. In this case, a standard calendar year of 365 days was used. A conversion efficiency rate applied was 10%.

Installed solar power projects in Central Asia**Kazakhstan**

Name/Project description	Location	Installed capacity	Year	Funding
Burnoye Solar-1 LLC; Solar PV station "Burnoe"	Jualynskiy region, Jambyl oblast	50 MW	2014	Samruk Kazyn Investment Foundation
Samruk-GreenEnergy LLC	Kapshagay city, Almaty oblast	2 MW	2014	Samruk Kazyna Investment Foundation
Burnoe-Solar-2 LLP	Jualynskiy region, Jambyl oblast	50 MW	2016	Samruk Kazyn Investment Foundation
Bayken-U LLP	Janakorgan region, Kyzylorda oblast	0.3 MW	2017	KazAtomProm
Samruk-Green Energy LLP	Kapshagay city, Almaty oblast	0.4 MW	2017	Samruk Kazyn Investment Foundation
SKZ-U LLC	Janakorgan region, Kyzylorda oblast	0.4 MW	2014	Own funds
Aksu-Energo LLP; SES Akbay	Sayram region, South Kazakhstan Oblsat	1.MW	2015	UND and public funding
Aksu-Energo LLP; SES Ochistnoy	Shymkent city, South Kazakhstan Oblast	1 MW	2015	Settlement and Financial Center for Support of Renewable Energy Sources
GroupIndependent LLP	Munayly region, Mangystau Oblast	2 MW	2016	Public loan under a governmental program for business support

Kyrgyzstan

Name/Project description	Location	Installed capacity	Year	Funding
Solar thermal collectors installed by the Bishkekteploenergo municipal utility (pilot project)	Bishkek city	0.5 MW	2017	The total cost of the project is 14.8 million soms. Funding is distributed as follows: Republican Fund for Environmental Protection – 10.6 mln soms; "Bishkekteploenergo" utility – 4.2 mln soms
Solar-PV powered housing in the remote village of Ken-Suu village in the Djumgal district	Naryn oblast	15 x 300W	2018	ADB funded

Tajikistan

We are not aware of any solar power stations in Tajikistan at the current time.

Turkmenistan

Name/Project description	Location	Installed capacity	Year	Funding
Solar desalination plants for the desalination of salt water in wind-solar complexes for transhumance	Garagum desert: Cherkezli and Ovez-Shyh small lands	Information not available	During the Soviet period.	County budget (based on information from the Scientific institute "Gun" (Sun))
The creation of a health complex on the basis of energy sources in the Caspian area. Projects have been started to create a "solar village" in which all life-support systems, including waste disposal systems, will be operated with the help of solar power plants.		Information not available	Information not available	The United Nations Educational, Scientific and Cultural Organization (UNESCO) tender
A wind and energy unit for a local secondary school	Balkan velayat (region), Gyzylysu island in the Caspian Sea	5 kW	During the Soviet period	County budget
A grant to investigate "the possibility of producing silicon from the Karakum sand for photovoltaic converters" was obtained by the scientific institute, "Gun". This project produced the first sample of silicon from quartz sand in the Karakum desert using solar energy.		Information not available	Information not available	Islamic Development Bank

Uzbekistan

Name/Project description	Location	Installed capacity	Year	Funding
Bukhara - Kandym Solar Power Plant	Bukhara region	1.2 MW	2016	UzbekEnerg
Namangan Pilot Solar Power Plant	Namangan region	0.4 MW	2016	UzbekEnerg
Tashkent - International Solar Energy Institute	Tashkent city	02. MW	2016	International Solar Energy Institute (ISEI) and various donors

Planned solar power projects in Central Asia

Kazakhstan	
Name	Description
Promondis Kazakhstan LLP	Construction of a solar-PV station with a capacity of 35 MW in a rural district of Koksarai in the South Kazakhstan region
KazSolar 50 LLP	Construction of a solar-PV station “Akadir ” in the Shet district of the Karaganda region with a capacity of 50 MW
KPM-Delta LLP	Construction of a solar-PV station with a capacity of 40 MW in the area of the village of Gulshat, in the Karaganda region
YK SES 50 LLP	Construction of a solar-PV station with a capacity of 50 MW in the Sholakkorgan Settlement of the Sozak District in the South Kazakhstan region
LJangiz Solar LLP	Construction of a 30 MW solar-PV station in the Zharminsky District of the East Kazakhstan region
SES Saran LLP	Construction of a solar-PV station with a capacity of 100 MW in the city of Saran in the Karaganda region
Solar Power Kapshagay LLP	Construction of a solar-PV station with a capacity of 50 MW in the Almaty region
KB Enterprises LLP	Construction of a solar-PV station with a capacity of 100 MW in the Shu district of the Zhambyl region
M-KAT Green LLP	Construction of a solar-PV station with a capacity of 100 MW in the Tselinograd district of the Akmola region
Kaz Green Tek SOLAR LLP	Construction of a solar-PV station with a capacity of 14 MW in Arys South Kazakhstan region (SKR)
Eco Pro Tech-Astana LLP	Construction of a solar-PV station with a capacity of 20 MW in Zylginsky /in the vicinity of SKR
Baikonyr Solar LLP	Construction of a Baikonur solar-PV station with a capacity of 50 MW in the Kyzylorda region
Companiya KaDi LLP	Construction of a 4.8 MW solar-PV station in the vicinity of Zhetysay
Nomad Solar LLP	Construction of a 28 MW solar-PV station in the Zhalagash district of the Kyzylorda region
ENVERSE KUNKUAT LLP	Solar-PV station with a capacity of 100 MW in the vicinity of Kapshagay in the Almaty region
Almaty Energo Project LLP	Construction of a solar-PV station with a capacity of 4.95 MW in the vicinity of Ushtobe in the Almaty region
Injenernaya Arena LLP	Construction of a heat and power plant with a capacity of 4.95 MW in the Maktaral district of SKR
Kapshagay Solar Park LLP	Construction of a solar-PV station with a capacity of 4.95 MW in the village of Sarybulak in the Almaty region
URBASOLAR SAS	Construction of a solar-PV station with a capacity of 5 MW in the Zhanakorgan district of the Kyzylorda region
TechnoBazalt LLP	Construction of a 3 MW solar-PV station in Kapchagai in the Almaty region
Hydroenergy Company JSC	Construction of a solar-PV station with a capacity of 10 MW in the Zhanakorgan district of the Kyzylorda region

Mistral Energy LLP	Construction of a solar-PV station with a capacity of 50 MW in the area of the town of Kapshagai in the Almaty region
Dala Solar LLP	Construction of a solar-PV station with a capacity of 2 MW in the Otyrar district of the Turkestan region
Hydroenergy Company JSC	Construction of a solar-PV station with a capacity of 10 MW in the Zhanakorgan district of the Kyzylorda region
DSTO Solar LLP	Construction of a 10 MW solar-PV station in the Tolebi district of the Turkestan region
KK-KIUNSEN LLP	Construction of a 10 MW solar-PV station in the Baidibek district of the Turkestan region
Hydroenergy company JSC	Construction of a solar-PV station with a capacity of 50 MW in the Zhambyl region
Avelar Solar Technology Ltd.	Construction of a solar-PV station with a capacity of 20 MW in Shymkent
Shell Kazakhstan B.V. Branc	Construction of a solar-PV station with a capacity of 50 MW in the Baidibek district of the Turkestan region

Kyrgyzstan

No planned solar power stations are known in Kyrgyzstan to date.

Tajikistan

No planned solar power stations are known in Tajikistan to date.

Turkmenistan

No planned solar power stations are known in Turkmenistan to date.

Uzbekistan

Name	Description
100 MW Samarkand solar-PV station	UzbekEnergo project planned in the Samarkand region under an ADB loan; planned for completion in 2016 (postponed).
100 MW Sherobod solar-PV station	UzbekEnergo project planned in the Surkhandarya region under an ADB loan; planned for completion in 2017 (postponed).
100 MW Guzar solar-PV station	UzbekEnergo project planned in the Kashkadaryo region under an ADB loan; planned for completion in 2018 (postponed).
100 MW Navoi solar-PV station	UzbekEnergo project planned in the Navoi region under an ADB loan; planned for completion in 2019.
100 MW Pap solar-PV station	UzbekEnergo project planned in the Namangan region under an ADB loan; planned for completion in 2019.

About CADGAT and Central Asia Regional Data Review

The Norwegian Institute of International Affairs (NUPI) and the OSCE Academy established the Central Asia Data-Gathering and Analysis Team (CADGAT) in 2009. The purpose of CADGAT is to produce new cross-regional data on Central Asia that can be used free of charge by researchers, journalists, NGOs, government employees, and students, both inside and outside the region. The data articles can be found at <http://osce-academy.net/en/research/cadgat/>

The following CADGAT data articles have been published:

1. Hydroelectric dams and conflict in Central Asia
2. The narcotics trade and related issues in Central Asia
3. Language use and language policy in Central Asia
4. The transportation sector in Central Asia
5. Road transportation in Central Asia
6. Gender and politics in Central Asia
7. Political relations in Central Asia
8. Trade policies and major export items in Central Asia
9. Intra-regional trade in Central Asia
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11. Holidays in Central Asia. Part I: Laws and official holidays
12. Holidays in Central Asia. Part II: Professional and working holidays
13. Media in Central Asia: Print media
14. Media in Central Asia: TV
15. Media in Central Asia: Radio
16. Renewable energy policies of the Central Asian countries
17. Wind power potential of the Central Asian countries
18. Solar power potential of the Central Asian countries

CADGAT has also produced a database on Elites in Central Asia, which can be found at <http://osce-academy.net/dbelite/>



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