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, 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.

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

<table>
<thead>
<tr>
<th>Aggregate solar power potential of the Central Asian countries</th>
<th>kWh/year</th>
<th>TWh/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kazakhstan</td>
<td>6684.3 × 10⁹</td>
<td>6684.3</td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>537.3 × 10⁹</td>
<td>537.3</td>
</tr>
<tr>
<td>Tajikistan</td>
<td>410.1 × 10⁹</td>
<td>410.1</td>
</tr>
<tr>
<td>Turkmenistan</td>
<td>1483.7 × 10⁹</td>
<td>1483.7</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>1195.0 × 10⁹</td>
<td>1195.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Breakdown of aggregate solar power potential into classes according to level of solar irradiation</th>
<th>Class</th>
<th>kWh/m²/day</th>
<th>kWh/year</th>
<th>TWh/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kazakhstan</td>
<td>7</td>
<td>3.5 - 4.0</td>
<td>989.6 × 10⁹</td>
<td>989.6</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>8</td>
<td>4.1 - 4.5</td>
<td>3723.8 × 10⁹</td>
<td>3723.8</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>9</td>
<td>4.6 - 5.0</td>
<td>1875.1 × 10⁹</td>
<td>1875.1</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>10</td>
<td>5.1 - 5.5</td>
<td>95.2 × 10⁹</td>
<td>95.2</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>11</td>
<td>5.6 - 6.0</td>
<td>0.6 × 10⁹</td>
<td>0.6</td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>8</td>
<td>4.1 - 4.5</td>
<td>54.6 × 10⁹</td>
<td>54.6</td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>9</td>
<td>4.6 - 5.0</td>
<td>268.4 × 10⁹</td>
<td>268.4</td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>10</td>
<td>5.1 - 5.5</td>
<td>210.9 × 10⁹</td>
<td>210.9</td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>11</td>
<td>5.6 - 6.0</td>
<td>3.4 × 10⁹</td>
<td>3.4</td>
</tr>
<tr>
<td>Tajikistan</td>
<td>9</td>
<td>4.5 - 5.0</td>
<td>124.9 × 10⁹</td>
<td>124.9</td>
</tr>
<tr>
<td>Tajikistan</td>
<td>10</td>
<td>5.0 - 5.5</td>
<td>200.7 × 10⁹</td>
<td>200.7</td>
</tr>
<tr>
<td>Tajikistan</td>
<td>11</td>
<td>5.5 - 6.0</td>
<td>84.2 × 10⁹</td>
<td>84.2</td>
</tr>
<tr>
<td>Tajikistan</td>
<td>12</td>
<td>6.0 - 6.5</td>
<td>0.4 × 10⁹</td>
<td>0.4</td>
</tr>
<tr>
<td>Turkmenistan</td>
<td>8</td>
<td>4.0 - 4.5</td>
<td>50.2 × 10⁹</td>
<td>50.2</td>
</tr>
<tr>
<td>Turkmenistan</td>
<td>9</td>
<td>4.6 - 5.0</td>
<td>791.5 × 10⁹</td>
<td>791.5</td>
</tr>
<tr>
<td>Turkmenistan</td>
<td>10</td>
<td>5.1 - 5.5</td>
<td>642.0 × 10⁹</td>
<td>642.0</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>8</td>
<td>4.0 - 4.5</td>
<td>35.4 × 10⁹</td>
<td>35.4</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>9</td>
<td>4.6 - 5.0</td>
<td>916.1 × 10⁹</td>
<td>916.1</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>10</td>
<td>5.1 - 5.5</td>
<td>243.5 × 10⁹</td>
<td>243.5</td>
</tr>
</tbody>
</table>

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

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

#### Kyrgyzstan

<table>
<thead>
<tr>
<th>Name/Project description</th>
<th>Location</th>
<th>Installed capacity</th>
<th>Year</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar thermal collectors installed by the Bishkekteploenergo municipal utility (pilot project)</td>
<td>Bishkek city</td>
<td>0.5 MW</td>
<td>2017</td>
<td>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; &quot;Bishkekteploenergo&quot; utility – 4.2 mln soms</td>
</tr>
<tr>
<td>Solar-PV powered housing in the remote village of Ken-Suu village in the Djumgal district</td>
<td>Naryn oblast</td>
<td>15 x 300W</td>
<td>2018</td>
<td>ADB funded</td>
</tr>
</tbody>
</table>

#### Tajikistan

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

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

### Uzbekistan

<table>
<thead>
<tr>
<th>Name/Project description</th>
<th>Location</th>
<th>Installed capacity</th>
<th>Year</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bukhara - Kandym Solar Power Plant</td>
<td>Bukhara region</td>
<td>1.2 MW</td>
<td>2016</td>
<td>UzbekEnergo</td>
</tr>
<tr>
<td>Namangan Pilot Solar Power Plant</td>
<td>Namangan region</td>
<td>0.4 MW</td>
<td>2016</td>
<td>UzbekEnergo</td>
</tr>
<tr>
<td>Tashkent - International Solar Energy Institute</td>
<td>Tashkent city</td>
<td>02. MW</td>
<td>2016</td>
<td>International Solar Energy Institute (ISEI) and various donors</td>
</tr>
</tbody>
</table>
Planned solar power projects in Central Asia

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 MW Samarkand solar-PV station</td>
<td>UzbekEnergo project planned in the Samarkand region under an ADB loan; planned for completion in 2016 (postponed).</td>
</tr>
<tr>
<td>100 MW Sherobod solar-PV station</td>
<td>UzbekEnergo project planned in the Surkhandarya region under an ADB loan; planned for completion in 2017 (postponed).</td>
</tr>
<tr>
<td>100 MW Guzar solar-PV station</td>
<td>UzbekEnergo project planned in the Kashkadarya region under an ADB loan; planned for completion in 2018 (postponed).</td>
</tr>
<tr>
<td>100 MW Navoi solar-PV station</td>
<td>UzbekEnergo project planned in the Navoi region under an ADB loan; planned for completion in 2019.</td>
</tr>
<tr>
<td>100 MW Pap solar-PV station</td>
<td>UzbekEnergo project planned in the Namangan region under an ADB loan; planned for completion in 2019.</td>
</tr>
</tbody>
</table>
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
10. Trade barriers and tariffs in Central Asia
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/