

SOLAR ENERGY IN UZBEKISTAN

OPPORTUNITIES AND CHALLENGES

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UZBEKISTAN



Population: 32,387 thousand
 GDP per capita: \$ 1,533
 GDP growth rate: 5.2%



Doing business: 67.40 (Rank 76) ↑
 TI Corruption Perception Index: 23 (Rank 158) ↑
 OECD Country Credit Risk: 5 ↑

Population growth rate World vs Uzbekistan, Source: World Bank

Literacy rate 99.99%
 Urbanized population 36.2%

UZBEKISTAN - ENERGY

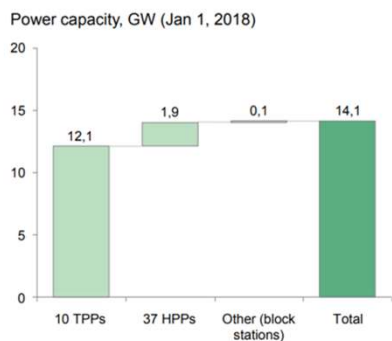


Energy consumption per capita, Source: World Bank

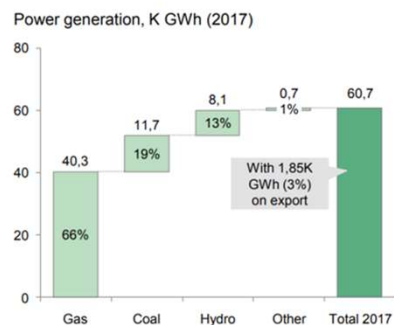


Fossil fuel energy consumption, Source: World Bank

Total installed capacity for power generation is ~14 gigawatts



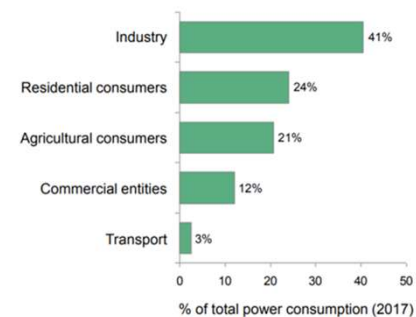
Generation is ~60K GWh with 2/3 coming from gas



Power transmission system includes ~23K km of lines



86% of total power consumed by industry, residential and agro consumers



Power generation and transmission in Uzbekistan, Source: Uzbekistan electro energy concept 2030

Central Asian Power Systems

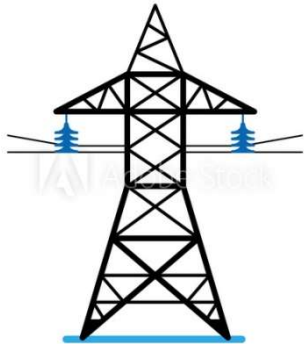


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Challenges to overcome



- Low efficiency of TPPs
- Poor assets condition
- Location of power assets



- Poor assets condition
- High level of losses



- Low tariffs
- High debt rate

1. Transmission Lines and Substations by Voltage, Length/Quantity, and Age

Voltage (kV)	Length (km)/Quantity	Average Age (years)
Transmission Lines	(length)	
500	2,257	28
220	6,079	30
110	15,300	28
Substations	(quantity)	
500	5	25–30
220	70	25–40

(2013) Uzbekistan: Energy/Power Sector Issues Note; and Uzbekenergo Joint Stock Company

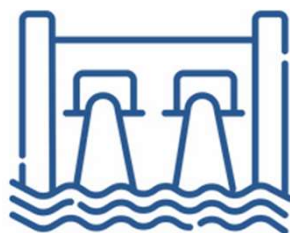
Electricity price:

- for industrial sector - \$0.044/kWh
- for households - \$0.033/kWh*

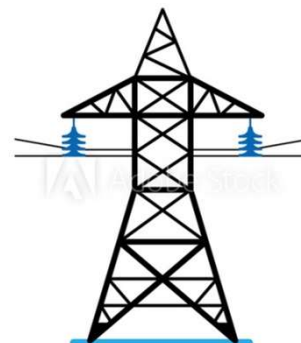
*the prices will apply starting from 1 June 2019



7 TPPs
**3 Combined heat and
power plants**



29 HPPs



7 HV
transmission
networks



14 regional
branches

UZBEKISTAN – SOLAR ENERGY

Resource assessment
(Asian Development Bank)



Solar resource assessment on 6 selected sites based on:

- Evaluation of expectable irradiation (global horizontal and direct beam) from publicly available sources
- Acquisition of satellite data for long-term evaluation
- Installation and operation of Automatic Weather Stations for measurement of meteorological data on ground
- Adjustment of satellite data with measurements from ground stations
- Detailed data analysis with derivation of expectable long-term annual mean values for global and direct beam irradiation, evaluation of data uncertainty and generation of TMYs for each site

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Resource assessment
(Asian Development Bank)

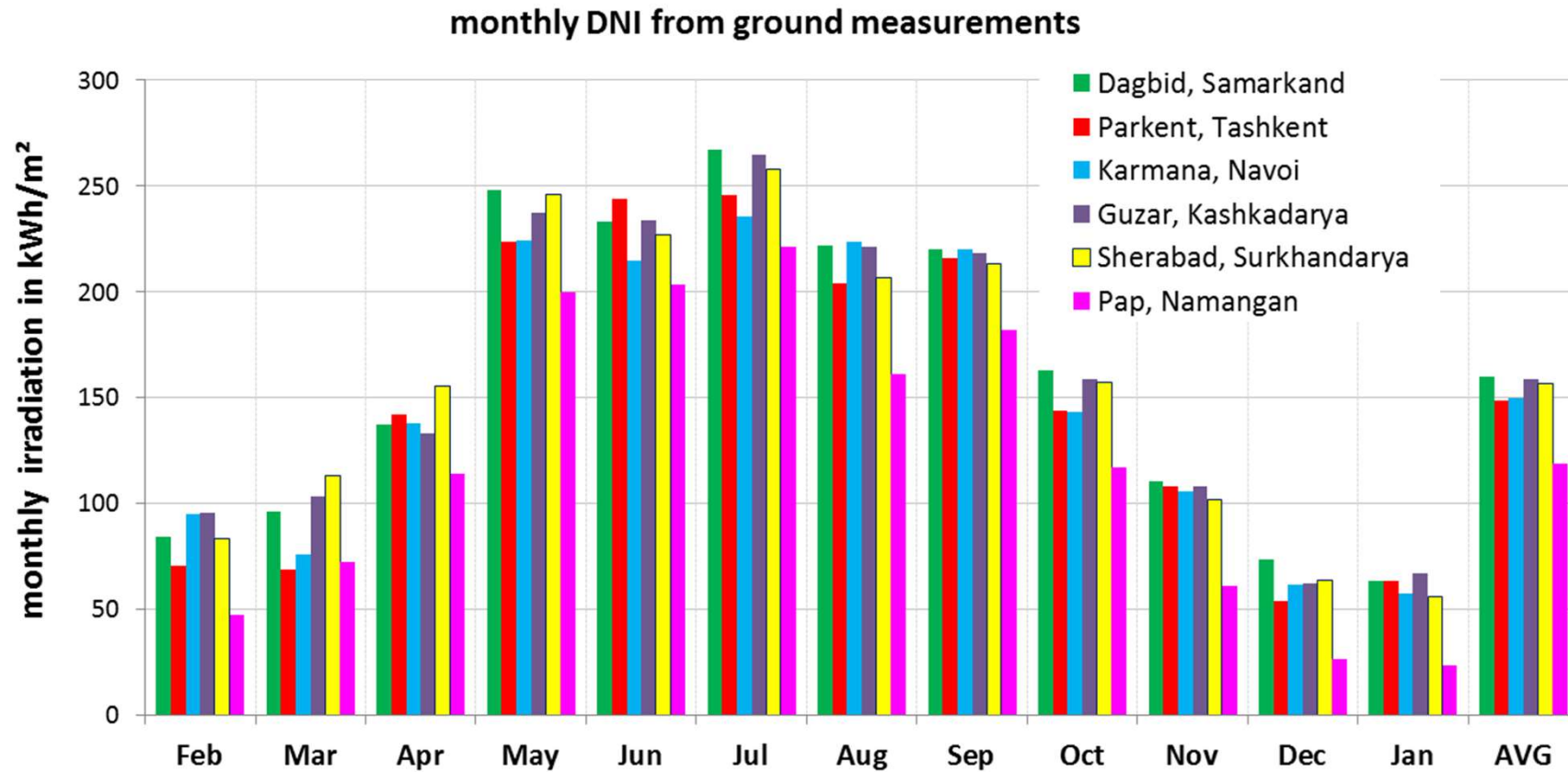


- Dagbid (Samarkand)
- Parkent (Tashkent)
- Karmana (Navoi)
- Guzar (Kashkardarya)
- Sherabad (Surkhandarya)
- Pap (Namangan)



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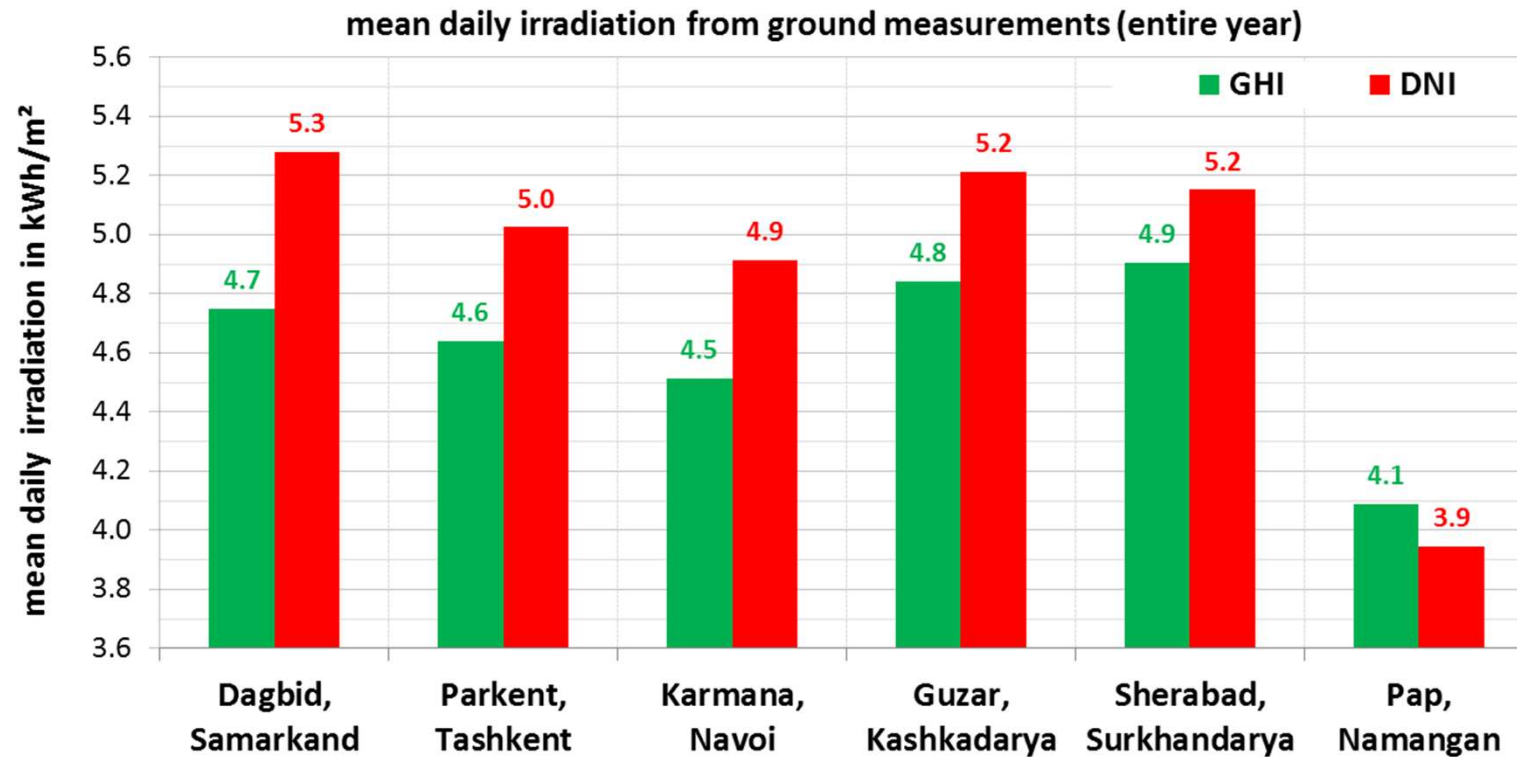
Measured monthly DNI from Feb 2013 to Jan 2014



UZBEKISTAN – SOLAR ENERGY

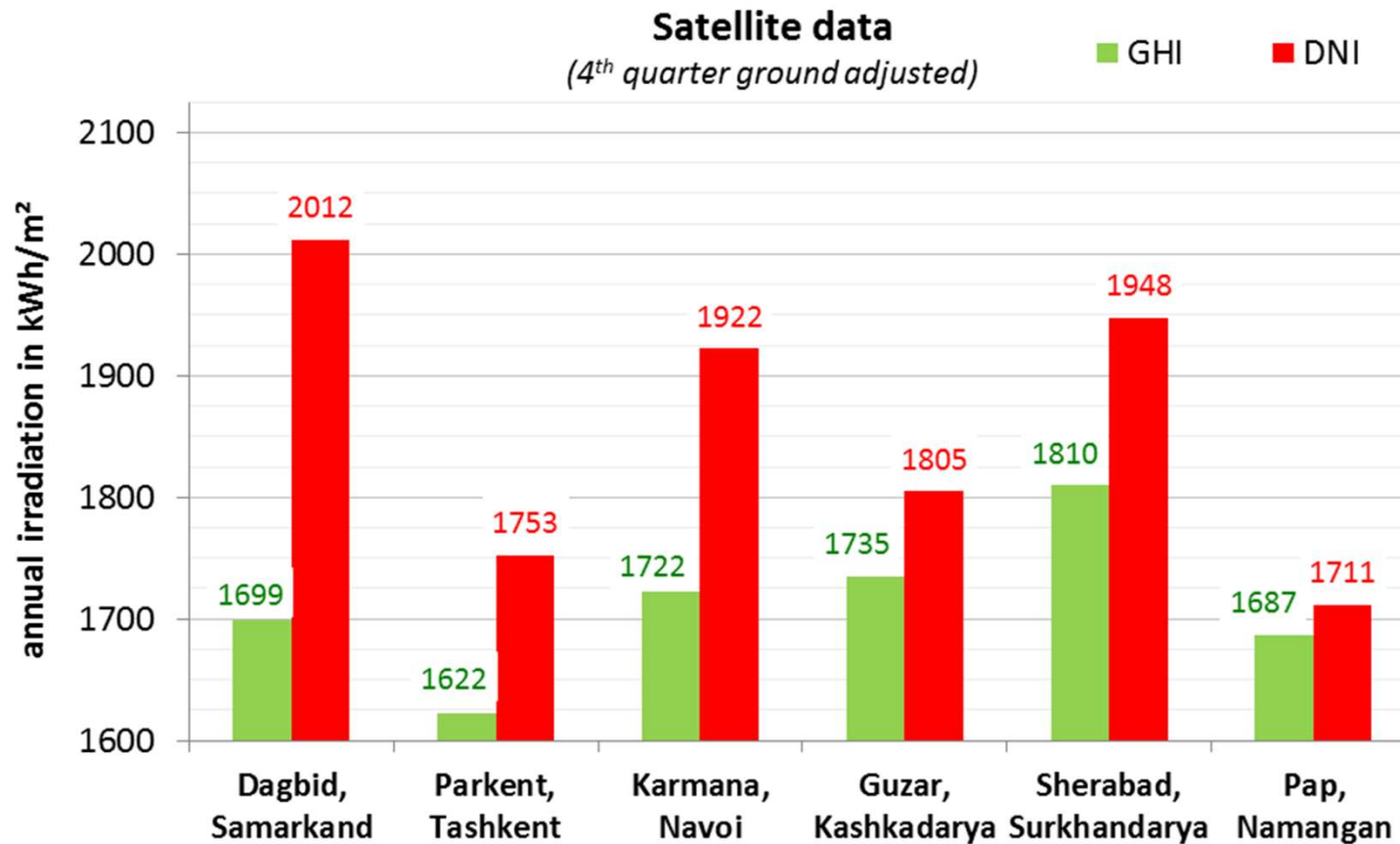
Mean daily irradiation for all 6 sites derived from long-term satellite data

(12 months ground data adjusted):



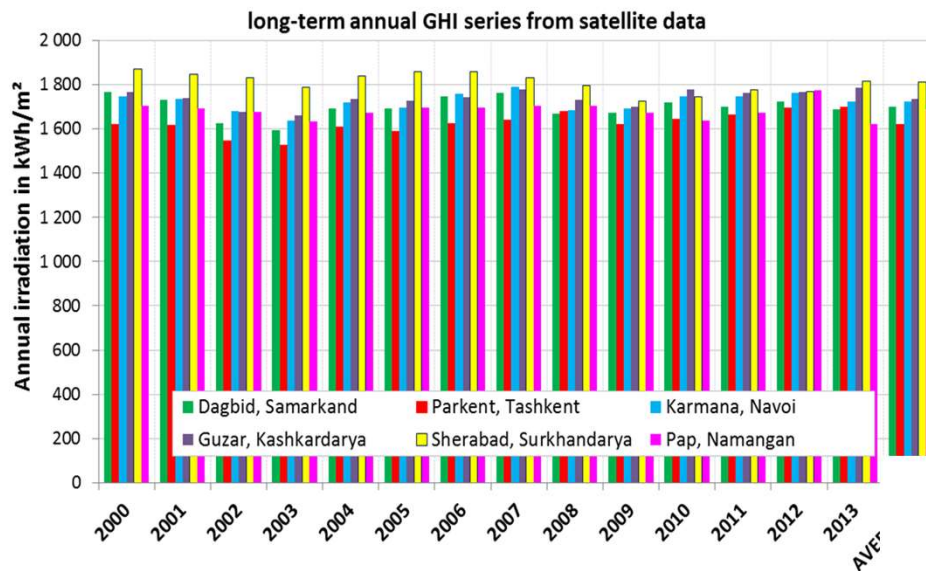
UZBEKISTAN – SOLAR ENERGY

Annual long-term mean of satellite data in Uzbekistan
(from >13 years of data)



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Annual GHI time series (satellite data)

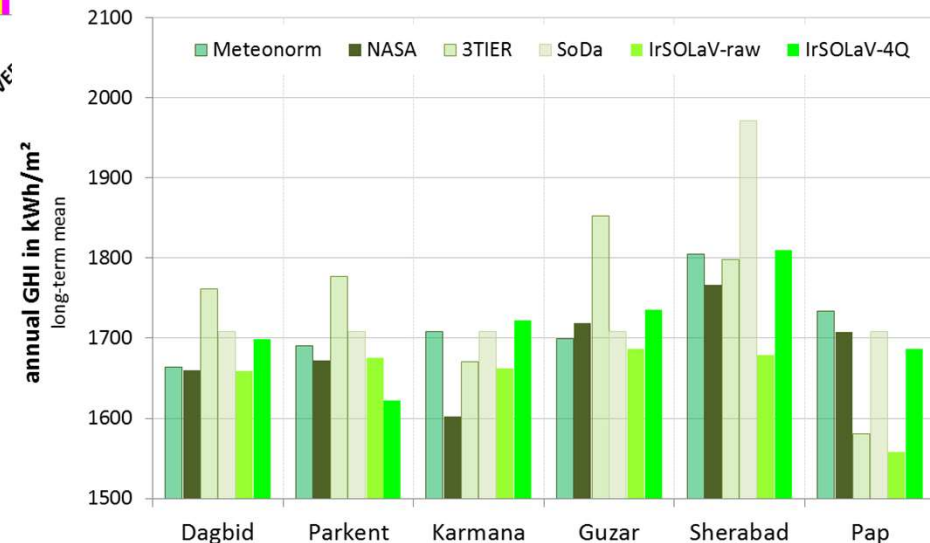


GHI: 1650 – 1845 kWh/m²a

Comparison with other data sets

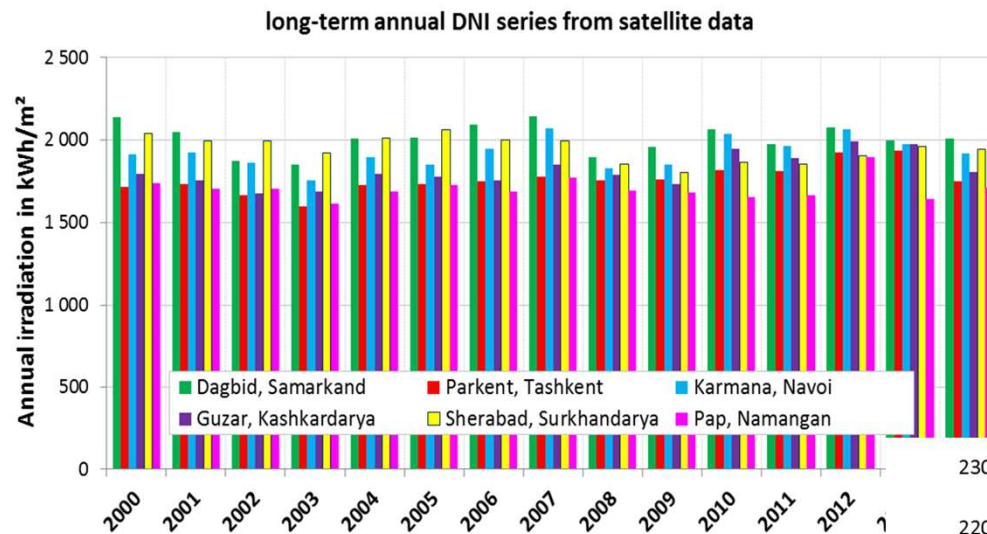
Range of mean annual value
Global Horizontal Irradiation:

≈ 1550 to 1970 kWh/m²a



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Annual DNI time series (satellite data)

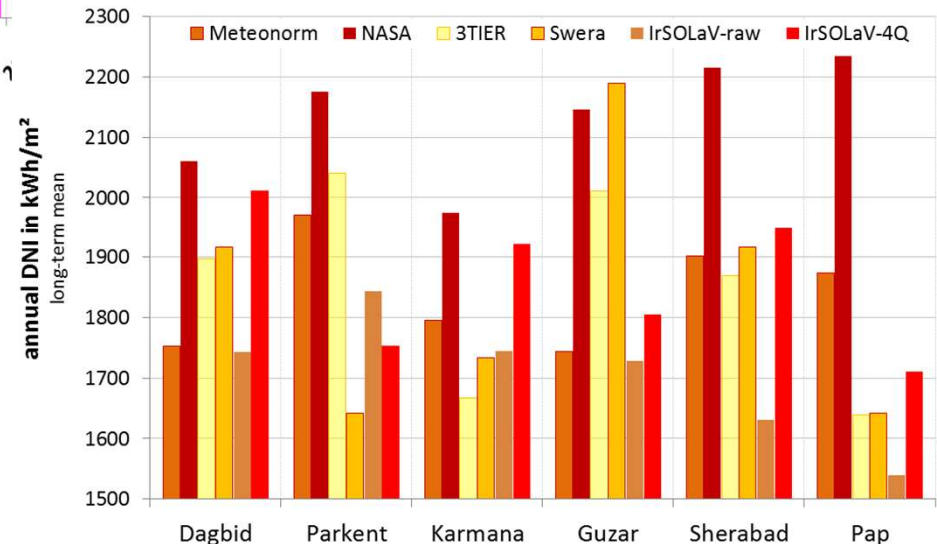


DNI: 1790 – 2000 kWh/m²a

Comparison with other data sets

Range of mean annual value **DNI**:

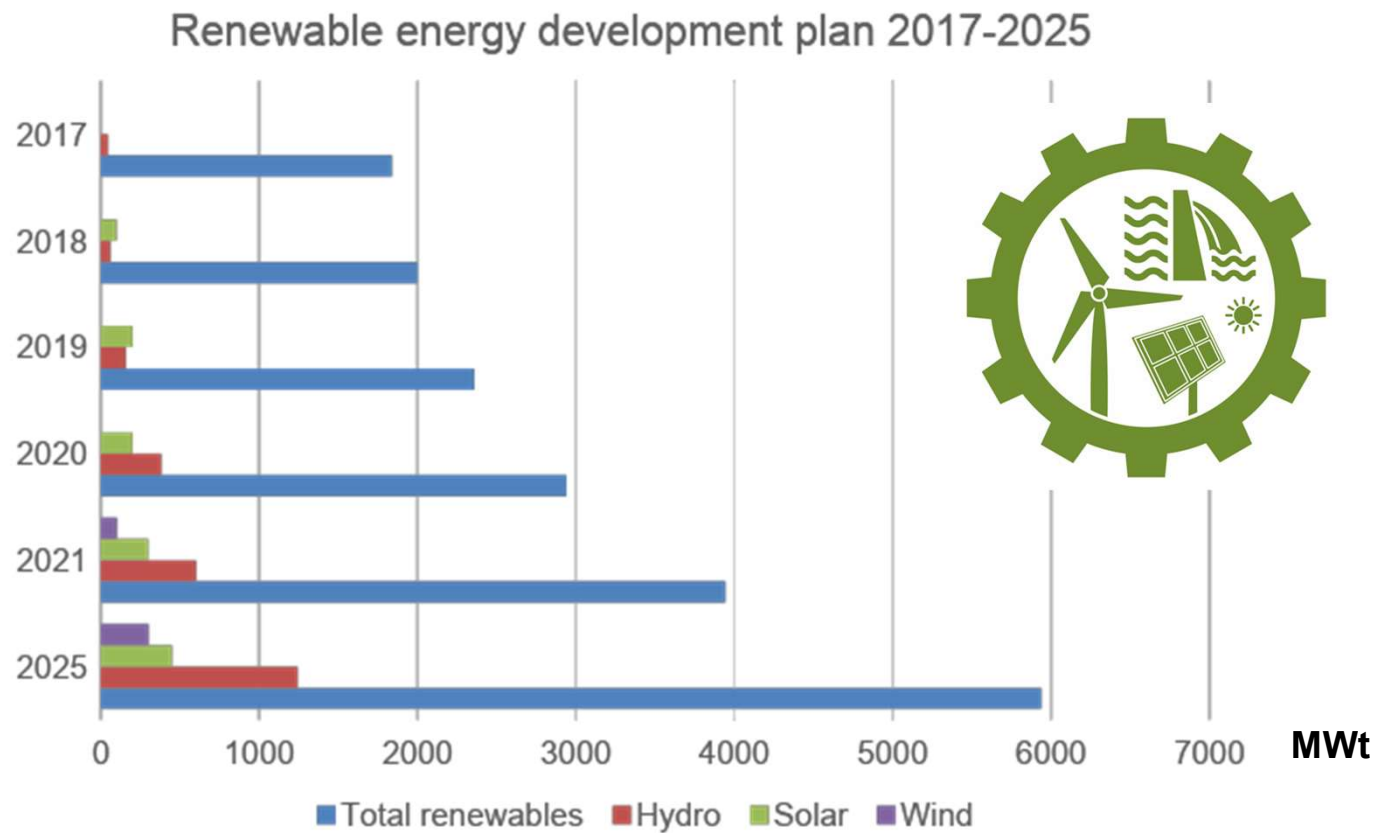
≈ 1540 to 2230 kWh/m²a



Regulation

Presidential Decree of 26 May 2017

- Renewable energy development programme for 2017-2021



Projects in perspective

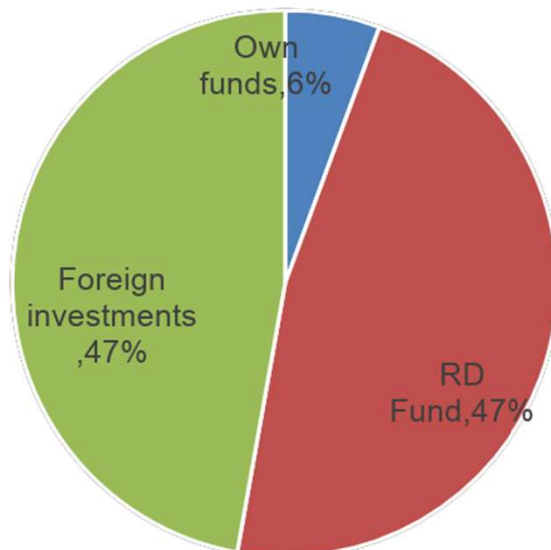
Presidential Decree of 26 May 2017

- Planned construction of PV plants in 2017-2021

**Samarkand region 100Mwt
(2017-2018)**



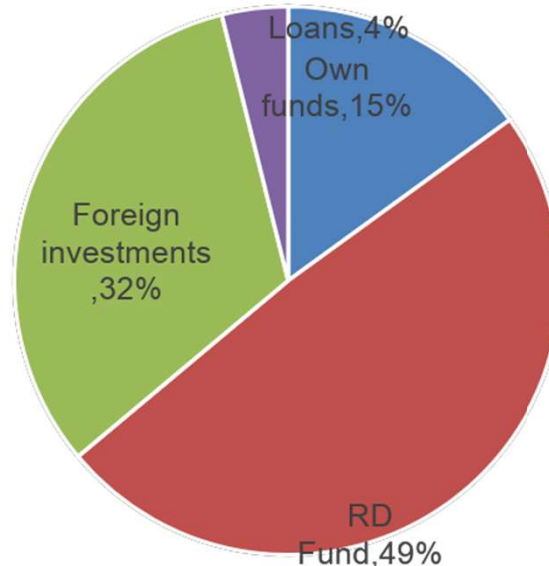
\$233,1 mln.



**Navoi region 100Mwt
(2017-2019)**



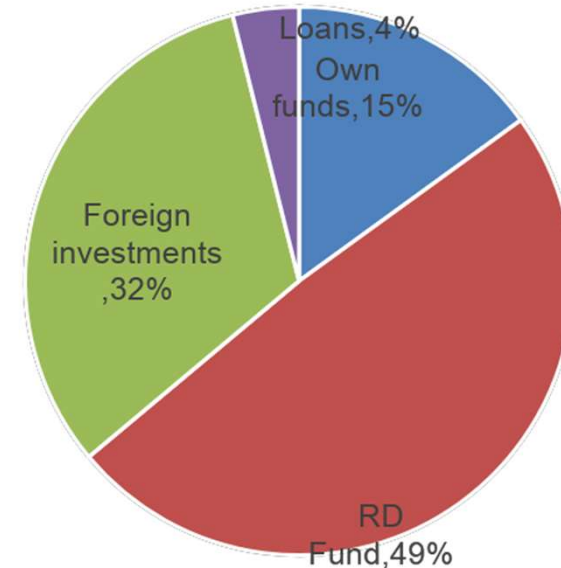
\$233,1 mln.



**Sherabad, Surkhandarya region 100Mwt
(2019-2021)**



\$233,1 mln.



RD: Republican Reconstruction and Development Fund

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PV power plants comparison

Plant	Location	Starting project year	Start operation year	CAPEX (million USD)	OPEX (million USD)	Production P50 (GWh/year)
100MW Sherabad PV (1 axis tracking)	Sherabad, Surkhandarya	2016	2018	206	1 (year 1) / 2(years 2-25)	222
100MW Guzar PV (1 axis tracking)	Guzar, Kashkadarya	2018	2020	196	1 (year 1) / 2(years 2-25)	214
100MW Pap PV (fixed tilt)	Pap, Namangan	2020	2022	165	0.8 (year 1) / 1.4(years 2-25)	159

	SHERABAD		GUZAR		PAP	
	Fixed	1 axis	Fixed	1 axis	Fixed	1 axis
GHI (kWh/m2*year)	1810		1738		1682	
Energy (GWh)	172	222	163	214	159	206
CAPEX (M USD)	177	206	171	196	165	191
OPEX (M USD/year)	1.4	2	1.4	2	1.4	2
Energy / Costs (GWh/ M USD)	19.3	20.4	18.6	20.5	18.7	20.1
Land use (ha)	195	280	195	280	195	280
Specific land usage (MWh/ha-year)	882	792	836	765	815	735
Specific water usage (MWh/m3)	34	44	27	36	17	22

Projects in perspective



SkyPower

- 1GW of total capacity PV power plants in several regions of the country (Tashkent, Samarkand, Navoi, Jizzakh, Surkhandarya and Kashkadarya)
- \$1.3bln. Sum of investments by SkyPower
- Long-term PPA contract with JSC Uzbekenergo
- Expected start: ?



JSC Uzbekenergo (ADB loan)

- 100MW PV power plant in Samarkand region
- \$300mln. Of which \$100mln sum of loan by ADB; \$200mln. own funds of JSC Uzbekenergo
- Expected start: Project was closed by the request of the government



Uzatom + Rosatom

- 2.4GW of total capacity by two reactors
- \$11bln. preliminary calculated sum of investments, soft loans by Russia
- Expected start in 2028

Regulation



Law on renewables
Grid connection
Feed-in tariffs
2017



Unification of standards
in accordance with IEC*
2017-2019

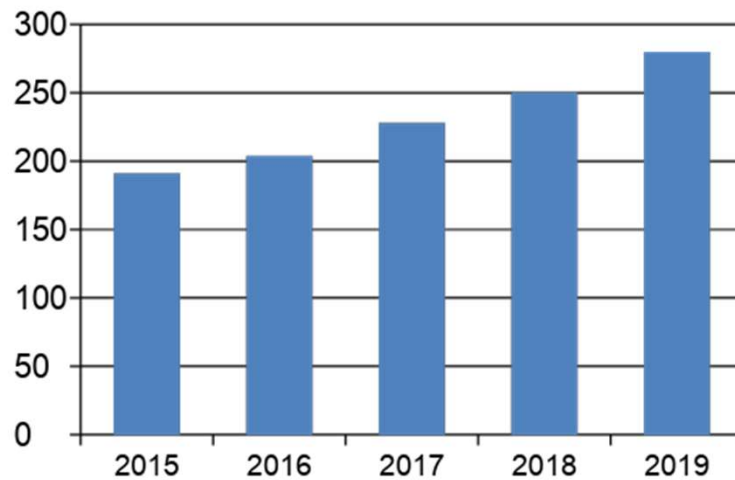


Tax and customs
incentives for production
of RES and RE generation
2017-2018

* International Electrotechnical Commission

Electricity price vs sustainable economic model

USZ to USD exchange rate dynamics in 2015-2019



Source: JSC Uzbekenergo

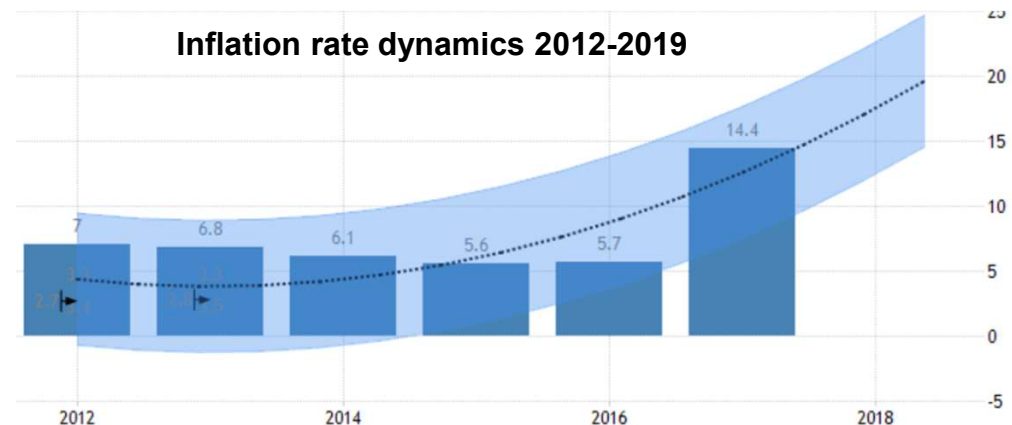


Source: <https://www.xe.com/currencycharts/?from=USD&to=UZS&view=5Y>

Natural Gas price 2015-2019



Inflation rate dynamics 2012-2019



Source: State Committee of the Republic of Uzbekistan on Statistics

Thank you!

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