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List of solar thermal power stations

This is a list of the largest facilities generating electricity through the use of **solar thermal power**, specifically concentrated solar power.

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The PS10 solar thermal power station.

Operational

Operational solar thermal power stations (of at least 50 MW capacity)

Electrical capacity (MW)	Name	Country	Location	Coordinates	Technology type	Storage hours	Notes and references
510	Noor / Ouarzazate Solar Power Station	Morocco	Ghassate (Ouarzazate province)	30°59′40″N 6°51′48″W	Parabolic trough and solar power tower (Phase 3)	3/7/7.5	160 MW Phase 1 with 3 hours heat storage. [1][2] 200 MW phase 2 with 7 hours heat storage is online from January 2018. [3][4] 150 MW (Phase 3) with 7.5 hours storage is online from November 2018 [5][6]
392	Ivanpah Solar Power Facility	US	San Bernardino County, California	35°34′N 115°28′W	Solar power tower		Completed on February 13, 2014 ^{[7][8][9]}
310	Solar Energy Generating Systems (SEGS)	US	Mojave Desert, California	35°01′54″N 117°20′53″W	Parabolic trough		Collection of 9 units 1984-1990 [10][11][12][13] [14][15][16][17][18] Originally 354 MW. First two units (44 MW out of total 354 MW) were decommissioned after 30 years and replaced by solar PV.
280	Mojave Solar Project	US	Barstow, California	35°00′40″N 117°19′30″W	Parabolic trough		Completed December 2014. Gross capacity of 280 MW corresponds to net capacity of 250 MW ^[19] [20][21]
280	Solana Generating Station	US	Gila Bend, Arizona	32°55′N 112°58′W	Parabolic trough	6	Completed in October 2013, with 6 hours thermal energy storage ^{[22][23]}
280	Genesis Solar Energy Project	■ US	Blythe, California	33°38′37.68″N 114°59′16.8″W	Parabolic trough		Online April 24, 2014 ^[24] [25][26]
200	Solaben Solar Power Station ^[27]	Spain	Logrosán	39°13′29″N 5°23′26″W	Parabolic trough		Solaben 3 completed June 2012 ^[28] Solaben 2 completed October 2012 ^[28] Solaben 1 and 6 completed September 2013 ^[29]
150	Solnova Solar Power Station	Spain	Sanlúcar la Mayor	37°25′00″N 06°17′20″W	Parabolic trough		Solnova 1 completed May 2010 Solnova 3 completed May 2010 Solnova 4 completed August 2010 ^{[30][31][32]} [33][34]
150	Andasol solar power station	Spain	Guadix	37°13′42.70″N 3°4′6.73″W	Parabolic trough	7.5	Completed: Andasol 1 (2008), Andasol 2 (2009), Andasol 3 (2011). Each equipped with a 7.5 hour thermal energy storage. [35][36]
150	Extresol Solar Power Station	Spain	Torre de Miguel Sesmero	38°39′N 6°44′W	Parabolic trough	7.5	Completed: Extresol 1 and 2 (2010), Extresol 3 (2012). Each equipped with a 7.5-hour thermal energy storage. ^{[28][37][38]}
125	Crescent Dunes Solar Energy	US	Nye County, Nevada	38°14′N 117°22′W	Solar power tower	10	with 10h heat storage; commercial operation began September 2015 ^{[39][40]}

Electrical capacity (MW)	Name	Country	Location	Coordinates	Technology type	Storage hours	Notes and references
	Project						
125	Dhursar	India	Dhursar, Jaisalmer district	26°47′N 72°00′E	Fresnel reflector		Completed November 2014, referred as 125 MW is some sources ^[41] [42][43][44]
121	Ashalim Power Station (Negev Energy)	srael	Ashalim	30°57′N 34°42′E	Parabolic trough	4.5	4.5h heat storage. Completed August 2019 and located in Negev desert ^[45]
121	Megalim Power Station (Negev Energy)	srael	Ashalim	30°56′N 34°43′E	Solar power tower		Completed April 2019 and located in Negev desert ^[46] [47][48]
100	Kathu Solar Park	South Africa	Northern Cape	27°31′59.67″S 23°8′10.56″E	Parabolic trough	4.5	completed February 2018, With 4.5h heat storage [49][50][51][52][53]
100	KaXu Solar One	South Africa	Pofadder, Northern Cape	28°53′40.56″S 19°35′53.52″E	Parabolic trough	2.5	with 2.5h heat storage ^[54] [55][56]
100	Xina Solar One	South Africa	Pofadder, Northern Cape	28°53′40.56″S 19°35′53.52″E	Parabolic trough	5.5	Commissioned in September 2017 with 5.5h heat storage ^[57]
100	Manchasol Power Station	Spain	Alcázar de San Juan	39°11′N 3°18′W	Parabolic trough	7.5	Manchasol 1 and 2 completed in 2011, each with 7.5h heat storage ^[28]
100	Valle Solar Power Station	Spain	San José del Valle	36°39′N 5°50′W	Parabolic trough	7.5	Completed December 2011, with 7.5h heat storage ^{[28][58]}
100	Helioenergy Solar Power Station	Spain	Écija	37°34′43″N 5°9′24″W	Parabolic trough		Helioenergy 1 completed September 2011 ^{[59][60]} Helioenergy 2 completed January 2012 ^{[28][59][60]}
100	Aste Solar Power Station	Spain	Alcázar de San Juan	39°10′22″N 3°15′58″W	Parabolic trough	8	Aste 1A Completed January 2012, with 8h heat storage ^[28] Aste 1B Completed January 2012, with 8h heat storage ^[28]
100	Solacor Solar Power Station	Spain	El Carpio	37°54′54″N 4°30′9″W	Parabolic trough		Solacor 1 completed February 2012 ^[28] Solacor 2 completed March 2012 ^{[28][61]}
100	Helios Solar Power Station	Spain	Puerto Lápice	39°14′24″N 3°28′12″W	Parabolic trough		Helios 1 completed May 2012 ^[28] Helios 2 completed August 2012 ^[28]
100	Shams solar power station	L UAE	Abu Dhabi Madinat Zayed	23°34′N 53°42′E	Parabolic trough		Shams 1 completed March 2013 [62][63]
100	Termosol Solar Power Station	Spain	Navalvillar de Pela		Parabolic trough		Both Termosol 1 and 2 completed in 2013 ^[28]
100	Palma del Río I & II	Spain	Palma del Río	37°38′42.56″N 5°15′29.32″W	Parabolic trough		Palma del Rio 2 completed December 2010 ^[28] Palma del Rio 1 completed July 2011 ^[28]

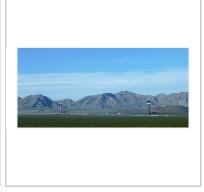
Electrical capacity (MW)	Name	Country	Location	Coordinates	Technology type	Storage hours	Notes and references
100	llanga 1	South Africa	Northern Cape (Upington)	28°29′25.79″S 21°32′27.13″E	Parabolic trough	5	With 5h heat storage. Operational since 2018 ^[64]
100	Shouhang Dunhuang	*; China	Dunhuang (Gansu Province)	40°5′33.11″N 94°39′55.56″E	Solar power tower	7.5	With 7.5h heat storage. Operational since end of December 2018 ^[65]
75	Martin Next Generation Solar Energy Center	US	Indiantown, Florida	27°03′11″N 80°33′00″W	ISCC with parabolic trough		Completed December 2010 ^[66]
75	Nevada Solar One	US	Boulder City, Nevada	35°48.0′N 114°58.6′W	Parabolic trough		Operational since 2007
50	Guzmán	Spain	Palma del Río	37°38′N 5°15′W	Parabolic trough		Completed July 2012 ^[28]
50	Khi Solar One	South Africa	Upington	28°33′0.36″S 21°5′5.28″E	Solar power tower	2	Completed Feb 2016 With 2h heat storage ^{[54][55]}
50	Bokpoort	South Africa	Groblershoop	28°43′26.96″S 21°59′34.88″E	Parabolic trough	9	with 9h heat storage ^{[67][68]}
50	Puertollano Solar Thermal Power Plant	Spain	Puertollano, Ciudad Real	38°39′N 3°58′W	Parabolic trough		Completed May 2009 ^[69]
50	Alvarado I	Spain	Badajoz	38°49′37″N 06°49′34″W	Parabolic trough		Completed July 2009 ^[70] [71][72]
50	La Florida	Spain	Alvarado (Badajoz)		Parabolic trough		Completed July 2010 ^{[28][73]}
50	Arenales PS	Spain	Morón de la Frontera (Seville)		Parabolic trough ^[28] [74][75]		2013
50	Casablanca	Spain	Talarrubias		Parabolic trough ^[28]		2013
50	Majadas de Tiétar	Spain	Caceres	39°58′10″N 5°44′32″W	parabolic trough		Completed August 2010 ^{[28][76]}
50	La Dehesa	Spain	La Garrovilla (Badajoz)	38°57′35″N 6°27′50″W	Parabolic trough		Completed November 2010 ^[28]
50	Lebrija-1	Spain	Lebrija		Parabolic trough		Completed July 2011 ^{[28][77}
50	Astexol 2	Spain	Badajoz	38°48′42″N 7°3′36″W	Parabolic trough	7.5	Completed November 2011, with 7.5h thermal energy storage ^{[28][74]}
50	Morón	Spain	Morón de la Frontera	37°7′11.24″N 5°33′50.45″W	Parabolic trough		Completed May 2012 ^[28]
50	La Africana	Spain	Posada		Parabolic trough	7.5	Completed July 2012, with 7.5h thermal energy storage ^[28]
50	Olivenza 1	Spain	Olivenza	38°45′18.73″N 7°8′40.42″W	Parabolic trough		Completed July 2012 ^[28]
50	Orellana	Spain	Orellana la Vieja	39°1′17.6″N 5°31′57.4″W	Parabolic trough		Completed August 2012 ^[28]
50	Godawari Green Energy Limited	India	Nokh Village,Rajasthan	27°36′01″N 72°13′25″E	Parabolic trough		2013 ^{[78][79][80]}

Electrical capacity (MW)	Name	Country	Location	Coordinates	Technology type	Storage hours	Notes and references
50	Enerstar Villena Power Plant	Spain	Villena	38°43′41.51″N 0°55′18.23″W	Parabolic trough		Completed 2013 ^{[28][81]}
50	Megha Solar Plant	India	Anantapur	14°56′47″N 77°41′15″E	Parabolic trough		Completed 2014 ^{[82][83]}
50	Delingha Solar Plant	China	Delingha	37°23′N 97°23′E	Parabolic trough	9	Completed July 2018 with 9 hours of thermal energy storage ^[84]
50	Supcon Solar Delingha	China	Delingha	37°23′N 97°23′E	Solar power tower	7	Completed December 2018 [85][86]
50	Shagaya CSP	Kuwait	Shagaya	29°13′41″N 47°03′45″E	Parabolic trough	10	Commercial operation started in February 2019, 10 hours thermal storage [87][88]
50	Waad Al Shamal ISCC Plant	Saudi Arabia	Waad Al Shamal	31°39′37″N 38°51′29″E	ISCC with parabolic trough		Commercial operation started in 2018, 1,390 MW plant with 50 MW solar ^[89]
50	Qinghai Gonghe CSP	China	Gonghe, Qinghai Province		Solar power tower	6	With 6 h heat storage. [86][90]
50	Luneng Haixi CSP	China	Haixi Zhou, Qinghai Sheng		Solar power tower	12	[86][91]

Solar thermal power stations







in San Bernardino, California, United near Seville, in Andalusia, Spain. States.

Part of the 354 MW SEGS solar complex The PS10 and PS20 solar power plant The Ivanpah solar project in San

Bernardino, California, United States.





the sun isn't shining.

The Andasol Solar Power Station, Spain, Parts of the Solnova Solar Power Station uses a molten salt thermal energy in the foreground. The two towers of the storage to generate electricity, even when PS10 and PS20 solar power stations can be seen in the background.

Under construction

Solar thermal power stations under construction (of at least 50 MW capacity)

Electrical capacity (MW)	Name	Country	Location	Co- ordinates	Expected completion	Technology	Notes
700	Mohammed bin Rashid Al Maktoum Solar Park Phase IV	United Arab Emirates	Dubai	24.7547°N 55.365°E	2020	Parabolic trough solar tower	600 MW parabolic trough and 100 solar tower, with 15h heat storage ^[92] [93][94]
200	Golmud CSP	China	Golmud, Qinghai province			Power tower	[86]
110	Cerro Dominador Solar Thermal Plant (Atacama 1)	Chile	María Elena, Antofagasta		2019	Solar power tower	[95]
100	Urat Middle Banner CSP	China	Urat Middle Banner, Inner Mongolia			Parabolic trough	[86][96]
50	Erdos Solar Power Plant	China	Hanggin Banner			Parabolic trough	[97]
50	Dacheng Dunhuang CSP	China	Dunhuang, Gansu Province			Fresnel reflector	[86]
50	Gansu Akesai CSP	China	Akesai, Gansu Province			Parabolic trough	[86]
50	Hami CSP	China	Hami, Xinjiang Autonomous Region			Power tower	[86]
50	Rayspower Yumen CSP	China	Yumen, Gansu Province			Parabolic trough	[86]
50	Yumen CSP	China	Yumen, Gansu Province		2019	Beam down tower	9h storage ^[98]

Announced

Solar thermal power stations announced

Electrical capacity (MW)	Name	Country	Location	Coordinates	Technology	Notes
230	Noor Midelt II	Morocco	Morocco	32°40′51″N 04°43′59″W		[99]
200	Noor Midelt I	Morocco	Morocco	32°40′51″N 04°43′59″W	Hybrid solar power with combination of 600 MW solar PV and 200 MW solar thermal with 5h heat storage	[100][101]
450	Tamarugal Solar Project	Chile	Atacama Desert, Chile		Three solar power towers with 13h heat storage	[102]
390	Likana Solar Project	Chile	Antofagasta		Three solar power towers with 13h heat storage ^[103]	
260	Copiapó Solar Project	Chile	Atacama Desert, Chile		Solar power tower PV integrated. With 14h heat storage	[104]
100	Redstone Solar Thermal Power	South Africa	Northern Cape	28°17′53″S 23°21′56″E	Solar power tower with 12h heat storage	[105][106][107
100	Solnova 2, 4–5	Spain	Sevilla	37°25′00″N 06°17′20″W	Parabolic trough with heat storage	[108]
100	CAP SunEdison	Chile	Atacama Desert, Chile			[109]
100	Gulang CSP	China	Wuwei, Gansu Province		Parabolic trough	[86][96]
100	Golden Tower CSP	China	Jinta, Gansu Province		Power tower	[86]
72	Mashhad solar- thermal power station	Iran	Mashhad, Iran		Parabolic dish with tracer system	[110]
64	Chabei CSP	China	Chabei, Hebei Province		Parabolic trough	[86]
60	Al-Abdaliya	K uwait	??		Parabolic trough	[111]
50	AZ 20	Spain	Sevilla		Solar power tower	[108][86]
50	Shangyi CSP	China	Shangyi, Hebei Province		Power tower	[86]
50	Zhangjiakou CSP	China	Zhangbei, Hebei Province		Fresnel reflector	[86]

Cancelled

Solar thermal power stations cancelled

Electrical capacity (MW)	Name	Country	Location	Coordinates	Technology	Notes
1,600	Sandstone Solar Energy Project	■ US	Nye County, Nevada	37°54′00″N 116°42′00″W	solar power tower	8 units with 10h heat storage ^[112]
1,000	Blythe Solar Power Project	US	Blythe, California		Parabolic trough	4 units, converted to 485 MW PV ^[113]
850	Stirling Energy Systems Solar One Project	US	San Bernardino County, California		Dish Stirling	converted to 618 MW PV, license terminated 27 August 2013 ^[114]
750	Stirling Energy Systems Solar Two Project	US	Imperial County, California		Dish Stirling	converted to 594 MW PV ^[115]
500	Palen Solar Power Project	US	Riverside County, California		Parabolic trough	2 units, certification expired 15 December 2015 ^[116]
250	Ridgecrest Solar Power Project	US	Kern County, California		Parabolic trough	2 units, license terminated 22 April 2014 ^[117]
160	Luz SEGS XI-XII Project	US	San Bernardino County, California		Parabolic trough	license expired 22 September 1989 ^[118]
150	Aurora Solar Thermal Power Project	Australia	Port Augusta, South Australia	32.2°S 137.6°E	solar power tower	[119]
100	El Reboso 2+3	Spain	La Puebla del Rio (Seville)			Parabolic trough ^{[120][121]}
100	SCE Solar 100	■ US	Johnson Valley, California		Solar power tower	license expired 1983 ^[122]
100	Diwakar	India	Askandra		Parabolic trough	2014, Parabolic trough with 3h heat storage ^[123]
100	KVK Energy Solar Project	India	Askandra		Parabolic trough	2014, Parabolic trough with 4h heat storage ^[124]

Decommissioned

- Eurelios pilot plant, a 1 MW, power tower design in Adrano, Sicily, operational 1981–1987^[125]
- Solar One pilot plant, operational 1982–1986; converted into Solar Two, operational 1995–1999; site demolished 2009 USA California, 10 MW, power tower design
- SES-5 USSR, 5 MW, power tower design, water / Steam, service period 1985–1989^[126]
- Maricopa Solar USA Peoria, Arizona, 1.5 MW dish stirling SES / Tessera Solar's first commercial-scale Dish Stirling power plant.
 Completed January 2010, [127] decommissioned September 2011 and sold to CondiSys Solar Technology of China on April 2012. [128] [129]

Largest plants by technology

Largest operational Solar Thermal Power Stations by technology

Technology type		Capacity MW	Name	Country	Location	Coordinates	Notes and references
Solar power	without thermal storage	392	Ivanpah Solar Power Facility	■ US	San Bernardino County, California	35°34′N 115°28′W	Completed on February 13, 2014 ^{[7][8][9]} The station uses natural gas as supplementary fuel.
tower	with thermal storage	150	Ouarzazate Solar Power Station	Morocco	Ghassate (Ouarzazate province)	30°59′40″N 6°51′48″W	
Parabolic trough		310	Solar Energy Generating Systems (SEGS)	US	Mojave Desert, California	35°01′54″N 117°20′53″W	Collection of 9 units ^{[10][11][12]} ^{[13][14][15][16][17][18]} The station has gas firing facility to run the units during night time.
oug	with thermal storage	360	Ouarzazate Solar Power Station	Morocco	Ghassate (Ouarzazate province)	30°59′40″N 6°51′48″W	
Beam-dow	Beam-down CSP		Yumen CSP	China	Yumen, Gansu Province		9h storage ^[130]
ISCC with trough	oarabolic	75	Martin Next Generation Solar Energy Center	US	Indiantown, Florida	27°03′11″N 80°33′00″W	Completed December 2010 ^[66] Basically combined cycle power plant running on natural gas. Solar energy is supplemented to reduce the natural gas consumption for the same station output.
Fresnel ref without the storage		100	Dhursar	India	Dhursar, Jaisalmer district	26°47′N 72°00′E	Completed November 2014, referred as 125 MW is some sources ^{[41][42][43][44]}
Brayton cycle CSP		0.4	Ouarzazate Solar Power Station	Morocco	Ghassate (Ouarzazate province)	30°59′40″N 6°51′48″W	10h thermal storage. Capacity expandable by adding any number of modules. Can also provide waste heat/ thermal energy for process steam production or HVAC consumption.[131][132] Commercial scale plant under construction to be commissioned by early 2020[133]
Dish Stirlin	Dish Stirling						No utility scale installastions currently operational, 1.5MW Maricopa Solar was largest

See also

- Concentrated solar power
- List of concentrating solar thermal power companies
- List of energy storage projects
- List of large wind farms
- List of largest power stations in the world
- List of photovoltaic power stations
- Plataforma Solar de Almería
- Renewable energy commercialization
- Renewable energy industry
- Solar power plants in the Mojave Desert
- Solar thermal energy
- Solar Turbine Plants

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Further reading

- Clean Tech Nation: How the U.S. Can Lead in the New Global Economy (2012) by Ron Pernick and Clint Wilder
- Deploying Renewables 2011 (2011) by the International Energy Agency
- Reinventing Fire: Bold Business Solutions for the New Energy Era (2011) by Amory Lovins
- Renewable Energy Sources and Climate Change Mitigation (2011) by the IPCC
- Solar Energy Perspectives (2011) by the International Energy Agency

External links

- CSP World (http://www.cspworld.org/)
- CSP plants and projects plotted on Google Earth (http://www.trec-uk.org.uk/resources.htm#CSP_GE)
- National Renewable Energy Laboratories list of US Solar Trough Plants (https://web.archive.org/web/20100406060955/http://www.nrel.gov/csp/troughnet/power_plant_data.html)

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