

An aerial photograph of a Concentrated Solar Power (CSP) plant. The image shows a vast field of heliostats (mirrors) arranged in a grid pattern, reflecting sunlight onto a central receiver tower. The tower is a tall, white structure with a cylindrical receiver at the top. The surrounding area is a flat, sandy landscape.

Opportunities for Chinese Developers, Technology providers and Construction companies in the Spanish CSP market

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Summary

- CSP situation in Spain
- Santa Cruz Termosolar Project
- Santa Cruz Termosolar – Technical Characteristics
- CSP Opportunities in Spain
- Chinese Industry role in the EU CSP market



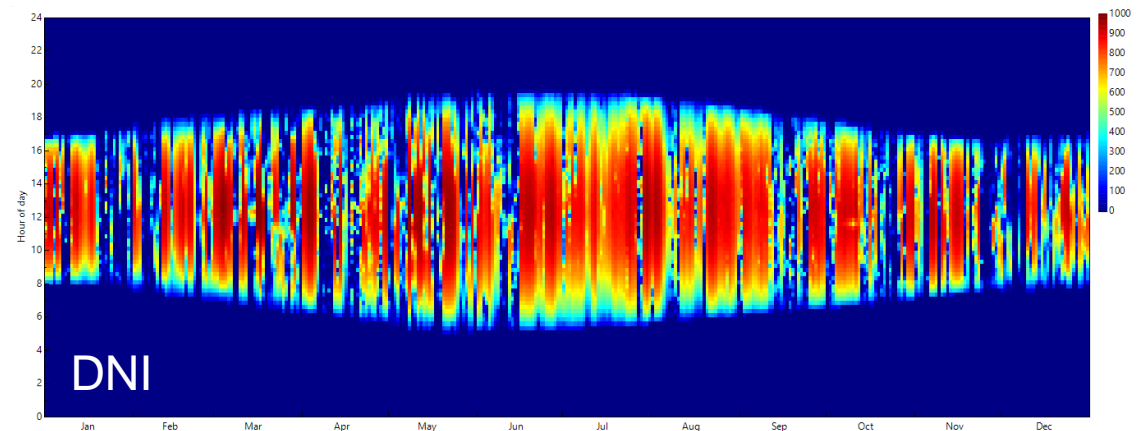
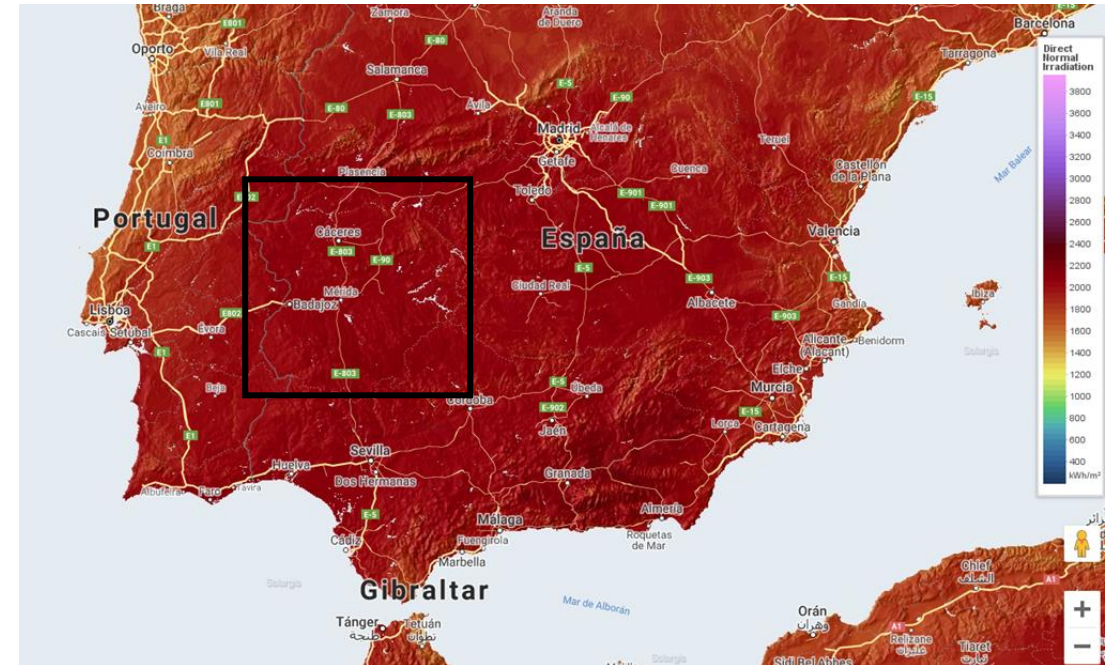
CSP situation in Spain

- Both markets have CSP projects in development, with potential Central Tower project that can become a reality.
- Energy markets are increasing their Variable Renewable Energy (VRE) shares that will demand large requirement of storage in the system in the following years.
- Net-zero goals have been implemented by different governments, looking to achieve ambitious targets for 2030 and 2050.
- Actually, CSP technology can have competitive cost, however, the project development process is longer and complicated to obtain the permissions compared to PV and Wind.
- Spain has good solar resource (>2100 kWh/m²-yr), making CSP projects attractive and profitable.

Santa Cruz Termosolar Project

- Project in development in Spain since 2021.
- CSP plant design aims to have high efficiency and competitive cost for the Spanish system.
- SCT will be part of the new Spanish CSP plants focusing on storage and dispatchability.
- Project targets COD in 2027-2028.

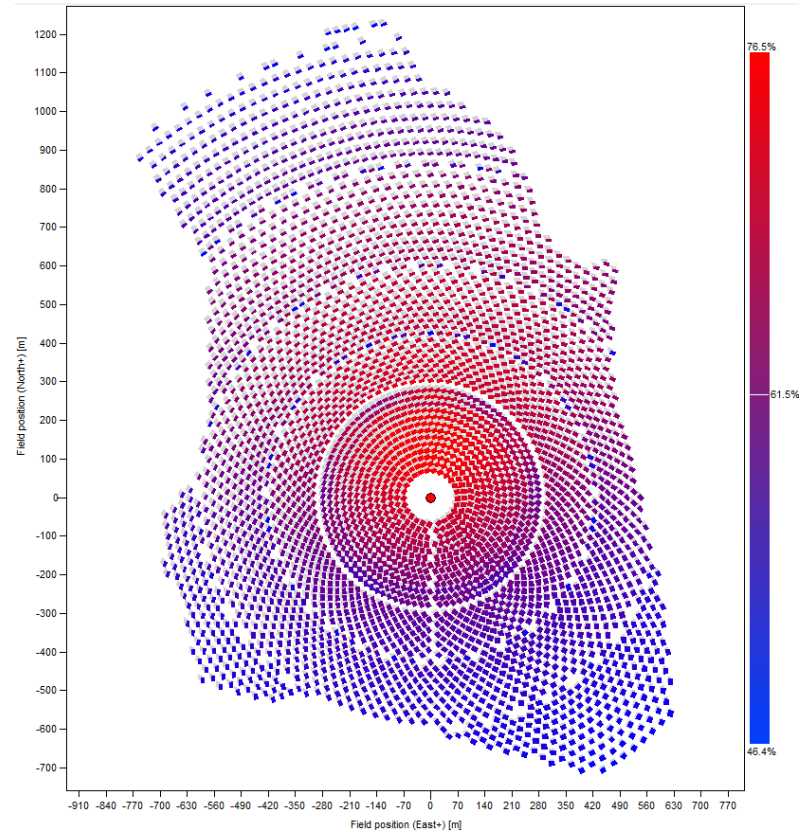
Parameter	
Location	Extremadura, Spain
DNI	2,100 kWh/m ² -yr
Capacity	50 MW CSP + 5 MW PV
CSP system	Central Tower with molten salts and heliostat solar field
TES system	Direct MS two-tank system
PV system	Bifacial PV – 1-axis system



Santa Cruz Termosolar – Technical Characteristics

- Central Tower technology with molten salts.
- Plant designed to operate during night hours, and the flexibility to adapt to different grid operator requirements.
- Project could potentially achieve the lowest LCOE in Spain targeting the upcoming auctions next year (2023).

Parameter	Unit
CSP gross capacity	50 MWe
TES storage	12-14 hr ~ 1500 MWh-th
Heliostat solar field	~500,000 m ²
Generation	180 – 220 GWh
Project area	~250 ha
PV system	5 MW for parasitic consumption



Preliminary layout of STC project



Terrain for STC project

CSP Opportunities in Spain

Calendar of CSP auction according the PNIEC

		Minimum power volume (MW)					
		2020	2021	2022	2023	2024	2025
CSP	Increment	0	200	0	200	0	200
	Accumulated	0	200	200	400	400	600

Source: Ministerio para la Transición Ecológica y el Reto Demográfico.



First CSP auction
Celebrated on:
Oct 25th, 2022
Capacity: 220 MW



Results:

- CSP auction deserted
- CSP reserve price under the bidder's price
- CSP bids may were over 200 EUR/MWh
- Auction conditions led to high uncertainty on bids affecting their financial risk and final PPA price

- Next auction will be in 2023.
- Important revision on the auction conditions are expected
 - PV hybridization, grid operator uncertainty, development process, storage value on the grid, inclusion of other revenues.

LCOE under 120 EUR/MWh are possible?

Opportunities



- 2023 CSP auction with attractive conditions with 200 – 400 MW.
- Several projects in development aiming COD by 2027-2028.
- Spanish grid will move towards a high VRE system that will requiring storage capacities.

Chinese Industry role in the EU CSP market

- China can play a relevant role on the CSP market in Europe as EPC contractor, Investors and Technology provider.
- China has already in operation more than +10 project (Parabolic Trough and Central Towers). Actually, more than +20 CSP project (mainly Central Towers) are in development or under construction.
- Technology providers and EPC contractors have acquired an important position in the market with a large project references in China.
- Chinese EPC Contractors have led the EPC of last CSP international projects that are currently in construction or in operation (NOOR III, DEWA IV, Redstone).
- Chinese Industry can be the EPC contractor, using the engineering, manufacturing and operational capabilities to decrease the cost in order to achieve lower LCOE, compared with European contractors, considering:
 - Engineering experience for already executed CSP project in China.
 - Procurement using Chinese supply chain.
 - Construction and operational personnel with high experience capabilities.
- One of the main challenge to overcome would be to align the engineering Chinese standards with the European standards and codes.



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