CosinSolar

To Provide Low-cost, High-quality, and Clean Energy!

QUARTERLY UPDATE

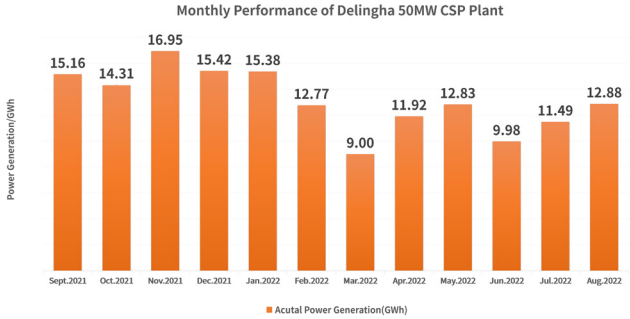
Oct. 2022

NEWS IN BRIEF

SUPCON SOLAR Delingha 50MW Molten Salt Tower CSP Plant

Project update

From September, 2021 to August, 2022, the actual yearly power generation was 158.1GWh, achieving 108.3% of the designed annual power generation (146GWh), setting the highest operational record of the tower CSP plant in the world.



The system of CSP plant is complicated, and the factors that affect its production include system design, system performance, equipment reliability, operation optimization and so on. It is easy for the CSP plant to generate electricity but not easy to achieve production target. **Here are the reasons behind the success of SUPCON SOLAR Delingha 50MW Molten Salt Tower CSP Plant.**

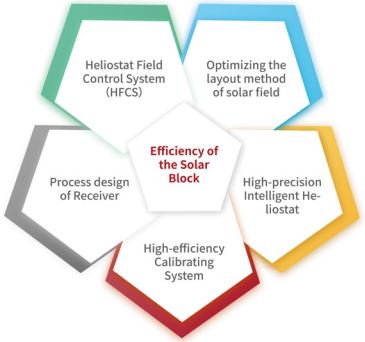
01 The optimal matching of each system improves the overall operating efficiency

The matching between the Solar Block, TESS and SGS Block, and turbine and generator system is the prerequisite to determine the performance of the CSP Plant. In order to improve the efficiency of each system and reduce the investment cost, multiple factors should be considered in the design of CSP station. The Molten Salt Tower CSP Design Software independently developed by Cosin Solar can achieve the optimal matching of each system through big data calculation and repeated iteration according to different boundary conditions.

Consideration	Optimization Objectives
Solar field scale and solar field layout	Land utilization and solar field efficiency
Height of tower	Investment and solar field efficiency
Receiver efficiency	Investment,solar field efficiency and solar resources utilization
Storage time and capacity	peak load regulation capacity, curtailment related to tank and system investment
Thermal exchange efficiency	Thermal exchange area, thermal exchanger design (single-array、double array)
Installed Capacity and operational mode	Power generation system efficiency and Energy storage and peak regulating capacity

02 High efficiency of the Solar Block to ensure thermal energy collection and power generation

The performance (efficiency) of the Solar Block is the basis of determining the performance of a CSP Plant. In Solar Block, the concentration precision of the heliostat directly affects the sub-system efficiency, and thus affects the efficiency and power generation of the plant. By applying self-developed High-precision Intelligent Heliostat, High-efficiency Calibrating System, HFCS, etc., and optimizing the layout method of solar field and the structure and process design of receiver, Cosin Solar greatly improves the efficiency of the Solar Block.



Optimization for solar field design

The special solar field design software of Cosin Solar is the basis of high efficiency of the whole solar field.

- Optimization principle: View the solar field from the perspective of the receiver-- no empty ground
- The solar field efficiency is about **1.5%** higher than that of the conventional radiation layout
- The land utilization is about **2.5%** higher than that of the traditional radiation layout

High-precision Intelligent Heliostat

The high-precision intelligent heliostat independently developed by Cosin Solar **has high surface accuracy and tracking accuracy,** which can accurately reflect the sunlight to the designated position of the receiver, improve the solar spot quality, reduce the energy spillage on the receiver, effectively improve the solar-electric efficiency, so as to improve the power generation of the CSP Plant.

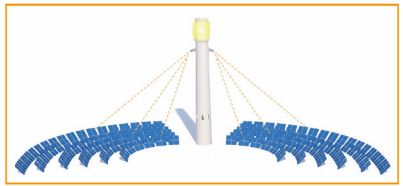
Product features		Working condition	
Area	30m²	Working Temperature Range	-40℃～65℃
Reflectivity	94%	Working Humidity	0%～95%
Driving mode	Rotary reducer + push rod	Working Wind Speed	13m/s (10min average) 18m/s (instant)
Accuracy	1.65 mrad	Survival Wind Speed	40m/s
Service life	30 years	Ingress Protection	IP65
Power consumption	0.057 kWh per day	Working Altitude	5000m
Maintenance	No Lubricant Replacement Needed	Antiseptic property	Anti-corrosion uvioresistant

CSP Service & DLR Certification

High-efficiency Calibrating System

The regular calibration of the solar field is very important to ensure the precision of solar concentrating. **Our machine visual auto calibration solution is 25 times more efficient than the traditional whiteboard calibration solution,** and can realize automatic repeated calibration without manual operation.

- During the construction period of the plant, due to the deviation of the heliostat installation, all heliostats shall be calibrated once before being put into operation. Our calibration system can greatly reduce the calibration period. At the same time, **the installation cost can be greatly reduced** because the heliostats installation process does not require accurate positioning and measurement of deviation.
- After the plant is put into operation, the heliostat accuracy may change due to the change of the settlement of the heliostat foundation and the influence of the external environment such as wind speed and temperature. The calibration system of Cosin Solar can **carry out high frequency periodic calibration on the operating mirror field**, ensuring that during the whole life cycle, the full-field heliostat is always at the best accuracy level.

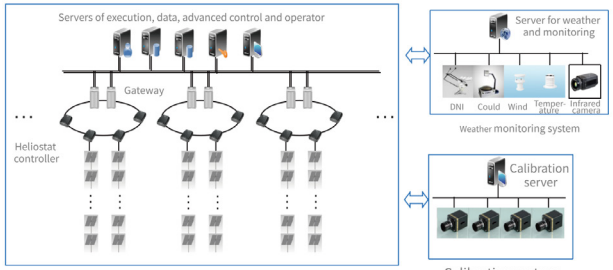


Project	Parameter
Calibration number of days	11 sunny day
Calibration precision	1.65mrad
Influence on the availability of solar field	<1%

Highly Integrated Control Systems

Relying on our nearly 30 years of experiences in control system, we independently developed our own solar field control system which can realize the cluster control of large-scale solar field, and **greatly improve the utilization of solar resources while ensuring the safe and stable operation of the solar and thermal gathering system of the plant, thus improving the power generation level of the plant.**

- The software and hardware of the control system are completely independently developed. The HFCS, the receiver control system and the DCS of the whole plant are deeply coupled and interlinked, realizing the automatic control of the main operation process.
- Translate the mature concept of DCS control system into controlling system server, power supply, and network multiple redundancy.
- Powerful control system ensures accurate sun tracking throughout the field, reduces spillage, and ensures evenly distributed energy on the surface of the receiver.

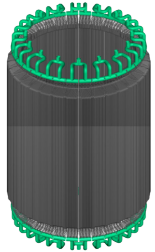


Solar field control system

High efficiency and high safety receiver

Molten salt receiver, which uses molten salt as working medium, is faced with severe conditions such as high temperature, frequent drastic changes between high and low temperature, corrosive environment and so on. In order to ensure the safe and efficient operation of the molten salt receiver, Cosin Solar has been optimizing from many fronts.

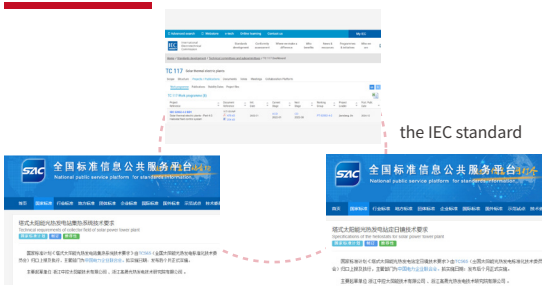
- **Material selection:** imported high nickel alloy tube, resistant to high temperature, corrosion, thermal stress, thermal fatigue; High absorption coating, improve the absorption rate of solar resources.
- **Structure design:** flexible structure, thermal stress, thermal fatigue; Modular factory prefabrication, avoid on-site processing, ensure the performance of the receiver, improve installation efficiency.
- **Control System:** ensure that the surface temperature of the receiver is uniform, the receiver control system and the HFCS are deeply coupled, interlock control, and reduce the thermal shock.
- **Anti-frozenand anti-blocking:** optimize the internal pipeline structure to reduce the occurrence of frozen and blocking conditions; The surface energy of the receiver can be monitored in real time, and the surface temperature can be monitored at any time. The automatic salt control system makes use of the solar field energy to speed salt melting under frozen and blocking conditions.



The comprehensive advantages of the Solar Block of Cosin Solar

- **High-precision Intelligent Heliostat + Efficient automatic Calibrating System + Highly integrated HFCS ensures the concentration accuracy of the whole solar field in the whole life cycle**
- **High precision concentration of heliostat and high efficiency receiver bring high efficiency of the whole Solar Block**
- **High efficiency Solar Block system, provide guarantee for the plant thermal collection and power generation**

Cosin Solar' s capbility and performance in the Solar Block obtains the recognition of the industry, leading the IEC standards of the CSP plant heliostats field control system, and two national standard "Technical requirements of thermal receiveing system of CSP tower plant" and "Specifications of the heliostats for CSP tower plant".



03 Reliable molten salt storage and thermal exchange system ensures high quality power generation

Cosin Solar has deeply studied the characteristics of molten salt system, and the independently developed process package optimization technology of molten salt thermal storage and exchange system has greatly improved the reliability and availability of special equipment.

- The unique structure design of molten salt storage tank **can improve the capacity and reduce the thermal energy loss at the same time.** The design of equalizing the flow in the tank greatly improves the reliability of the tank body.
- **The molten salt thermal exchanger uses the world's first double array design scheme,** and with a lot of optimization, greatly improve the availability of equipment; At the same time, **it can also realize a large range and fast load change, and realize better load adjustment and speed than the traditional ones in thermal power.**
- Joint design of molten salt pump, pipeline and supporting platform, **overcome technical challenges such as wear resistance design of molten salt pump in high temperature environment and seal design of molten salt valve, etc.**

04 The core equipment is controllable and reliable to ensure the stable operation of the plant

The reliability of key equipment is an important factor affecting the operation performance of CSP Plant.

The design and manufacture of core equipment of the Solar Block are autonomous and controllable

- The core equipment such as heliostats, welding parts, sheet metal parts and electronic control parts are all equipped with automatic production equipment and special tooling to ensure the consistency of the quality of the production and manufacturing process.
- Automatic heliostat assembly line, PLC HMI control, workpiece automatic loading, automatic positioning, automatic inter-process flow, online detection, avoid the outflow of unqualified products.

Heliostat Assembly Workshop

Receiver Panel Assembly Workshop

Equipment integration optimization of molten salt heat storage and exchange system

We cooperate closely with equipment manufacturers, deeply involved in the equipment design, manufacturing and installation process, master the key performance and control points of equipment, **form a complete equipment quality control process of molten salt storage and thermal exchange system, and ensure the operation reliability of key equipment.**

The reliability of its core equipment has been verified

- **Most applications in China:** three tower CSP Plant, the longest of which has been in use for nearly **10 years**
- **High altitude (above 3,000 meters), extreme cold (as low as -37 ° C), and blowing sand**

05 Fully automatic operation system to achieve the best operation strategy

The core of operation optimization of plant is to maximize the utilization of solar resources under the safe and stable operation of the receiver.

Key issues

Cloud is an important factor affecting thermal energy collection and output of Plant. For example, there are more than 200 cloudy days in Delingha a year. Selecting the operation strategy in the case of cloud is very important

Continued operation: It may cause uneven surface temperature of the receiver, affecting safe operation.

Shutdown and salt drainage: The "safest" option for operators, but it

wastes solar resources and requires preheating of the receiver and pipes to restart after a cloud.

The solutions

Cloud Forecasting System: Through cloud identification and cloud motion tracking, DNI prediction function within 30 minutes is realized to help operators select the best operation strategy.

Solar field energy scheduling system: Through the unified field energy scheduling across the whole area, the surface energy of the receiver can be evenly distributed under cloud conditions, without drastic changes in surface temperature, and the field shutting down and salt drainage can be avoided as far as possible, so as to achieve the maximum utilization of solar resources.

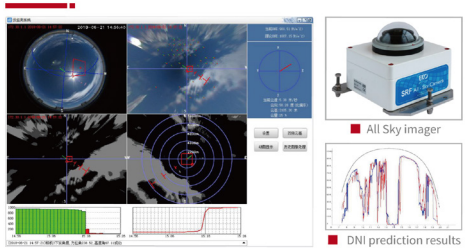
Fully automatic operation of the Solar Block system

In order to improve the stability and security of the system operation, the automatic operation software independently developed by Cosin Solar realizes **the automatic control of the Solar Block system and one button startup and stop, which reduces the system efficiency degradation and equipment operation risk caused by human factors.**

- Meteorological system, cloud monitoring system, infrared system and HFCS are deeply coupled, realizing automatic operation strategies under complex conditions such as cloud.
- Abnormal condition automation: automatic detection and troubleshooting of receiver blockage, overtemperature safety protection, power-off safety interlock, etc.

Cloud Forecasting System

The first Cloud Forecasting System developed in China has the functions of cloud identification and motion tracking, and realizes the DNI prediction function within 30 minutes.



The simulation platform for the Solar Block

Operation simulation

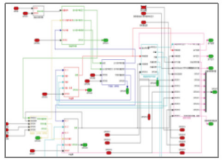
- Simulation of key equipment, such as receiver and heliostat field, supports the simulation of temperature distribution data on the surface of the receiver
- Simulation of the whole process of system preheating, heating, running, and stop
- Operation data export function

Training

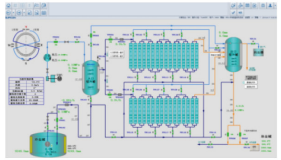
- Consistent with the software platform on the project site to improve the effect of operation training
- Interactive cooperation between teacher and student station, to achieve online assessment function

Failure simulation

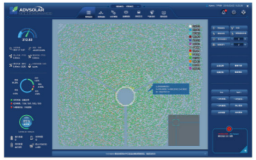
- Operation simulation and interlocking protection after failure
- To help operators to formulate fault handling plans to shorten the trouble-shooting time



Equipment simulation model library



DCS Control system software



AdvSolar Heliostats control software

Heliostat Field Auto-cleaning Vehicle

It is very important for the CSP Plant to maintain the cleanliness of the heliostat. **The fully automatic driverless cleaning vehicle of Cosin Solar has the functions of automatic navigation, water washing/dry cleaning, which can greatly improve the cleaning efficiency of the heliostat field, ensure the cleanliness of the mirror and reduce the operation cost.**

SolarPACES 2020 Technology Innovation Award ■ Before cleaning ■ After cleaning

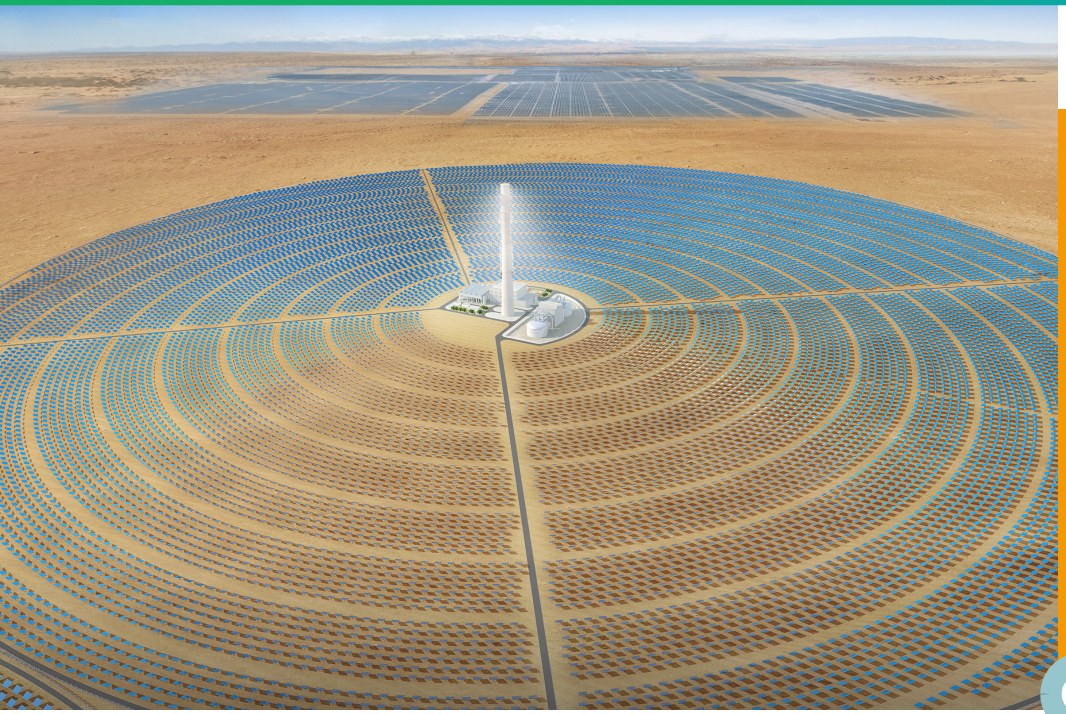
Summary

Judging by performance of the same type of CSP Plants around the world, it is safe to say that CSP Plants are "easy to build and difficult to achieve production". **For a CSP Plants with huge investment, whether it can reach the designed power generation on schedule is the premise that determines whether the project owner can get the expected returns.** Therefore, when selecting the key technology sources and core equipment of the CSP Plants, it is important for the owner to look into the technology provider' s previous performance.

Behind the excellent operation performance of SUPCON SOLAR Delingha 50MW Molten Salt Tower CSP Plant is many years' dedicated research and development and engineering practice of Cosin Solar in the field of tower CSP, which is our long-term investment and accumulation in design optimization, system performance, equipment reliability, operation strategy and other aspects. **It fully proves the advanced, mature and reliable nature of our independent research and development tower CSP technology.**

TOP NEWS

CTGR Awards EPC to Cosin Solar for Qinghai Qingyu DC 100MW CSP Project



Project Profile

On July 25, 2022, Powerchina Northwest Engineering Corporation Ltd. (Powerchina Northwest fo short) received the "Notification of Award" from China Three Gorges Renewables (Group) Co., Ltd. (CTGR for short). It was confirmed that the consortium of Powerchina Northwest, Cosin Solar, and Energy China ZTPC, **won the EPC project of CTGR Qinghai Qingyu DC 100MW CSP Project.**

According to the division of responsibility, Cosin Solar will participate in the overall design and project management, and be responsible for the technical scheme of the solar block, equipment supply, as well as related commissioning and trial operation guidance services.

The total installed capacity of CTGR Qinghai Qingyu DC Phase II Section 3 project is 1000MW, including PV of 900MW and Tower CSP of 100MW. The 100MW CSP project adopts the molten salt tower CSP technology and is located in the southern part of Wutumeiren Solar Power Park, Geermu City, Haixi state, Qinghai Province.

The tower of Jinta ZhongGuang Solar “100MW CSP + 600MW PV” Project reached a height of 100 meters

Project Construction Update

On September 17, the tower of Jinta ZhongGuang Solar "100MW CSP + 600MW PV" project reached a height of 100 meters.

The elevation of the center of the receiver is 220 meters, and the height of the concrete tower is 195 meters. The concrete pouring for the foundation of the tower began on June 17, 2022. After 93 days of construction, the tower reached 100.5 meters on September 17, overcoming the adverse effects of the epidemic situation and severe weather such as sandstorms and strong winds. The tower is scheduled to reach the top in November this year.

Read More →

UPCOMING EVENTS

CSP Focus China 2022

November 2nd-3rd, 2022

Online:
https://lm.enewie.com/live/YDVKEF

Cosin Solar is attending this event

China Solar Thermal Electricity Conference 2022

November 8th-11th, 2022

Gansu，China

Cosin Solar is attending this event

CosinSolar

A Global Leading Provider for Molten Salt Tower CSP

- **The former SUPCON SOLAR，officially renamed in July 2021 into Cosin Solar Technology Co., Ltd. (Cosin Solar for short)**
- Founded in 2010, focus on Tower CSP and Energy Storage technology
- Independent R&D with fully patented technology and homebred equipment
- Technology consultancy, Equipment integration, Engineering services
- Development, Investment, Construction, Operation of projects

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