



# Helius New Energy Co., Ltd

HangZhou, Zhejiang Province, China.



# Collaborating for A Green Future

Concentrating Solar Power (CSP) is a system that converts solar energy into thermal energy and generates electricity through a thermodynamic conversion process.

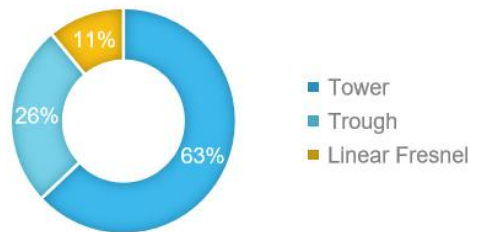
The operation of solar thermal power generation involves using a large number of mirrors that track the sun and focus the radiation to reflect it onto a heat absorber. The high-temperature working fluid generates high-pressure steam, which drives steam turbines to generate electricity. Alternatively, the thermal energy can be stored in tanks and released when needed to generate electricity.



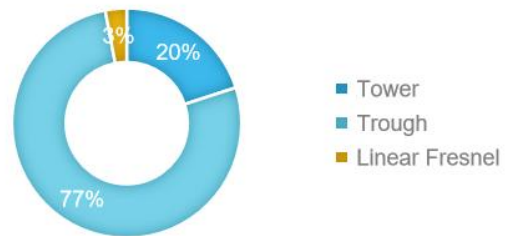
# Three Concentrating Solar Power Generation Technologies

The currently commercially applied solar thermal power generation technologies mainly consist of Tower, Trough, and Linear Fresnel.

The proportion of cumulative installed solar thermal power capacity in China



The global proportion of cumulative installed solar thermal power capacity



In China, the main concentrating configuration applied is Tower technology which dominates approximately 63.1 % of the market.

On a global scale, trough technology accounts for 77% of the market share. The primary reason is that trough technology was the first to achieve commercialization on a global level.





## The Role of CSP

### 1. Contribute to Energy Reform

This technology enables the conversion of surplus electricity from the grid into stored thermal energy, which can be used for subsequent power generation. Thermal energy storage complements intermittent renewable energy sources, thereby effectively increasing the proportion of renewable energy consumption.

### 2. Enhancing Grid Operational Efficiency

Excess steam thermal energy can be converted into stored heat within the thermal storage medium. Moreover, it can be released as needed, enabling an instantaneous response to grid dispatch instructions and facilitating peak shaving and valley filling operations.

### 3. Renewable Energy Supply

Solar thermal power generation converts solar energy into electricity, which is a continuously renewable resource, making solar thermal power generation a sustainable solution for energy supply.

### 1. Low Carbon and Green

The lifecycle carbon emissions of CSP are only 1/50 of coal-fired power and 1/6 of photovoltaic power, making it conducive to achieving carbon neutrality targets. This represents a low-carbon energy form that contributes to mitigating climate change.

### 2. Stability and Large-Scale Energy Storage

By storing excess heat during the day and releasing it at night for power generation, it achieves uninterrupted power supply. The release of stored heat when necessary enhance both load-shifting capabilities and peak load capacity of the plant.

### 3. High Operational Efficiency

Concentrating solar power has advantages in terms of thermal storage capacity, scalable construction, operational lifespan, safety, and power generation output.

## The Advantages of CSP

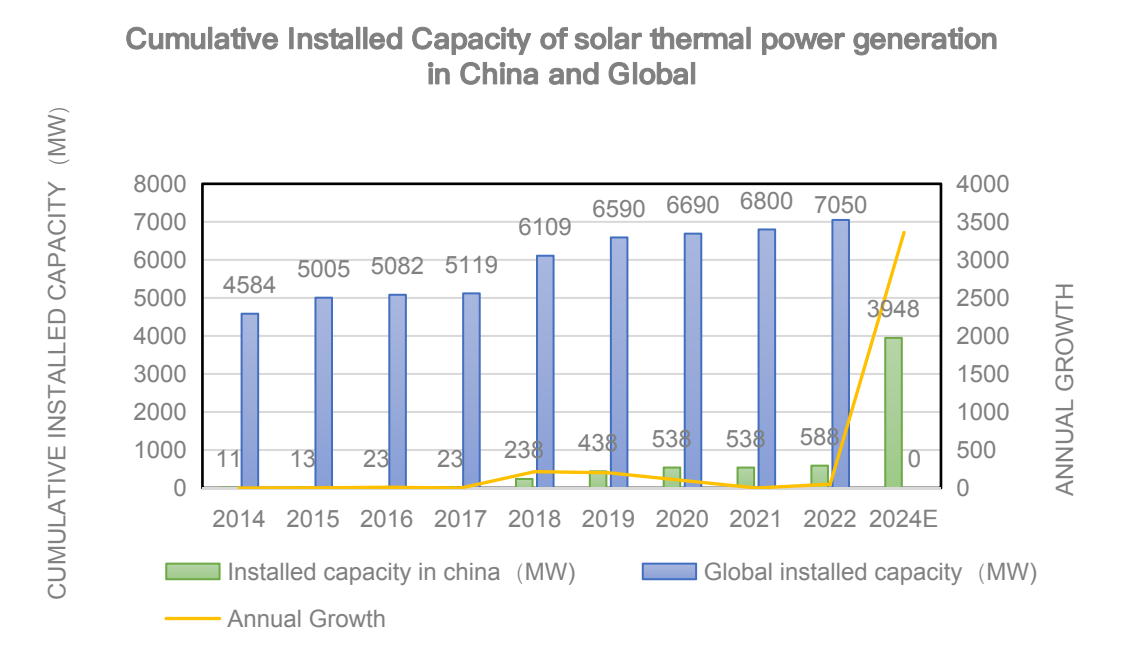




# Global Development of Thermal Power Generation Capacity

According to the statistics, by the end of 2022, the global cumulative installed capacity of concentrating solar power was approximately 7,050 MW.

The development of global and Chinese concentrating solar power cumulative installed capacity from 2014 to 2022 is shown:



## ► Summary of Data Analysis

- As of the end of 2022, the cumulative installed capacity of solar thermal power systems globally has exceeded 7.05 GW, marking a growth of 526% compared to the capacity in 2010.
- Since the commissioning of the world's first concentrating solar power plant in 1995, there has not been a single safety incident, including explosions, in the approximately 7 GW of installed solar thermal power capacity globally (with energy storage capacity exceeding 1000 GWh).
- By the end of 2022, China's cumulative installed capacity of solar thermal power was 588 MW (0.588 GW), representing 8.3% of the global cumulative installed capacity of concentrating solar power.
- There was a significant growth rate in 2018. This was mainly due to the commissioning of three solar thermal power demonstration projects in China, with a total installed capacity of 200 MW.

# Helius New Energy Co., Ltd

- A new energy technology enterprise focused on "CSP" , "molten salt energy storage" , "operation and maintenance" , multi-energy complementarity, and intelligent energy management. We provide specialized "operation and maintenance +" teams for solar thermal power plants, as well as integrated solutions and devices for molten salt energy storage.
- Established in January 2018, with a registered capital of 1.1245 billion RMB, situated within Shangcheng District, Hangzhou City, Zhejiang Province.
- The company owns two tower CSP stations with molten salt energy storage: a 10MW project and a 50MW project, both located in Delingha, Qinghai Province.

## Development Timeline

2018.8

Established in January 2018 with a registered capital of 1.1245 billion RMB.

The Delingha 50MW Tower CSP completely connected to the grid for power generation which is one of the country's first batch of CSP demonstration projects.

2020.12

Zhongguang New Energy holds full ownership of Qinghai Zhongkong Solar Power Generation Co., Ltd.

The project under the general contracting of Zhongguang New Energy, has been put into operation.

2022.8

From 2021.8 to 2022.8, the Delingha 50MW CSP Plant generated 158 million kWh of electricity which surpassing the expected output.

2018.12

2021.11





# Development Strength

The Delingha 50MW Tower CSP has undergone a comprehensive technical assessment by the independent engineering consulting company Fichtner from Germany. The design technology of the plant has reached the most advanced level globally.

The company has obtained the ISO "Three Systems" certification, which serves as a significant endorsement of their comprehensive strategy for quality, environment, and occupational health and safety development. This certification signifies Helius's advancement toward a high quality development.



Director of  
Zhejiang  
Energy  
Federation

Director of  
Hangzhou  
Energy Storage  
Industry  
Association

27 patents  
17 invention patents  
5 software copyrights

Member of China Solar Thermal  
Power Station Development  
Supply Chain Platform

Director of the Solar  
Thermal Industry  
Technology  
Innovation Strategic  
Alliance



# Main Business



## Concentrated Solar Power

By using mirrors to track the sun and focus the radiation to an absorber containing a heat-absorbing working fluid. This process efficiently converts solar energy into thermal energy. High-temperature molten salt exchanges heat with water resulting in the generation of high-pressure steam that drives steam turbines to produce electricity.

## Molten salt storage

A high-efficiency storage technology that absorbs energy at low temperatures and releases it at high temperatures. This technology is not only applicable to solar thermal power generation but can also serve as a novel energy storage solution within emerging power systems predominantly.



## Operation and Maintenance

We offer comprehensive and systematic O&M solutions that cover the entire lifecycle. These solutions ensure standardized practices and provide robust support for the healthy operation of solar thermal power plants for their owners.

## Others Initiatives

- Single-tank Molten Salt Storage
- Industrial Tourism
- Diversified Layout



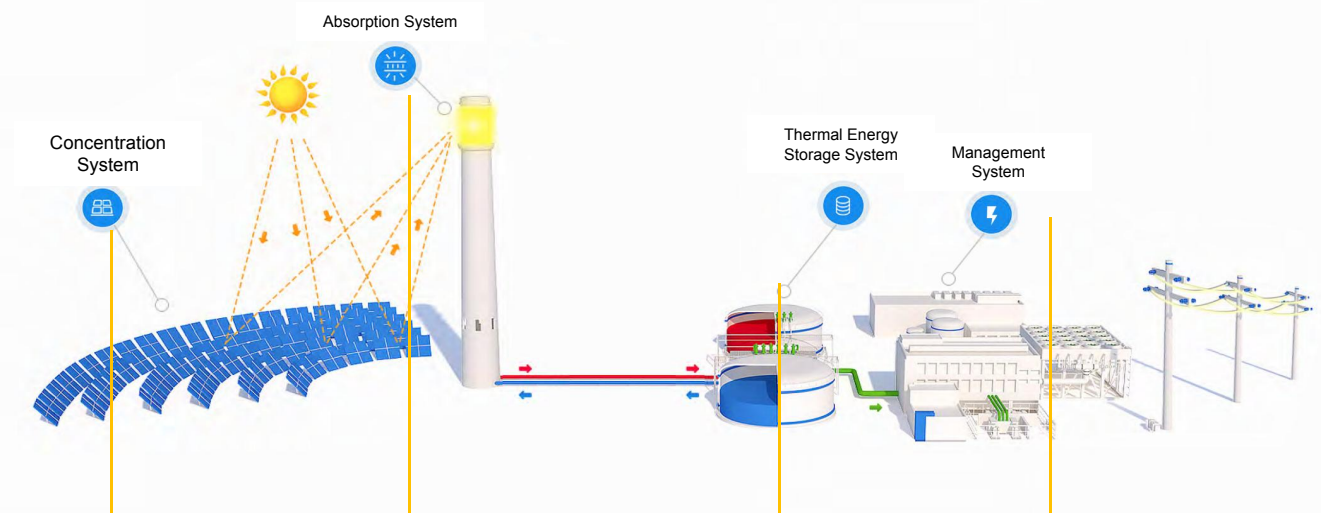


# Molten Salt Tower CSP System



## Technical Description

This system efficiently converts solar energy into thermal energy by concentrating sunlight. It includes the thermal energy storage system to shift production during high demand times and avoid producing during low demand times. The heat exchange system utilizes high-temperature molten salt and water to exchange heat when power generation is required. This process generates high-temperature steam turbines for electricity generation.



### Concentration System

The power plant utilizes sun-tracking mirrors to reflect solar irradiance in the solar receivers which are located at the top of the towers.

### Absorption System

By utilizing solar energy to heat its working fluid and efficiently converts the concentrated solar energy into thermal energy.

### Thermal Energy Storage System

The thermal storage system utilizes hot and cold liquid salt tanks to store solar heat energy for later steam generation. The thermal storage capability allows the excess heat to be stored.

### Management System

Utilizing a fully intelligent management system for operation and maintenance ensures the secure and stable operation of the system while maximizing benefits with the lowest possible costs.

# The main components of the power plant



## Concentration System



**High accuracy:** The sun-tracking accuracy of the heliostats reaches 1.65 mrad, ensuring efficient utilization of solar energy.

**Intelligent system:** The heliostat controller is handled by the Control System.

The heliostats have received the highest rating of "Excellent" in the quality inspections by reputable third-party organizations from Germany and the German Aerospace Center (DLR).

**Large-Scale:** Able to accommodate 100,000 heliostats with a total concentrating area of 2 million square meters.

**Safe and Reliable:** The heliostats exhibit strong weather resistance, with an operational temperature range of  $-40^{\circ}\text{C}$  to  $65^{\circ}\text{C}$  and a working wind speed limit of 24 m/s.



## Large-scale heliostats Control System

## Absorption System



**The special meterail** helps address challenging conditions like drastic temperature fluctuations and corrosive environments.

**Flexible Structural Design:** Minimizes temperature stress and thermal fatigue effects to the greatest extent. Both real-time surface temperature monitoring and anti-freezing design to ensuring secure operations.

## High Reliability System and Equipment:

Leak Prevention; Intermittent Operation, Frequent Start-Stop; Coordinated Energy Variation Control; Corrosion Resistance;

**Molten Salt Tanks:** Material Selection and Wall Thickness Design, Expansion and Stress Analysis and Insulation Optimization Design.



## Thermal Energy Storage System



# Thermal Energy Storage System

The TES system will be based on molten salt, flowing through a heat exchanger installed between two tanks and exchanging heat with steam/water streams. The thermal storage capability allows the excess heat to be stored until utilized for power generation. The heated salt will be stored in an insulated tank to provide a steam heating source after the sun sets, allowing the facility to more closely satisfy the load demands of the electricity grid system.

Simultaneously, the molten salt energy storage system also serves as the optimal solution for the flexible transformation of thermal power units, enabling combined heating and steam generation and providing comprehensive energy services.

## Grid-Friendly

- Utilizes steam turbine generators, capable of providing reactive power and rotational inertia to the grid, contributing to voltage and frequency stability.
- Offers services such as load regulation, frequency regulation, and voltage regulation system backup.

## Large Energy Storage Capacity

- Achieving a wide range of large-scale energy storage, from 10 MWh to 10 GWh

## High safety

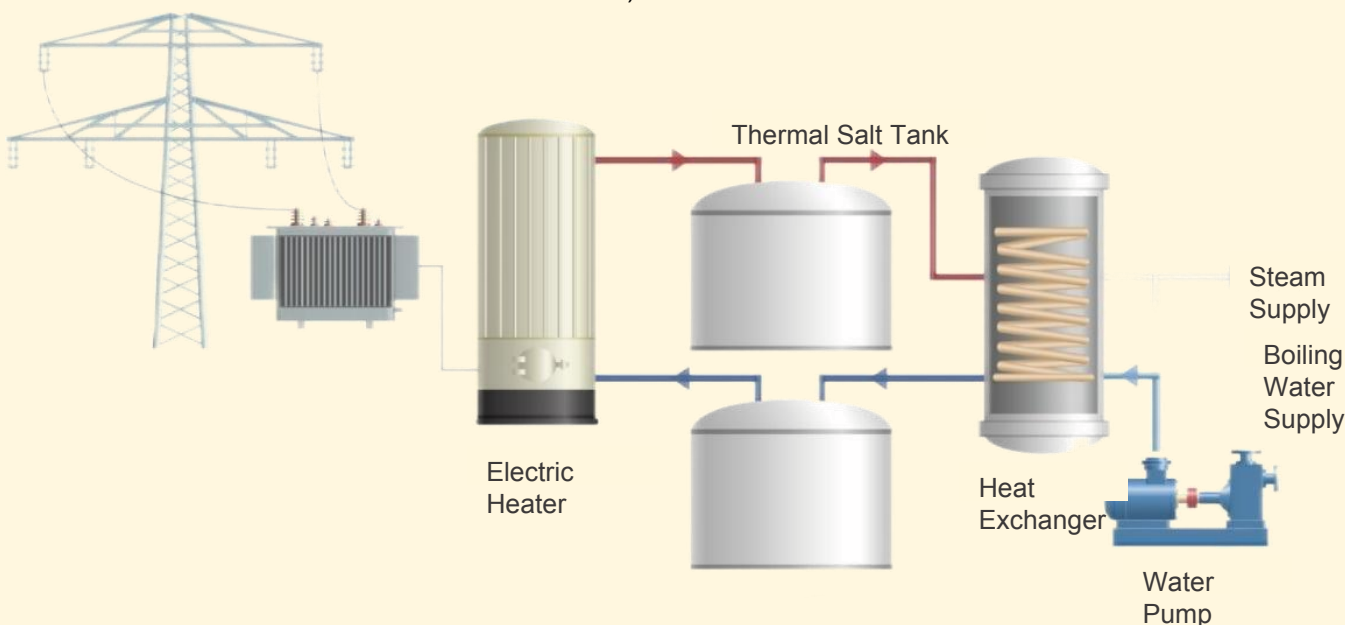
- Molten salt energy storage involves purely physical changes, eliminating risks of explosion or combustion throughout the process.
- › Molten salt has a long history of stable and safe operation in chemical and other fields.

## Short Construction Period

- Construction period is approximately 8 to 10 months (excluding steam turbines) / 12 to 18 months (including steam turbines).

## Wide Applicability

- Flexible and adjustable temperature range, applicable from 80 to 600 ° C.



# Operation & Maintenance+

Helius fully utilizes its experience in the construction and operation of solar thermal power stations to specialise in its O&M business. It offers standardized, systematic O&M solutions covering the entire lifecycle to solar thermal power station owners, ensuring the healthy operation of their power stations.



## 1 World Record

Delingha's 50MW tower solar thermal power station is the world's first tower molten salt energy storage power station that achieves annual actual power generation exceeding the annual design power generation.



## 2 Service Base

The service bases in **Qinghai** and **Gansu** collectively cover the spare parts sharing and technical support needs of all solar thermal power stations in Northwest China.



## 3 Major Service Resources:

1. O&M team with 10 years experience: more than 70% are middle and senior technician and more than 50% have professional qualifications.
2. China's first solar-thermal power O&M talent training centre.
3. Continuous O&M cost optimization capability.

▽



## 4 Ace Strategies

1. Complex weather operation strategy.
2. Frequent start-stop and variable load operation strategy of conventional islands.
3. Stable operation strategy of thermal storage and exchange system.
4. Efficient cleaning strategies for the mirror field.



## 5 Service Products

1. O&M trusteeship.
2. Talent dispatch.
3. Joint storage and backup.
4. Predictive maintenance.
5. Value-added sharing.




# The Delingha 50MW Tower CSP





The Delingha 50MW Tower CSP is the first demonstration project to achieve its design capacity in China. It is located in the Photovoltaic (Thermal) Industry Park at the western exit of Delingha City, Qinghai Province.


Equipped with a 7-hour molten salt energy storage system, the designed annual electricity generation is 146 million kWh, equivalent to the annual electricity of over 80,000 households. It can annually save around 46,000 tons of standard coal and reduce carbon dioxide emissions by approximately 121,000 tons, resulting in substantial social benefits.

 Capacity: 50MW

 Steam Parameters: 13.2MPa, 540.0°C


 Storage Duration: 7 hour

 Molten Salt Consumption: 10093 tons

 Total Heliostat Area: 542700m<sup>2</sup>

 Tower Height: 200 metres

 CSP Plant Land Area: 3.5km<sup>2</sup>

 Annual Power Generation: 146 million kWh

## 2018

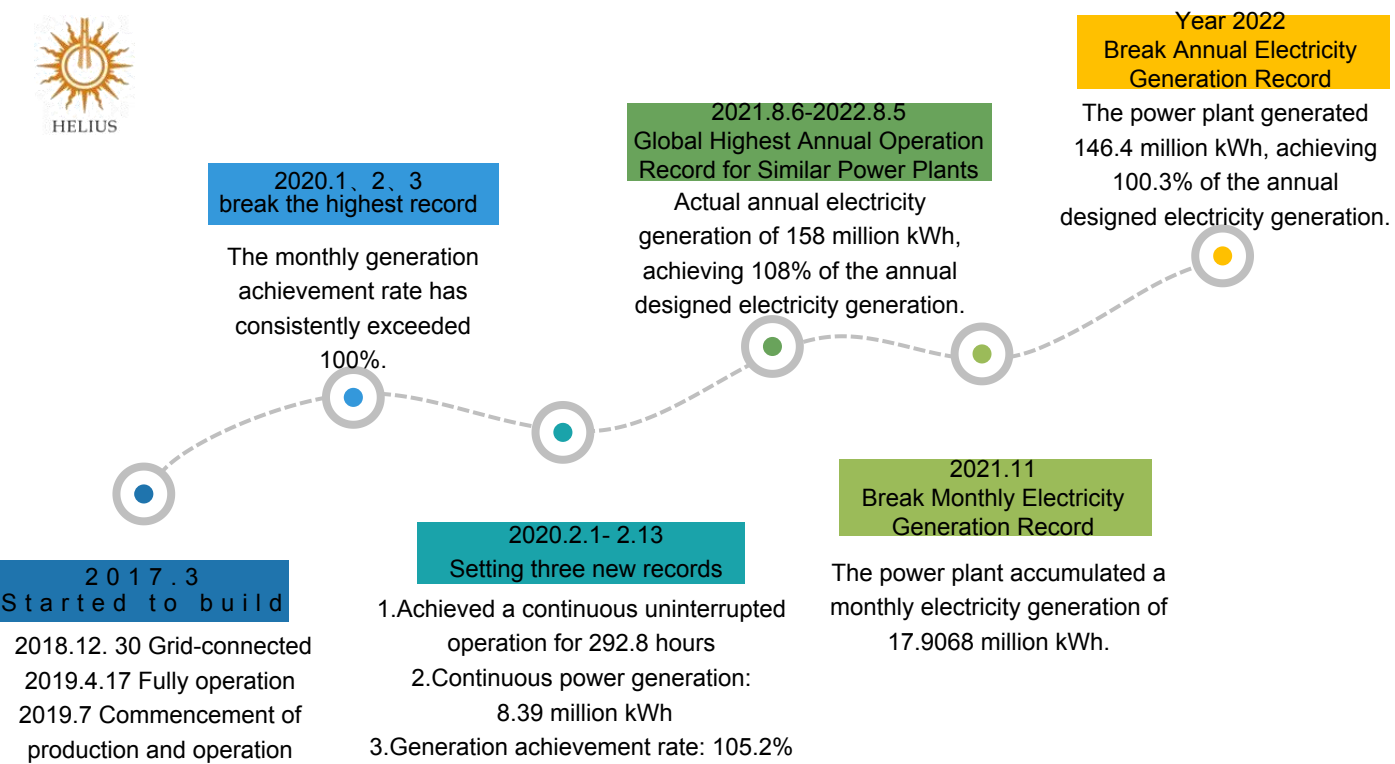
Consist with 27135 heliostats  
Each mirror area: 20m<sup>2</sup>

Electricity Price in 25-Year Period :  
1.15 RMB/kWh

During the construction of the power plant, approximately 550,000 square meters of glass, 20,000 tons of steel, 10,000 tons of molten salt, and 30,000 tons of cement are consumed which promotes the development of the equipment manufacturing, industrial automation, and artificial intelligence industries.



# The Delingha 50MW Tower CSP



The CSP station has been continually reaching new records in last four years . Additionally, the power station has undergone a comprehensive technical assessment by the independent engineering consultancy firm Fichtner from Germany, confirming its advanced quality and design technology at the forefront of similar global power stations.





# The Delingha 10MW Tower CSP

Stable operation for 10 years, achieving 97% attainment of power generation targets which ranking first globally.

2-hour molten salt energy storage upgrade completed in August 2016.

Adopted the tower-type two-fluid (water/molten salt) working fluid technology route



Capacity: 10MW / 2 hour



CSP Plant Land Area: 250000m<sup>2</sup>



Storage Duration: 2 hour



Point Photovoltaic Efficiency: 15.9%



Total Heliostat Area: 63000m<sup>2</sup>



Steam Parameters: 8.83MPa/510°C



## The first tower CSP operational station in China and the sixth in global

In July 2013, the Delingha 10MW Double Tower CSP Tower plant completely integrated into the Qinghai power grid.



## The first tower CSP station with molten salt energy storage in China and the third in global

Completed 2- hour molten salt energy storage retrofit, and achieved full-load power generation on August 21, 2016.



## The first CSP station approved grid-connected electricity pricing in China

In September 2014, the National Development and Reform Commission approved a grid-connected electricity price of 1.2 RMB per kilowatt-hour which signifying a significant step towards the commercial operation of solar thermal power technology.



## The CSP is located at an elevation of 3017 meters above sea level.

The project fully demonstrated China's independently developed tower-type solar thermal system integration technology and core equipment development capabilities to adapt severe environment.



# Operation & Maintenance

## Building...

### Concentrated solar power (CSP) + photovoltaic (PV) Shanshan Qike Tai, Turpan, Xinjiang

The project utilizes a molten salt tower CSP with a matching steam turbine system consisting of an ultra-high-pressure, 8-stage reheat, axial exhaust, and direct air-cooled condensing steam turbine. The steam turbine has a rated capacity of 100MW.

- Construction: State Power Investment Corporation Henan Electric Power Co., Ltd.
- Construction Scale: Total capacity of 1GW (100MW CSP + 900MW PV)
- CSP Project: Based on a 500,000m<sup>2</sup> mirror field, 8-hour thermal storage system with 6-hour molten salt, 20MW waste heat boiler, and a 100MW steam turbine generator set. Future expansion conditions include a reserved 300,000m<sup>2</sup> mirror field, 4-hour storage tank, and 40MW electrical heater.
- Land Area: Total land area for the CSP section is 168.97 hectares.
- Location: Qiketai Town, Shanshan County, Turpan, Xinjiang, China

### Jinta Helius Solar "PV + CSP" Project

This project utilizes a molten salt solar thermal tower CSP with a steam turbine rated capacity of 100MW.

- Construction: Jinta Zhongguang Solar Power Generation Co., Ltd.
- Project Scale: Total capacity of 700MW (CSP 100MW + PV 600MW)
- Land Area: Total land area approximately 25,631 acres, with the CSP portion occupying around 5,425 acres.
- Location: Baishuiquan District, Jinta County, Jiuquan City, Gansu Province, China.



# Molten Salt Energy Storage Project Case Study:

Xizi Aerospace Zero-Carbon Smart Energy Center Integrated with Source-Grid-Load Storage Project

Recipient of Zhejiang Province's First Batch of New Energy Storage Demonstration Projects in the 14th Five-Year Plan

**Steam Supply:** Flow rate of 8 t/h, steam pressure of 0.4 MPa, 150 ° C

**Thermal Storage:** 410 t of molten salt, thermal storage temperature of 186 ° C - 400 ° C

**Energy Storage:** All-vanadium flow battery, 400 kWh capacity

**Photovoltaic:** 3 MW



## Technical Advantages:

This project establishes a zero-carbon, intelligent, safe, and efficient new ecological energy system. It effectively addresses the challenge of accommodating renewable energy during periods of low electricity demand and offers an alternative solution for replacing fossil fuel-based power generation and heating.

Huangyan  
Thermal  
Energy  
Storage  
Project

**The project has successfully been selected as the Zhejiang Province's 2022 New Power System Pilot Demonstration Project.**

**Energy Storage Capacity:** 42.5MW/340MWh + 50t/h industrial steam

**Technical Solution:** Utilizing molten salt energy storage technology, this approach stores thermal energy in the form of heat.

**Significance:** Upon completion of this project, the existing fossil fuel heating system will be replaced which holds significant demonstration value for the replacement of fossil fuels.

**The project has successfully been selected as one of the first batch of new energy storage demonstration projects in Zhejiang Province's "14th Five-Year Plan".**

**Energy Storage Capacity:** The total energy storage capacity is 144MW/880MWh

**Technical Approach:** The project adopts high-temperature molten salt energy storage technology, which stores surplus electricity from off-peak periods or renewable energy sources in the form of thermal energy.

**Significance:** By connecting various centralizing renewable energy resources, the project aims to establish a low-carbon and zero-carbon energy consumption model.

Hangzhou  
Pharmaceutical  
Molten Salt  
Energy  
Storage  
Project



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