The key to maximizing concentrated solar power plant output

Siemens SunField LP

Answers for energy.

SIEMENS

Making solar energy precise and efficient

Siemens designs reliable, efficient, and optimized solar field solutions

Solar fields generate clean, carbon-free, renewable energy from an endless resource. They contribute to a more sustainable and ecologically sound power generation landscape. However, like any other power generation project, solar fields are, first and foremost, expected to perform at maximum levels and generate revenue. That is why they must prove their inherent financial feasibility before implementation.

However, sound project planning can easily become problematic due to the technical complexity of a solar field. If all of the critical solar components are delivered from multiple sources and providers, both delivery and performance risk can increase.

The SunField LP from Siemens is a groundbreaking solar field concept designed to address these issues. Its vertically integrated concept can help reduce project risks and reduce costs considerably for both investors and EPCs. It can enable more precise cost control, performance optimization of the entire trough, streamlined construction and an outstanding degree of electrical production at an excellent price/performance ratio.

Siemens manufactures and supplies all of the relevant solar field components, from solar receivers to parabolic reflectors and solar collector assemblies (SCA). As a single source supplier for an entire solar field, Siemens takes advantage of its decades of research and development in solar power, as well as its significant experience in testing, calibrating and optimizing parabolic trough performance.

The result is a reliable, highly efficient solar field solution based on commercially proven technology. As such, the SunField LP can suit investors' and EPCs' operational and financial models and promote bankability.

Solar power expertise and technology at your fingertips

The SunField LP is a vertically integrated concept in which all critical heat-generating components are designed and manufactured to work harmoniously and are delivered as a package. This can facilitate the development of solar thermal power plants by providing developers with a single-source solution for all critical components of the entire solar field. It opens the highly promising solar thermal market for interested parties possessing initiative and financing, but lacking the essential technical expertise.

All critical components in one system Siemens SunField LP

A high degree of integration and harmonization helps provide high efficiency

A solar field collects sunshine, concentrates it, converts it into thermal heat, and, finally, into electrical power. While this working principle may seem simple, it requires precise engineering and thorough research and development efforts to optimize the energy yield of the solar fields and turn solar power generation into an environmentally and economically beneficial option.

The SunField LP builds upon Siemens' long-standing engineering experience with solar fields, as well as decades of on-site testing and integration at the commercially operational solar thermal facilities in California and various test facilities. Through many years of experience and modeling, Siemens has developed optimized solar field sizes and configurations. All key components of the Siemens SunField LP are precisely harmonized and coordinated with one another in order to obtain highest efficiency.

Everything you need for your solar power field – from project planning to operation and maintenance

The SunField LP package also includes important planning elements, including solar field design and engineering and design coordination. In addition, Siemens also offers power plant operations and maintenance services to help maximize the operational integrity of the SunField LP.

Collector assemblies

The basic component of the SunField LP solar field is the Siemens solar collector assemblies (SCA), a metal parabolic framework designed to hold the receiver and reflector panels in place and keep them perfectly aligned.

Line-based production for all components and processes, rather than the project-based approach employed by other providers, helps provide the Siemens SCA with the high accuracies necessary for optimal electricity production, and can enable fast and simple assembly and installation.

The SCA includes the latest advances in high torsion stiffness, vibration damping, high stiffness against bending, and corrosion resistance. These advances are important for consistent maximum optical efficiency. A hydraulic drive pylon and control system enable the SCA to precisely track the sun over the entire course of the day.

Reflector panels

The parabolic reflector panels are made up of hot-formed mirrored glass panels supported by a truss system that gives the solar collector assembly its structural strength. To increase the transmissivity for solar radiation, the reflecting panels with their silver-based mirror coating are made of special glass with a particularly low iron content. The reflector panels need to be built to the highest standards of precision and durability, as even the slightest degradation can potentially impair the overall efficiency of the power plant.

Solar receiver

The high efficiency of the UVAC 2010, which is the heart of the parabolic trough system, makes the development of relatively small, highly productive and cost-competitive solar fields possible.

The UVAC 2010 is designed for extremely low heat loss and high transmissivity. It is characterized by its superior thermal efficiency, which helps significantly increase the electrical output of a solar power plant. Its optical and thermal properties provide for outstanding heat creation compared to other available receivers.

The UVAC 2010 is composed of a selectively coated stainless steel tube within an anti-reflective evacuated glass tube. The UVAC 2010 includes Siemens' patented vacuum maintenance unit and the anti-"fluorescent phenomenon" coating, designed to provide stable performance over time, even under extreme conditions.

Field supervisory control

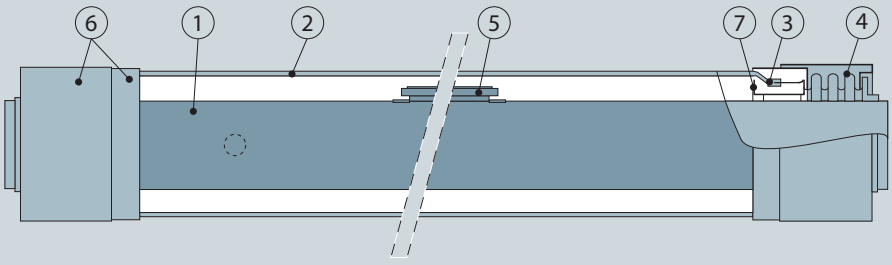
A specially designed, advanced field control system assures the efficient collection of solar radiation. At the core of this system is a specialized sun position sensor. It enables precise tracking and focus of the sun's rays onto the UVAC, and periodically sends commands to a drive system designed to position the SCA for optimal effect. The control system consists of local microprocessor controllers on each SCA and a field supervisory controller in the central control building, where the operators monitor the status of each SCA and all operational values, including solar insolation, wind velocity and HTF temperature. An interactive user interface contributes to the system for user-friendliness and responsiveness.

Solar field modeling

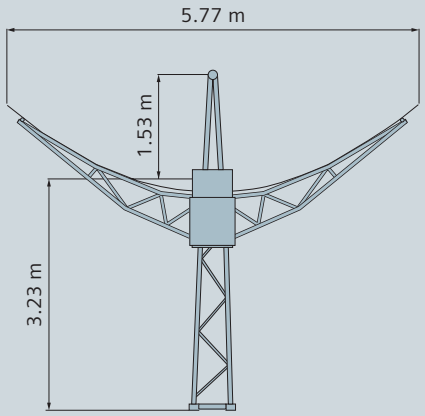
Siemens has designed a complex solar field operational model to complement the SunField LP. The model simulates the operating modes of the solar field, uses meteorological data to perform a heat balance calculation at certain time intervals throughout the year, and provides a calculated estimate of potential output over the lifetime of the power plant. Optical interaction factors, transient conditions, start-ups and changing weather conditions are all taken into consideration. The results are provided in terms of yearly and hourly values, and are verified and calibrated on the basis of results from various plants in operation.

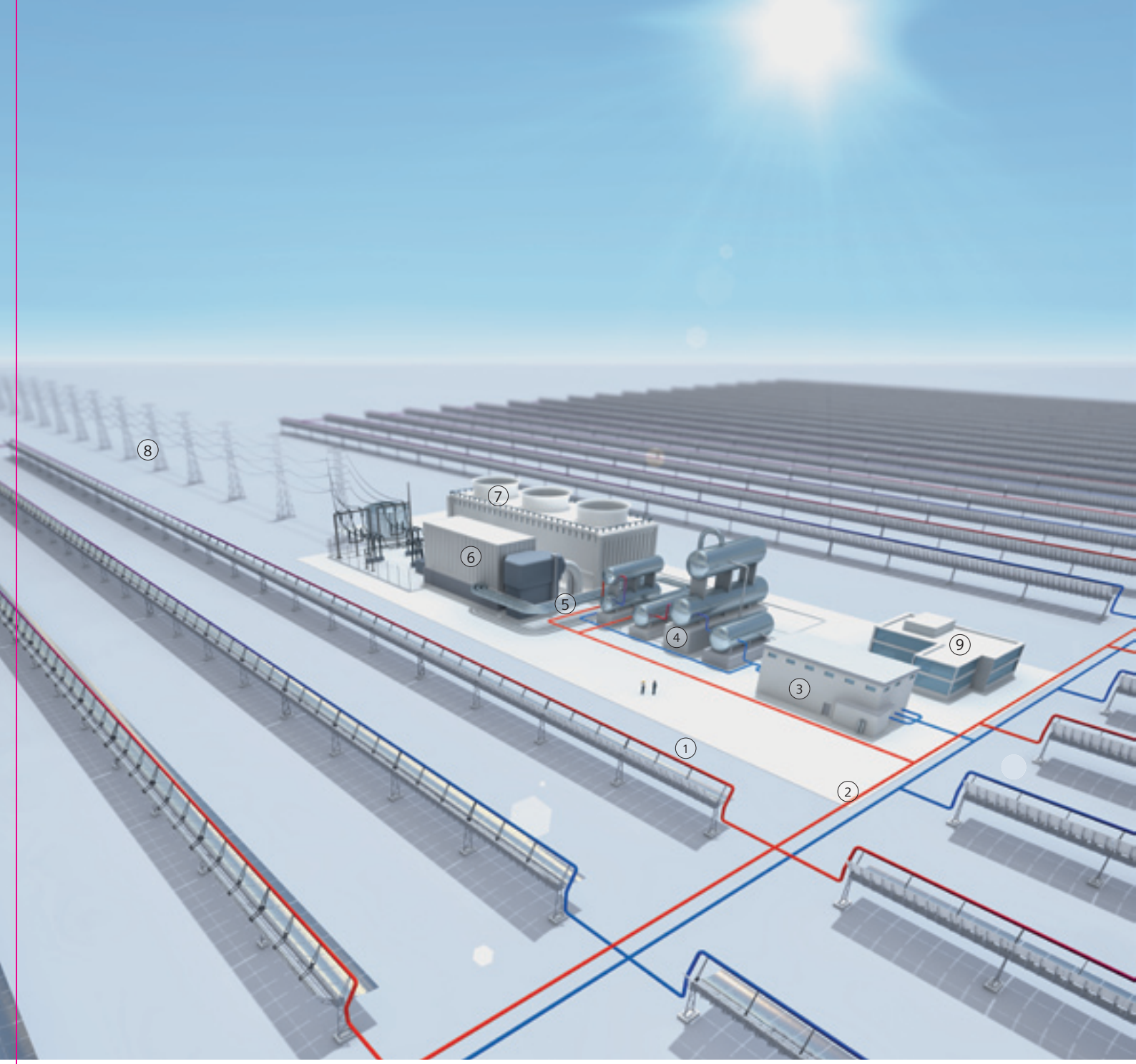
Components of the Siemens UVAC 2010

1. Coated stainless steel absorber tube
2. Coated glass sleeve enclosure
3. Glass-to-metal joint
4. Bellows
5. Hydrogen and barium getters
6. External shields
7. Internal shield



Schematic of a solar trough





1. Solar energy is concentrated by the mirrors onto the receivers. Solar collectors track the sun in order to maximize the solar energy yield.
2. Heat transfer fluid is circulated and heated through the solar field loops. Cooled heat transfer fluid is returned and reused.
3. Pumps circulate the heat transfer fluid through the solar field.
4. Heat exchangers transfer the thermal energy from the heat transfer fluid system to the water steam cycle.
5. The water steam cycle transfers the thermal energy from the heat exchangers to the steam turbine.
6. The steam turbine converts thermal energy to electric power.
7. The cooling tower cools the water cycle.
8. Clean power is delivered to customers via the power grid.
9. Central control optimizes solar power plant operations.

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