



# Solar Simplified





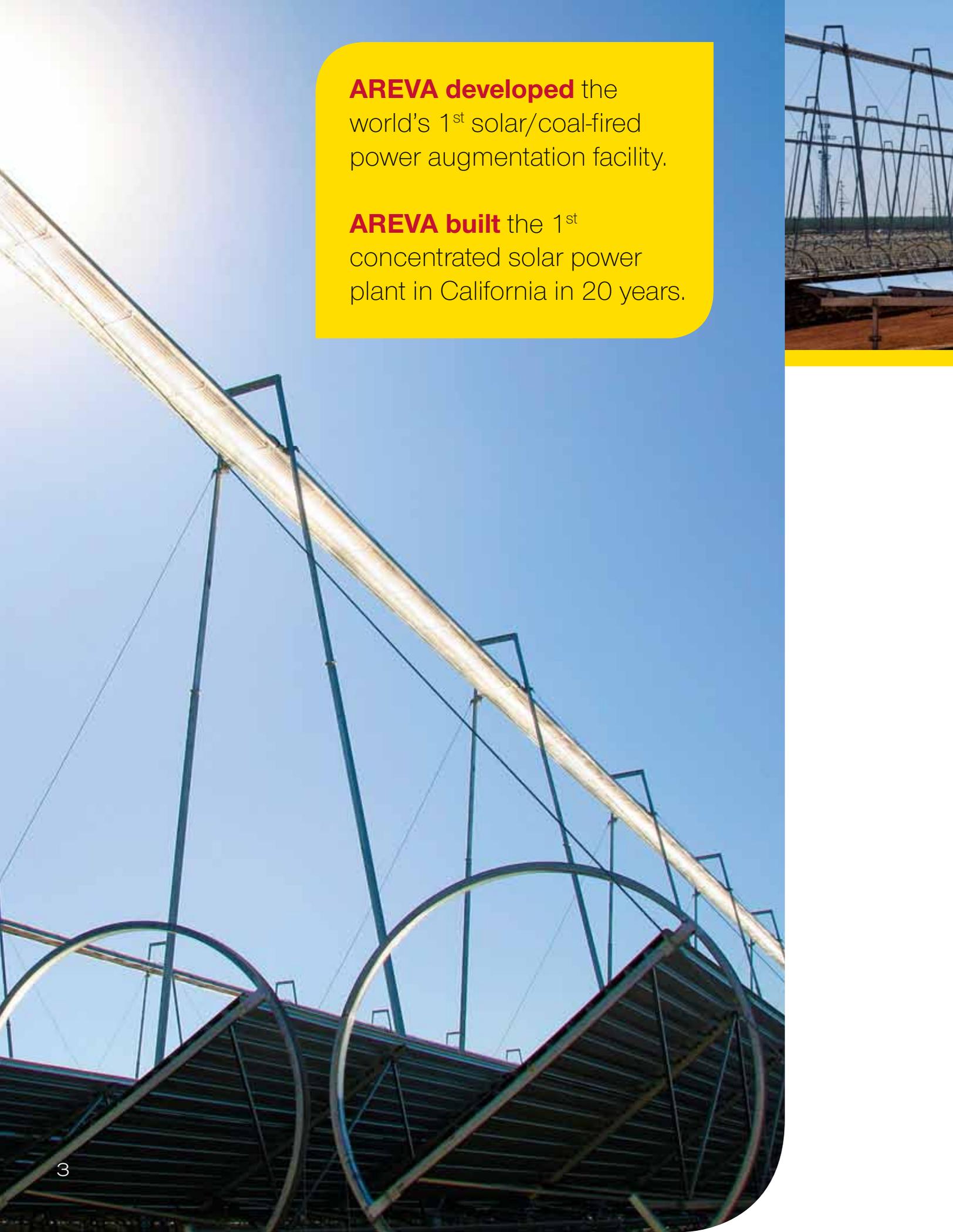
# Experience You Can Count On **Technology That Delivers**



AREVA uses its global energy experience to deliver turnkey concentrated solar power (CSP) solutions that help customers thrive in a dynamic energy market.

AREVA's solar steam generators are customized to meet our customers' exacting energy requirements and are backed by AREVA's performance guarantees.





**AREVA developed** the world's 1<sup>st</sup> solar/coal-fired power augmentation facility.

**AREVA built** the 1<sup>st</sup> concentrated solar power plant in California in 20 years.





## A Bankable Energy Solution

AREVA offers turnkey energy solutions for stand-alone solar thermal plants, power augmentation of conventional power plants, and industrial steam processes. AREVA also brings the project delivery and commissioning services needed to establish these facilities, as well as performance guarantees to ensure your facility's success. It's a winning combination that you can take to the bank.

### Turnkey Delivery

- Delivering the lowest cost CSP solution with reliable project execution
- Reducing risk through performance guarantees — for everything from our solar steam generator fields to the balance-of-plant components — supported by AREVA's financial strength and global market presence
- Offering EPC management using best-in-class engineering, procurement, and construction capabilities
- Controlling every aspect of design, manufacturing, and installation to deliver an effective, customized solution
- Providing life-cycle services for long-term operations and maintenance
- Enhancing existing technology and delivering innovative breakthroughs to meet customer performance and reliability goals

### Quality Technology

- Offers a proven and reliable CSP solution
- Produces high-pressure, superheated steam for stand-alone power plants
- Integrates with fossil-fired plants for power augmentation
- Deploys at customer-specified utility and industrial scales
- Offers firm power through hybridization
- Offers ASME "S" Stamp certification for quality assurance
- Helps satisfy renewable portfolio standards and sustainability goals



# Reliable. Superheated Steam. Low-cost. Land-efficient. Water-wise.

## A Proven Technology.

Compact Linear Fresnel Reflector (CLFR) technology cost-effectively uses modular, flat mirrors, or reflectors, to focus the sun's heat onto elevated "receivers" that enclose a system of boiler tubes through which water flows. The concentrated sunlight boils the water in the tubes, directly generating high-pressure, superheated steam for use in everything from utility-scale power generation to steam augmentation for existing power plants and industrial processing applications.

## Simple. Reliable.

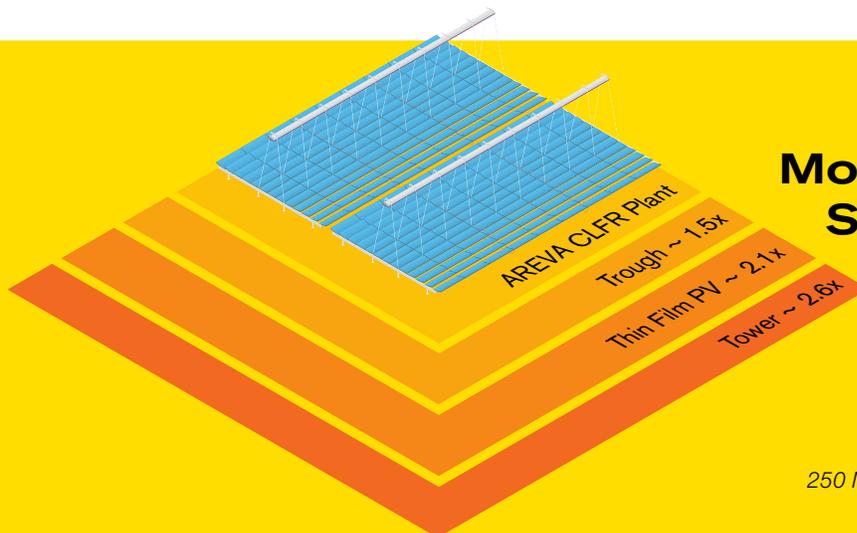
AREVA's proven technology, high-volume manufacturing capability, and use of standard materials enable rapid, cost-effective scale-up to meet your unique energy needs. Our solar steam generators are perfectly suited to meet peak power demand. They continue to operate through periods of transient cloud coverage, providing seamless, reliable power to the grid. And our optional natural gas boiler backup design ensures that power is always available — even when the sun isn't shining.

## Scalable. Local.

Designed to integrate easily with existing steam equipment, AREVA's solar steam generators are modular and scalable. Equipment can be installed rapidly with minimal grading. In addition, the equipment can be manufactured onsite or nearby, enabling companies to use local materials and labor, lowering installation costs and boosting local employment.

## Small Footprint. Big Results.

AREVA has the most land-efficient CSP technology in operation today, lowering costs, simplifying permitting, and reducing environmental impact. Our high energy density is well-suited for existing power plant and industrial sites that may be land-constrained. Water is our working fluid, eliminating the need for costly synthetic oils. And our closed-loop system, combined with an air-cooled design, allows AREVA to reduce water consumption by more than 90% compared to wet-cooled CSP power plants.



## Most Land-Efficient Solar Technology

CSP Reference Plant  
250 MWe CLFR = 890 Acres = 360 Hectares \*  
\* Daggett, CA, weather and radiation data



# Solar Reliability Meets Innovation

AREVA places innovation at the very heart of its industrial development. To better serve our customers, we continually invest in R&D to enhance our technology.



## Kimberlina Solar Thermal Power Plant, Bakersfield, California

The Kimberlina solar power plant is the first concentrating solar power facility built in California in 20 years. Kimberlina generates high-pressure, superheated steam.

## Kogan Creek Solar Boost Project South West Queensland, Australia

CS Energy's 750 megawatt coal-fired Kogan Creek Power Station near Chinchilla will become home to a 44 megawatt solar thermal addition. The project is scheduled to commence operation in 2013 and is the largest solar integration with a coal-fired power plant.



## Sundt Solar Boost Project Tucson, Arizona

Tucson Electric Power (TEP) is partnering with AREVA Solar on a pioneering solar thermal addition to TEP's H. Wilson Sundt Generating Station in Tucson, Arizona to increase plant output by 5 megawatts without added emissions.

### Durable Solar Field

**Heat Transfer Fluid:** Water/steam;  
no oil or molten salts

**Steam Generator Tubing:** Carbon steel,  
horizontal-mount solid piping, no moving joints

**Tracking:** Automatic computer control

### Temperature

Up to 842°F (450°C)

### Pressure

Up to 2,400 psia (165 bara)



## Simple Solutions. Powerful Results.

AREVA's versatile solar steam generator can be used for stand-alone power plants, for solar steam augmentation at existing power plants, or for industrial processing.



### **Stand-alone Power Plants (>50 MWe)**

AREVA's CLFR power plants produce reliable, cost-effective electricity. AREVA's equipment can also be integrated with a gas-fired boiler to ensure dispatchability and continuous power production. Our high-pressure, superheated steam solution helps power producers meet customer demand while fulfilling renewable energy mandates.



### **Power Augmentation (>10 MWe)**

Solar steam enables existing fossil fuel power plants to increase capacity at peak periods, without increasing emissions. These solar booster plants can be built and operating within 9 months, depending upon the size of the installation. This clean, land-efficient technology facilitates permitting, and its direct solar steam design eliminates the need for costly heat exchangers and synthetic oils.

**AREVA is the only solar steam boiler manufacturer to receive the American Society of Mechanical Engineers (ASME) “S” Stamp Certificate of Authorization – the industry hallmark for safety and reliability.**



### **Steam for Industrial Processing (>2.5 MWe)**

To protect against fuel price volatility and to meet sustainability goals, solar steam can displace fossil fuel consumption for mining, desalination, enhanced oil recovery, chemical processing, food processing, and pulp and paper manufacturing. Our solar steam generators integrate simply with conventional steam systems in retrofit and new plant designs.

# The AREVA Advantage

## **Simple and Durable Design**

- Low wind profile
- Direct steam generation
- Water as the working fluid
- Steel-backed, flat mirrors for long life

## **Cost-Effective, Emissions-Free Electricity**

- Delivers the lowest cost CSP technology
- Provides the most land-efficient solar technology
- Eliminates (via solar-only stand-alone) or significantly reduces (via solar/gas hybrid) fuel and emissions cost risks
- Reduces costs through simple design
- Helps meet renewable portfolio standard requirements
- Delivers on-peak energy

## **Reliable and Robust**

- Technology is proven in multiple settings from saturated to superheated steam
- Equipment excels under the toughest environmental conditions (UV, rain, high wind, sandstorms, hail, seismicity)

- Hybrid systems can provide the same dispatchability as fossil-fired power plants

## **Rapid Deployment and Installation**

- Modular and scalable
- High-volume, automated production and standard materials
- Rapid field installation (6–24 months)
- Modular, standard, or customized design for hybrid options

## **Optimized Siting**

- Ease of permitting (no synthetic fuels or molten salt, no solar field VOC emissions, no toxic materials or fire hazards)
- Easier access to contiguous, flat land and transmission
- Closed loop system and dry-cooling capability to conserve water
- No fuel infrastructure necessary
- Non-flammable, non-toxic working fluid
- Maximum peak power per unit of land
- Onsite or regional manufacturing





AREVA supplies solutions for power generation with less carbon. Its expertise and unwavering insistence on safety, security, transparency and ethics are setting the standard, and its responsible development is anchored in a process of continuous improvement.

Ranked first in the global nuclear power industry, AREVA's unique integrated offering to utilities covers every stage of the fuel cycle, nuclear reactor design and construction, and related services. The group is also expanding in renewable energies – wind, solar, bioenergies, hydrogen and storage – to be one of the top three in this sector worldwide.

With these two major offers, AREVA's 48,000 employees are helping to supply ever safer, cleaner and more economical energy to the greatest number of people.

[www.aveva.com](http://www.aveva.com)

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Energy is our future, don't waste it!

**AREVA SOLAR**

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