

**BIG Solutions for BIG Problems ...**

# Concentrating Solar Power

*Recent electricity and gas shortages in California and other western states, along with an expanding recognition of environmental issues, have highlighted the need for clean, large-scale renewable power. Because of its low cost, ability to deliver power during periods of peak demand, and capability for large-scale and distributed deployment in the near-term, concentrating solar power (CSP) can be a major contributor to solving our nation's energy problems now and in the future.*

## CSP is ...

**... proven, reliable technology.** 354 megawatts (MW) (enough for 100,000 homes) of CSP systems have operated successfully in the Southern California desert for the past decade. These solar electric generating system (SEGS) plants consistently operate as well as or better than when they were new.

**... dispatchable.** CSP plants with cost-effective storage or natural gas hybridization can deliver power to the utility grid when that power is most needed, not just when the sun is shining. The SEGS plants' peaking capacity routinely approaches 100%.

**... competitively priced solar power.** These existing CSP plants produce power now for as low as 12¢ per kilowatt hour (12¢/kWh) (including both capital and operating costs), with costs dropping to as low as 5¢/kWh within 10 years as technology refinements and economies of scale are implemented. Independent assessments by the World Bank, ADLittle, the Electric Power Research Institute, and others have confirmed these cost projections. While not currently the lowest cost electricity, CSP is already close to competitive in peaking markets, and there is significant demand for carbon-free electricity from green sources, even at above-market prices, where utility customers have the option of choosing their energy supplier.



*Solar Two successfully demonstrated the power tower concept, including the capability to store energy economically for dispatch at periods of peak demand. U.S. industry is building the first commercial power tower using this technology in Spain and simultaneously investigating near-term opportunities in the United States.*

**... a near-term solution.** 135 MW of new international CSP capacity is currently under design (supported in part by the World Bank/Global Environment Facility and Spanish solar premiums), while U.S. industry is simultaneously pursuing a 200-MW CSP power park in the southwest United States. Because CSP uses relatively conventional technologies and materials (glass, concrete, steel, and standard utility-scale turbines), production capacity can be scaled up to several hundred megawatts per year rapidly, using existing industrial infrastructure.



*354 MW of SEGS plants continue to operate successfully on the California power grid. Annual output of the plants has increased by 35% as plant operations have improved during the past 10 years, and operation and maintenance costs have correspondingly dropped 40%. These plants have demonstrated the ability of CSP to meet utility requirements. Several domestic and international projects are currently being planned.*

**... clean and environmentally friendly.** CSP plants produce no emissions during solar electricity generation. While hybrid plants like SEGS do burn gas during hybrid operations (for a maximum of 25% of their power), newer CSP technologies incorporating storage have the same dispatchability with no fossil fuel usage and zero emissions.



*Solar dish systems are the most efficient solar systems in the world. They provide economical power for utility line support, distributed, and remote applications, and are capable of fully autonomous operation. Sized between 10 and 25 kW per dish, systems can be deployed individually for water pumping or village power applications or grouped to form megawatt-scale power plants.*

# Frequently Asked Questions

## About Concentrating Solar Power

providing local jobs and a boost to the manufacturing economy, rather than the continuing drain of having to buy fuels for conventional plants. Expensive, special-purpose semiconductor or comparable manufacturing plants are not required for CSP, substantially limiting investment in production capacity and the time required to scale up. As few as five developers implementing the technology would have the capability to put more than 20,000 MW online in the southwest United States by 2020.

**Since these plants are operating reliably, why haven't more plants been built in the last few years?** The field of mirrors in a concentrating solar power plant delivers the thermal energy that is provided by fossil fuels in a conventional power plant. Because the sunlight is free, the initial capital expenditure for the collectors is equivalent to buying a lifetime supply of fuel. To recover this high first cost, plant operators need to be able to sign long-term power purchase agreements. However, the current environment favors low first-cost, gas-powered plants, with ratepayers bearing the risk of escalating fuel costs. Other factors, including risks associated with building new technologies, tax equity with conventional technologies, and cost reductions needed from technology advances and economies of scale, are also important.

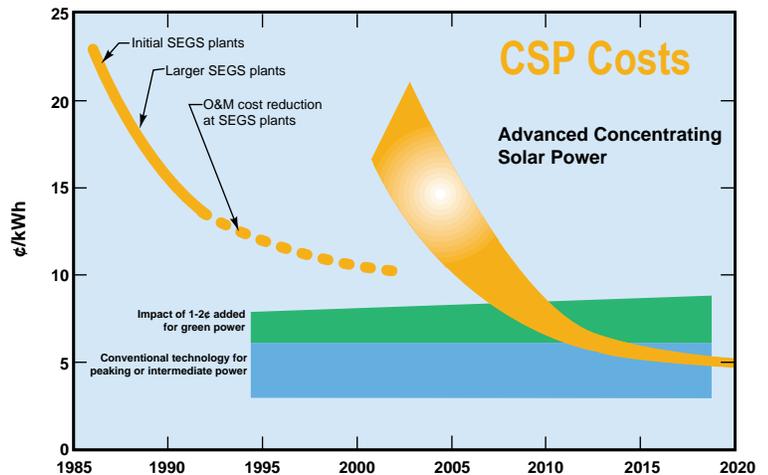
**Sunlight is intermittent. How can we count on solar energy to supply power when needed?** Concentrating solar power technologies can employ cost-effective thermal storage, which sets aside the accumulated heat energy for later conversion to electric power. Concentrating solar power plants also can be hybridized with fossil fuels. Both options allow these plants to generate electricity even when the sun is not shining (for example, at night or during cloudy weather).

**The Solar Two solar plant is no longer operating. Are solar power towers a technology failure?** No. Solar Two was a pilot-scale experiment to validate dispatchable solar power generation with molten-salt storage. Solar Two successfully met all of its objectives, and the key U.S. industry participants in the project are now beginning a commercial solar power tower project in Spain using this technology. They are actively seeking U.S. customers for domestic plants.

**Do concentrating solar plants require a lot of land?** Relatively speaking, no. Consider the Hoover Dam. Lake Mead covers nearly 250 square miles. A concentrating solar power plant occupying only 10 to 20 square miles of land could generate as much energy on an annual basis as the Hoover Dam did last year. Taking into account the land required for mining, concentrating solar power plants also use less land than coal power plants.

**What is the benefit of continuing federal support for concentrating solar power research and development?** Concentrating solar power is on the brink of commercial viability, and U.S. industry is actively seeking commercial projects. To ensure the success of these initial plants and thus enable large-scale construction of additional plants, U.S. industry requires continuing access to the research base on which these plants will be designed. Eliminating federal support for concentrating solar power at this critical stage could disrupt plans to build critically needed commercial plants. The benefit of U.S. investments to date would be lost, and foreign competitors would provide future U.S. solar power plant capacity.

**The energy shortfall in California is large, perhaps as much as 5,000 MW next summer. Can concentrating solar power really help?** The nine SEGS plants built in California were constructed in less than one year each, and the final pair of plants each had a capacity of 80 MW. Previously demonstrated production capacity of 200 MW per year could be reestablished in two years,



## Industry

The CSP industry includes 21 companies who design, sell, own, and/or operate energy systems and power plants based on the concentration of solar energy. CSP companies include energy utilities, independent power producers or project developers, equipment manufacturers, specialized development firms, and consultants. While some firms only offer CSP products, many offer related energy products and services. Four of the 21 are "Fortune 500 Companies." Current companies include:

Duke Solar Energy, LLC  
Nexant (a Bechtel Technology and Consulting Company)  
The Boeing Company  
KJC Operating Company  
Florida Power & Light Energy Operating Services, Inc. (FP&L)  
SunRay Corp.  
Salt River Project

Arizona Public Service Corporation  
Spencer Management Associates  
Stirling Energy Systems  
Science Applications International Corporation  
STM Corp.  
WG Associates  
Concentrating Technologies, LLC

United Innovations Inc.  
Reflective Energies  
Industrial Solar Technologies  
Spectrolab, Inc.  
Kearney & Associates  
Morse Associates, Inc.  
Nagle Pumps, Inc.

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