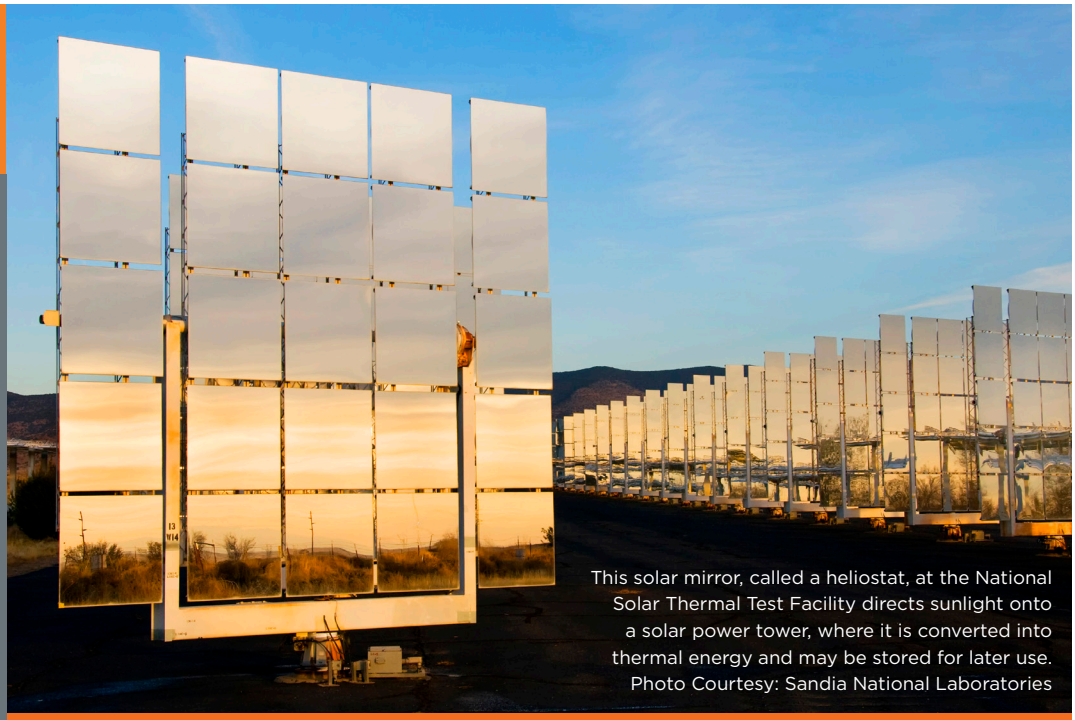
SunShot
U.S. Department of Energy

The U.S. Department of Energy SunShot Initiative is a collaborative national effort to make solar energy technologies cost-competitive with traditional forms of energy by the end of the decade. Reducing the total installed cost for utility-scale solar electricity to roughly 6 cents per kilowatt hour without subsidies will result in rapid, large-scale adoption of solar electricity across the United States. Reaching this goal will re-establish American technological leadership, improve the nation's energy security, and strengthen U.S. economic competitiveness in the global clean energy race.



This solar mirror, called a heliostat, at the National Solar Thermal Test Facility directs sunlight onto a solar power tower, where it is converted into thermal energy and may be stored for later use. Photo Courtesy: Sandia National Laboratories

Concentrating Solar Power

Concentrating solar power (CSP) is a dispatchable, renewable energy option that uses mirrors to focus and concentrate sunlight onto a receiver, from which a heat transfer fluid carries the intense thermal energy to a power block to generate electricity. CSP systems can store solar energy to be used when the sun is not shining. It will help meet the nation's goal of making solar energy fully cost-competitive with other energy sources by the end of the decade. Worldwide, CSP activity is rapidly scaling, with approximately 10 gigawatts (GW) in various stages of operation or development.[1] In the United States alone, nearly 2 GW of CSP are in operation.[2]

Since SunShot's inception, the levelized cost of electricity for CSP in the U.S. has decreased about 36 percent, from $0.21 cents per kilowatt hour to $0.13 cents per kilowatt hour—that's more than half way towards achieving the SunShot 2020 cost targets.

CSP Technology Basics

CSP technologies are primarily deployed in four system configurations: parabolic trough, linear Fresnel, dish engine, and power tower. Parabolic trough and linear Fresnel systems focus sunlight onto a linear receiver, whereas dish engine and power towers focus sunlight onto a single receiver.

A distinguishing factor of CSP is its ability to incorporate simple, efficient, and cost-effective thermal energy storage at the point of power generation. With CSP systems, the materials used to deliver energy to engines or turbines, usually molten salt or oil, may be held in a tank for later use. This allows electric utilities to balance the intermittencies of solar availability by storing energy to be used during peak energy consumption hours, which, depending on the season, can occur before the sun rises and after it sets. CSP with thermal energy storage can also enable higher levels of penetration of other variable generation sources onto the electrical grid, such as photovoltaics and wind, through its ability to withhold energy delivery while the wind or sun is available, then deliver power

This molten salt test loop at Sandia National Laboratories' National Solar Thermal Test Facility has been used to further understand challenges related to thermal energy storage. Photo Courtesy: Sandia National Laboratories

[1, 2] http://www.solarpaces.org/csp-technology/csp-projects-around-the-world

The Crescent Dunes Solar Energy CSP plant, located in Tonopah, Nevada, is the largest molten-salt power tower CSP plant in commercial operation in the world. This plant has 10 hours of thermal energy storage, allowing it to continue to deliver power to the grid well into the night. Photo courtesy: Doc Searls

when they are not. This ability enables CSP plants to become flexible resources for the grid without any fossil fuel emissions. Additionally, CSP systems can synergistically integrate with fossil-fueled power plants to offset fuel use and reduce carbon footprints.

Leading the Advancement of Technology

The goal of the U.S. Department of Energy SunShot Initiative is to reduce the costs of solar energy by roughly 75% by 2020, which will lead to the rapid, wide-scale adoption of this clean, renewable energy resource. The goals of SunShot's CSP subprogram include lowering costs and advancing technology to the point that CSP is competitive in the power market by 2020. Research and development is conducted through cost-shared contracts with industry, universities, and national laboratories. In addition, the CSP subprogram develops partnerships with federal and state agencies, as well as throughout the solar industry, to encourage the deployment of CSP technologies by addressing permitting, environmental, and transmission issues.

World-Class Research

The SunShot Initiative funds critical research and development (R&D) that helps to overcome cost, reliability, performance, and manufacturability challenges. Private companies in the solar industry, universities, and national laboratories are working to find new solutions that will lower the cost of solar energy.

In order to improve sunlight collection capabilities, SunShot supports research and development efforts to develop high optical accuracy reflectors, reduce collector structure weight and material, develop highly efficient tracking and control methods, and reduce both collector soiling and the amount of water required for operations and maintenance. Funding for receiver R&D supports the development of fundamentally new receiver designs and novel solar selective coatings and explores high temperature receiver corrosion with a variety of potential heat transfer fluids. Power conversion and systems R&D funding supports the development of high temperature power cycles and solid-state power conversion techniques. Thermal energy storage R&D funding helps engineer heat transfer fluids for high temperature stability and improved thermophysical properties and develops novel thermal energy storage methods to meet technical and cost targets.

Offering Financial Opportunities

Since 2007, the CSP subprogram has established over 100 partnerships through competitive solicitations with companies, universities, and national laboratories. Awarded projects are selected through a rigorous peer review process, and are actively managed with defined quantitative and measurable milestones and deliverables in order to drive the technologies under research toward commercially viable solutions. All of these projects represent important steps toward making CSP a cost-competitive source of power.

Get Involved

The SunShot Initiative regularly issues new funding programs to advance technologies that will help to make solar energy cost competitive with traditional forms of energy. To see current funding opportunities, visit energy.gov/sunshot. While you're there, be sure to sign up for our newsletter to stay in the loop about upcoming funding opportunities. Here's how the funding application process works:

- Applicants submit a short concept paper
- Applicants are "encouraged" or "discouraged" from submitting a full application
- Applicants submit full technical applications
- Approved applications are selected for award negotiation
- Awardees enter into a cooperative agreement with DOE, measureable technical and business objectives and deadlines

For more information about the CSP subprogram within SunShot, visit energy.gov/eere/sunshot/concentrating-solar-power.

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