SunShot
U.S. Department of Energy

The DOE SunShot Initiative is a collaborative national initiative to make solar energy technologies cost-competitive with other forms of energy by reducing the cost of solar energy systems by about 75% 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.

SunShot will work to bring down the full cost of solar – including the costs of solar cells and installation by focusing on four main pillars:

1. Technologies for solar cells and arrays that convert sunlight to energy;
2. Electronics that optimize the performance of the installation;
3. Improvements in the efficiency of solar manufacturing processes; and
4. Installation, design, and permitting for solar energy systems.

Photo from Geri Kodey, NREL/PIX 14381

Concentrating Solar Power

Concentrating Solar Power (CSP) offers a utility-scale, firm, dispatchable renewable energy option that can help meet the nation's goal of making solar energy cost competitive with other energy sources by the end of the decade. Worldwide, CSP activity is rapidly scaling, with approximately 20,000 megawatts (MW) in various stages of development in 20 countries.[1] In the United States alone, more than 500 MW of CSP are currently in operation, with another 1,300 MW under construction and approximately 7,500 MW under development.

CSP Technology Basics

Concentrating Solar Power systems focus and intensify the sun's light and absorb the energy to heat a fluid to high temperature which is used to drive a turbine or engine connected to a generator. There are four primary configurations of CSP systems. Parabolic trough systems use mirrors that reflect and focus sunlight onto a linear receiver tube. Linear Fresnel systems approximate the parabolic shape of a traditional trough collector with long, ground-level rows of flat or slightly curved mirrors that reflect the solar rays onto an overhead, downward-facing linear receiver. Power tower systems use numerous tracking mirrors, called heliostats, which reflect the sun's rays to a receiver located on top of a centrally located tower. The receiver in each of these configurations contains a fluid that is heated by the sunlight and then used to create superheated steam, which spins a turbine and drives a generator to produce electricity. Dish-engine systems use a parabolic dish of mirrors to direct and concentrate sunlight onto a central engine that produces electricity. CSP technology inherently lends itself to energy storage because the materials used to deliver energy to the energy conversion device (turbine or engine) may be held in a tank and then used to produce electricity on demand, or extended into nighttime.

[1] http://www.greentechmedia.com/content/images/reports/RB7.jpg

Leading the Advancement of Technology

The goal of the U.S. Department of Energy's (DOE's) SunShot Initiative is to reduce the costs of solar energy by about 75%, which will lead to the rapid, wide-scale adoption of this clean, renewable energy. The goals of the CSP Subprogram include lowering costs and advancing technology to the point that CSP is competitive in the intermediate power market by 2015 and in the baseload power market by 2020. Research and development (R&D) 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 land and transmission issues.

Offering Financial Opportunities

Since 2007, the CSP subprogram has established 40 ongoing partnerships through competitive solicitations with companies and universities by giving financial and technical assistance to each awardee. The 12 contracts awarded in 2007 focus on advanced CSP components and manufacturing concepts; the 15 contracts awarded in 2008 emphasize novel thermal energy storage concepts and improved heat transfer fluids. All of these projects represent important steps toward making CSP a cost-competitive source of power. Two of these awards developed technology which are being deployed in commercial projects financed in part by DOE Loan Guarantees. Similarly the national laboratories have developed tools and systems to improve system performance or reduce operation costs, some of which have been successfully licensed for commercial use.

In May 2010, the CSP subprogram added 13 new contracts that will develop CSP components and systems capable of providing low-cost, baseload power. The grantees, receiving up to $62 million in DOE funding, will seek to improve CSP designs to extend plant operation to an average of about 18 hours per day, a level of production that would make it possible for these plants to displace traditional coal-burning power plants.

World-Class Research

National laboratories, primarily the National Renewable Energy Laboratory (NREL) and Sandia National Laboratories (SNL), provide critical R&D to meet cost, reliability, performance, and manufacturability challenges. These laboratory facilities are uniquely equipped with validation systems and instruments developed by the staff of the national labs. These researchers have produced new high-performance, environmentally-durable, optical materials, and developed accelerated lifecycle testing methods. NREL designed the Infrared (IR) Survey System to rapidly determine receiver tube performance in the field and it is now available for license to industry. Sandia developed the Solar Optical Fringe Alignment Slope Technique (SOFAST) which validates the optical precision of high-volume manufactured concentrating reflectors.

The laboratories also perform resource assessment of accurate weather and solar insolation data captured through improved satellite imaging, additional ground data sites, and forecasting. Other research topics include thermal storage and heat transfer concepts; trough, tower, and dish-engine component and system R&D; and CSP systems analysis.

Solar Program Priorities

The DOE SunShot Initiative is a collaborative national initiative to make solar energy cost-competitive with other forms of energy by the end of the decade. Reducing the installed cost of solar energy systems by about 75% will drive widespread large-scale adoption of this renewable energy and restore U.S. leadership in the global clean energy race. Concentrating Solar Power is one of four subprograms in Solar Energy Technologies Program (SETP), along with Photovoltaics, Systems Integration, and Market Transformation. These subprograms focus on accelerating the advancement of solar energy technologies to meet SunShot objectives. To learn more, energy.gov/sunshot.

The National Renewable Energy Laboratory's (NREL) Video Scanning Hartmann Optical Test (VSHOT) laser scanning system determines the accuracy of concentrator mirror structures and is used in both a laboratory setting and in the field. *Photo by Alison Gray, NREL/PIX 16739*

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