SunShot
U.S. Department of Energy

"The SunShot Initiative will spur American innovations to reduce the costs of solar energy and re-establish U.S. global leadership in this growing industry." – Secretary Steven Chu

Photo from MicroLink Devices/PIX 16605, by Joe Verrengia, NREL/PIX 16995, and from Bill Timmerman/PIX 08981

SunShot: Making Solar Energy Cost Competitive Throughout the United States

"We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard."

– President Kennedy, September 12, 1962

When the Soviets beat the United States in the space race by sending Sputnik into orbit, America responded. President Kennedy challenged the nation to put a man on the moon within a decade. So the United States invested in science, math, and engineering education—and in research and development (R&D)—spurring countless innovations and entire new industries. Eight years later, Neil Armstrong bounded on the moon's surface. President Kennedy's "moon shot" launched a concerted, national effort requiring "the best of our energies and skills" and put a man on the moon.

Today, the U.S. Department of Energy (DOE) is pursuing the SunShot Initiative: a program that will aggressively drive innovation to make solar energy cost-competitive—without subsidy—within a decade. Reaching this goal means reducing solar energy's installed cost by 75 percent at utility scale through innovation in the ways solar systems are conceived, designed, manufactured, and installed. With costs reduced 75 percent, solar energy systems could be deployed throughout the U.S., hastening the transition to the clean energy economy. The SunShot Initiative aims to re-establish American technological leadership, strengthen U.S. economic competitiveness in the global clean energy race, and lead to America's secure energy future.

The SunShot Initiative represents a challenge to America to effectively and affordably capture the sun's energy. SunShot will bring together America's best and brightest, combining the expertise of research laboratories, universities, and the private sector. If successful, SunShot will drive down the cost of solar electricity to about 6 cents per kilowatt hour and enable solar photovoltaics (PV) to account for 15–18% of America's electricity generation by 2030.

Reaching the SunShot Goal

The SunShot Initiative builds on the Department's significant R&D efforts in solar energy over the past decade. Innovations in both science and technology have driven the cost of solar down 60 percent since 1995, and have yielded a number of critical breakthroughs in solar PV and concentrated solar power (CSP) performance and cost.

The SunShot Initiative will accelerate and advance those research efforts. It will refocus DOE's solar energy R&D and take new approaches to lower the costs of the entire solar system from modules to the balance of systems. SunShot is investing in solar technology and manufacturing improvements in addition to taking steps to reduce installation and permitting costs, which is one of the most significant growing costs for solar energy systems. In the future, local permitting could be digitized and streamlined, while new codes and standards could ensure high performance over the more than 20-year lifetime of solar products.

Within DOE, SunShot leverages the strengths of different offices, including the Office of Energy Efficiency and Renewable Energy; the Office of Science; and the Advanced Research Projects Agency-Energy (ARPA-E). Each office brings distinct capabilities to the table from applied R&D to early-stage scientific discoveries to advanced power electronics work and transformative technology development. DOE's work will complement work with the national laboratories, industry, universities, and government at the federal, state, and local levels.

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

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

SunShot organizes these four pillars into two stages:

1. Two to three years of "horizontal" R&D focused on reducing solar modules, power electronics, and balance-of-system (BOS) costs. In this first stage, DOE will invest in transformative ideas to lower manufacturing costs, improve efficiency, and foster new discoveries. The first stage will also focus on systems integration activities that reduce costs for BOS hardware; grid integration; technology validation; and solar resource development. These activities facilitate wide-scale deployment of distributed and central station solar technologies.
2. Two to three years of intense "vertically integrated" systems-level demonstration projects that will demonstrate the commercial viability of the SunShot approach. This second stage will encourage further private sector investment by reducing technology risk through the demonstration projects.

SunShot is another critical step to driving innovation and building advanced manufacturing capabilities to build the clean energy economy. If the technology is invented in America, it should be made in America, and SunShot is taking steps to increase domestic high technology manufacturing. Key initiatives like SunShot will help the United States lead the 21st century global economy, supporting jobs and spurring whole new industries, all while protecting the environment and leading to America's secure energy future.

Track Record of Solar R&D Success

Through the SunShot Incubator Program, DOE accelerates a diverse set of promising innovations proven on a laboratory scale. The SunShot Incubator has a long track record of success, having leveraged private dollars with public dollars at a ratio of 24-to-1.

For instance, in 2011, DOE awarded $3 million to Lexington, Massachusetts-based **1366 Technologies, Inc.** to develop a kerfless wafering technique for the production of silicon wafers. This new "Direct Wafer" process delivers significant improvements in manufacturing efficiency since it does not require sawing individual wafers from blocks of silicon. This innovation will dramatically reduce the cost of producing silicon wafers for use in PV modules, helping to make the cost of generating electricity using PV technology more comparable to, and competitive with, conventional utility-grid electricity prices.

In another project, **CaliSolar**, a solar PV module manufacturer in Sunnyvale, California, identified a method to produce solar cells from low-cost, abundant, but impurity-rich silicon feedstock (or solar-grade silicon). DOE awarded $3 million to the company to develop metallization, hydrogenation, and cell processing specifically for the use of metallurgical silicon. CaliSolar implemented manufacturing technologies to produce high performance solar silicon using processes that require less energy than lower capital costs.

In Longmont, Colorado, **Abound Solar** specializes in low-cost, high-throughput, automated fabrication of thin-film cadmium telluride (CdTe) cells and modules. In 2008, DOE awarded $2.4 million to Abound Solar to help develop a robust, industrial-scale, continuous process for manufacturing solar PV modules at a cost below $1 per watt and to reduce capital expenditure costs below $1.50 per watt. In 2010, DOE built on Abound Solar's previous successes, closing a $400 million loan guarantee. With the loan guarantee, Abound Solar is expanding its manufacturing capability to include an additional 840 megawatts of generating capacity, helping solar energy achieve economies of scale.

For More Information

Visit *www.energy.gov/sunshot*

U.S. DEPARTMENT OF ENERGY

energy.gov

DOE/GO-102011-3332 • June 2011

Photos from SunPower/PIX 13823, iStock/14403815, SunPower/PIX 06430