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 by Dennis Schroeder, NREL/PIX 19176

Photovoltaics

DOE works with national labs, academia, and industry to support the domestic photovoltaics (PV) industry and research enterprise. SunShot aims to achieve widespread, unsubsidized cost-competitiveness through an applied research and development (R&D) portfolio spanning PV materials, devices, and manufacturing technologies.

DOE's structured R&D funding enables efforts along the entire PV technology development pipeline, from new devices and processes, through prototype design and pilot production, to systems development and manufacturing. The Next Generation PV Program funds the development of high-risk high reward transformational technology projects. The Foundational Program to Advance Cell Efficiency seeks to narrow the gap in efficiency seen in today's top performing Lab cells and standard manufactured cells. Moving closer to commercialization, the SunShot Incubator Program then develops prototype designs to full scale, while the Supply Chain Program and the PV Manufacturing Initiative refines and advances innovative and mature crosscutting technologies.

DOE currently funds projects to advance all major PV module technologies. These include wafer silicon (Si); amorphous and single-crystal thin-film Si (a-Si); cadmium telluride (CdTe) and copper indium gallium diselenide (CIGS) thin-films; high-efficiency (III-V semiconductor) multi-junction PV cells and concentrating solar power; advanced organic and dye-sensitized PV cells; and emerging next-generation PV technologies.

Current PV Portfolio

The Next Generation PV II Program supports innovative, exploratory research to create new, disruptive technologies with the potential for much higher efficiency, lower cost, or more reliable performance than existing commercial and near-commercial PV. This early-stage research program bridges the gap between basic and applied solar research, advances the state-of-the-art in PV, and demonstrates and proves new concepts in materials, processes, and device designs. The program moves beyond incremental near-term progress to break through performance barriers and achieve cost-competitiveness. Successful Next Gen PV applicants may not be ready to bring their research to market in the short term, but

are likely to provide the innovations and solutions for future technologies. Next Gen proposals also include an educational component to help train new solar scientists.

The Sunshot Incubator Program expanded the PV Technology Incubator Program from its original focus on module-related PV technology innovation to include concentrating solar power (CSP), power electronics, and balance-of-systems (BOS) innovation. Any commercially viable technological innovation that substantively aids in reducing the installed cost of utility-scale solar can now be funded through the SunShot Incubator.

The program links public and private partners to accelerate the commercialization of solar energy innovation. Incubator partnerships leverage technical capabilities and resources within DOE's National Renewable Energy Laboratory (NREL) and other DOE labs to support small businesses and spur technology development toward full-scale manufacturing in the U.S. Early-stage incubator assistance enables companies to cross technological barriers to commercialization while encouraging private sector investment. Since the program's inception in 2007, $60 million in government funds have led to more than $1.3 billion in venture capital and private equity investment in incubator companies.

The Sunshot Incubator consists of two tiers. Tier 1 focuses on accelerating development of innovative technologies from lab-scale demonstration to full-scale prototype. Tier 2 projects focus on shortening the timeline for companies to transition innovative full-scale pre-commercial prototypes to the pilot stage, and full-scale manufacture.

The Foundational Program to Advance Cell Efficiency (FPACE) seeks to overcome fundamental barriers to improved efficiency of commercial and near-commercial semiconductors. FPACE aims to narrow the wide gap between champion cell efficiencies seen in the lab and the efficiencies seen in large scale manufacturing. By looking at fundamental barriers to PV performance, such as recombination, low fill-factors, and parasitic losses, among others, successful FPACE proposals help close the gap between a cell's actual photo-output and its ideal theoretical maximum efficiency.

The PV Supply Chain and Cross-Cutting Technologies effort targets innovations which can substantially impact a large portion of the solar industry through reductions in common manufacturing and product costs. This effort encompasses everything from better roll-to-roll assembly methods through improved anti-reflection coatings to cheaper electronics. Successful proposals improve common PV manufacturing processes and materials that hold the potential to impact the PV industry within 2-6 years, accelerating the ability of solar energy in general to be mass-produced and mass-implemented.

The PV Manufacturing Initiative includes two efforts, PVMI I: Advanced Manufacturing Partnerships, and PVMI II: SUNPATH. Advanced Manufacturing Partnerships focuses on coordinating teams of industry and academia to generate new solutions for PV manufacturing to reduce the cost of module-scale production. It establishes joint-use facilities that provide PV companies and suppliers access to equipment and services that accelerate development of new PV technologies while making the transition to domestic, commercial-scale production. The partnerships strongly leverage industry, state, and local funds and are expected to grow over time, adapting to market conditions and continuously adding new industrial and academic participants. The most recent iteration of this Funding Opportunity awarded $110 million to three such teams to develop cost-saving technologies and methods for PV module production.

SUNPATH furthers the work of Advanced Manufacturing Partnerships. By leveraging technological advances in production processes, as well as the academic and industry relationships built in SUNPATH, Advanced Manufacturing Partnerships helps PV manufacturers move up from pilot-scale development to full-scale production lines of modules, cells, and substrates. Moreover, by stimulating companies in the U.S., Advanced Manufacturing Partnerships ensures that the advances made in PV manufacturing by U.S. researchers will go towards domestic PV production. In this way, the end goal of Advanced Manufacturing Partnerships is to simultaneously lower the cost of PV manufacturing in the U.S. significantly, provide a stream of new jobs in the green industry, and establish U.S. leadership in global PV manufacturing.

The SunShot Initiative is bringing together the country's top talent to reduce the installed cost of solar energy systems, including photovoltaic systems, to achieve grid cost parity. If successful, SunShot will enable PV to meet 15–18% of America's electricity needs by 2030, making the U.S. a leader in the 21st century global clean energy race.

To learn more about solar at DOE, check out energy.gov/sunshot.

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