



National Renewable Energy Laboratory

Federal Programs Enable Unprecedented Solar Power Deployment

Federal investment in scientific discovery and technology is vital to maintaining U.S. economic leadership globally and in growing key emerging sectors such as clean energy

Overview

Traditional energy resources such as oil and gas have received incentives from the U.S. government for more than a century. Now, federal programs are also spurring emerging technologies, including solar power. These initiatives are aimed at helping solar become cost-competitive with conventional sources and are driving the sector's rapid rise. Tax credits and loan opportunities have been important tools in encouraging domestic discovery, development, and deployment. Partnerships among researchers, industry, and government agencies have also been crucial, fostering breakthroughs in technology maturation and deployment.

These collaborations and incentives helped to double the nation's solar power capacity between 2008 and 2012, reduce costs by more than 56 percent since 2010, and stimulate job growth.¹ Yet stiff competition for federal funding and uncertainty surrounding national incentives threaten market progress: The investment tax credit for solar projects is set to expire at the end of 2016.² To best compete in a global economy, solar businesses, investors, and customers need stable, supportive policies.

Stages of Innovation

The introduction of advanced ideas, devices, or processes drives the emergence and creation of market sectors and supports the U.S. economy. The three stages of progression for discovery and invention are:

- **Basic science and early stage R&D.** Fundamental exploration to acquire new knowledge of materials and processes leading to novel theories and products.
- **Applied research.** Establishment of state-of-the-art concepts and prototype advancements, and exploration of the feasibility of scaling up these modern commodities.
- **Technology maturation and deployment.** Evaluation of materials, components, and efficiencies to optimize performance, demonstrate concepts, and support market adoption.

Federal policies bolster U.S. solar industry

Solar installations in the United States have surged more than 3,000 percent since implementation of the investment tax credit in 2006.³ This and other policy actions, along with price declines and new financing models, helped attract more than \$17 billion in private funding and record levels of deployment in 2013, including a doubling of utility-scale capacity.⁴ Looking ahead, the U.S. Energy Information Administration predicts that solar will be the fastest expanding source of renewable power from 2012 to 2040, increasing by 7.5 percent a year.⁵

U.S. Solar Industry, 2013

Key Statistics	
2nd	Rank among all sources of energy for new generating capacity in the United States
13 gigawatts	New solar capacity
3rd	U.S. rank worldwide in solar investment
29%	Solar's share of new U.S. energy capacity
50	Number of states with a stake in the solar industry
143,000	Employees in the solar sector
+19%	Change in solar sector employment, 2012-13

Source: Solar Energy Industries Association

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The country's rising number of solar installations is also key to the expansion of distributed generation—energy produced at or near the point of consumption. The traditional model, in which electricity is produced centrally at large power plants using fossil fuels, is being challenged as residential and commercial customers can now generate a portion or all of their own power on-site from cleaner, more efficient, renewable sources. Distributed systems, powered by the sun or wind turbines, that also incorporate storage devices and combined heat and power units, improve reliability, provide protection from electrical grid blackouts, enrich the diversity of power sources, and reduce transmission losses—resulting in amplified efficiency.⁶

By aiding innovation and deployment efforts, federal tax incentives enable continued advancement of solar technologies and maturation of the U.S. industry. These national policies are also encouraging the adoption of distributed and cutting-edge renewable generation facilities, adding to the resiliency and efficiency of the country's grid.

SunShot Initiative reduces costs, drives innovation

The U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy promotes a range of projects and applied research activities related to solar innovation. Between 1975 and 2008, more solar industry patents were linked to technological advancements funded in part by DOE than by any other organization in the world, positioning the United States as a global leader in the development of new technologies to harness the sun's power.

In 2011, DOE launched the **SunShot Initiative** to make the solar industry cost-competitive with conventional electricity sources by reducing upfront charges to less than \$1 per watt by 2020. The initiative has funded more than 350 projects with private companies, universities, and national laboratories. From 2010 to 2013, the average price per kilowatt-hour at utility-scale photovoltaic systems dropped nearly 50 percent.⁷ Achieving the initiative's goal will help create 390,000 more solar jobs and lower consumer energy costs by 14 percent, or about \$20 billion annually, by 2050.⁸

SunShot Initiative reduces costs for novel technologies

The Energy Department's SunShot Initiative works to bring down costs by advancing research, manufacturing, and growth in the solar industry. The project's prize competitions are spurring market development and promoting this aspect of the nation's economy.

SunShot Incubator Program

The SunShot Incubator Program provides early-stage assistance to help start-ups reach commercialization and encourages private-sector funding. Since its launch, the program has awarded \$104 million in federal financing, resulting in more than \$1.7 billion in venture capital and private equity investment.⁹ The incubator has helped establish 61 start-up companies, including one that pioneered a product that lowers the cost and improves the efficiency of photovoltaic cells.

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SunShot Catalyst Program

In May 2014, DOE announced the SunShot Catalyst, a series of challenges to drive the development of solutions to “soft cost” challenges faced by the solar industry. Soft costs are expenses not directly related to construction, such as grid connection, permitting, installation, and consumer education, and they account for up to 64 percent of the total price for new systems.[†] The yearlong program consists of four stages: ideation, business innovation, prototype, and incubation. Contestants will be rewarded at each step, with funding totaling \$500,000. The goal is to introduce participants to the tools, capabilities, and resources available from DOE and national laboratories. The competition also encourages partnerships and networking through an online collaboration portal.

^{*} U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, “SunShot Incubator Program,” <http://energy.gov/eere/sunshot/sunshot-incubator-program>.

[†] U.S. Department of Energy, Office of Energy Efficiency of Renewable Energy, “SunShot Catalyst Program,” <http://energy.gov/eere/sunshot/sunshot-catalyst-program>.

DOD embraces solar to reduce costs

The U.S. Department of Defense is the nation’s largest institutional consumer of energy and is embracing renewable resources to improve mission effectiveness and security. The U.S. military needs safe, secure, reliable, and affordable electricity to operate its facilities on an uninterrupted basis. From large, centralized, utility-scale projects to portable systems, the Pentagon is using the sun’s rays to meet essential power requirements for bases and field locations, such as combat operations, emergency response, humanitarian relief, and homeland defense. At the same time, solar is also helping the agency reduce costs and reach its renewable resource generation goal of procuring 25 percent of its total consumption from renewable sources by 2025.⁹

Expanding on the Pentagon’s goal, the Army, Air Force, and Navy-Marine Corps have each pledged to generate 1 gigawatt of distributed clean energy on their installations by 2015.¹⁰ As of 2013, nearly 60 percent of these projects across the branches were solar, and photovoltaic technology accounted for 58 percent of planned additions through 2017.¹¹

In addition to on-base photovoltaic arrays, the Defense Department’s Installation Energy Test Bed funds innovative projects that harness the sun’s power and are mission-compatible and at the appropriate scale for military installations.¹² By partnering with businesses and public and private institutions, DOD is enhancing operational energy security and resiliency.



Solar installation at Nellis Air Force Base in southern Nevada.

Investment in U.S. solar industry still critical

The United States has seen tremendous growth of the solar industry in response to successful federal programs and incentives that have driven down costs and encouraged deployment of new technologies. These investments have resulted in thousands of new jobs and reduced emissions, while also helping to position the country as a global leader in the solar market.

However, the boom and bust nature of national energy policies makes it difficult for renewable technologies to compete with conventional fossil fuel sources as uncertainty shakes investor confidence and keeps capital on the sidelines. Government financing and long-term incentives are the drivers for investment. For the United States to be a leader in the global clean energy economy, continued funding of innovation and federal policies are essential.

For more information on the role these programs play in assisting the solar industry, follow these links:

- [Office of Energy Efficiency and Renewable Energy- Solar Energy Technologies Office](#)
- [SunShot Initiative](#)
- [Department of Defense Installation Energy Test Bed](#)
- [The Pew Charitable Trusts, Power Surge: Energy Security and the Department of Defense](#)

Endnotes

- 1 Isaac Arnsdorf, "Fracking Sucks Money From Wind While China Eclipses U.S.," Bloomberg (May 29, 2014), <http://www.bloomberg.com/news/2014-05-29/fracking-sucks-money-from-wind-while-china-eclipses-u-s-.html>.
- 2 U.S. Department of Energy, "Solar," <http://energy.gov/eere/renewables/solar>.
- 3 The Pew Charitable Trusts, "Solar Industry Continues Record-Breaking Growth" (Sept. 11, 2014), <http://www.pewtrusts.org/en/research-and-analysis/q-and-a/2014/09/solar-industry-continues-record-breaking-growth>.
- 4 U.S. Energy Information Administration, "Short-Term Energy Outlook: Renewables and Emissions," Aug. 12, 2014, http://www.eia.gov/forecasts/steo/report/renew_co2.cfm?src=Renewable-b1; and The Pew Charitable Trusts, 2013 Who's Winning the Clean Energy Race? 31, 50, <http://www.pewtrusts.org/-/media/Assets/2014/04/01/clenwhoswinningthecleanenergyrace2013pdf>.
- 5 U.S. Energy Information Administration, "Annual Energy Outlook 2014," April 2014, MT-20, [http://www.eia.gov/forecasts/aeo/pdf/0383\(2014\).pdf](http://www.eia.gov/forecasts/aeo/pdf/0383(2014).pdf).
- 6 U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, "Distributed Energy," <http://energy.gov/oe/technology-development/smart-grid/distributed-energy>.
- 7 U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, "Progress Report: Advancing Solar Energy Across America," <http://energy.gov/articles/progress-report-advancing-solar-energy-across-america>.
- 8 U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, "SunShot: Mission," <http://energy.gov/eere/sunshot/mission>.
- 9 Solar Energy Industries Association, "Enlisting the Sun: Powering the U.S. Military With Solar Energy 2013" (May 17, 2013), <http://www.seia.org/research-resources/enlisting-sun-powering-us-military-solar-energy-2013>.
- 10 The Pew Charitable Trusts, *Power Surge: How the Department of Defense Leverages Private Resources to Enhance Energy Security and Save Money on U.S. Military Bases* (January 2014), 10, <http://www.pewtrusts.org/-/media/legacy/uploadedfiles/peg/publications/report/PEWDoDReport2013KS10020314pdf.pdf>.
- 11 Ibid.; and Vince Font, "The Solar Battlefield: How the US DOD Will Bring Solar Technology Mainstream," Renewable Energy World.com (April 23, 2014), <http://www.renewableenergyworld.com/rea/news/article/2014/04/the-solar-battlefield-how-the-us-dod-will-bring-solar-technology-mainstream>.
- 12 Department of Defense, Strategic Environmental Research and Development Program, "Installation Energy Test Bed," <https://www.serdp-estcp.org/Featured-Initiatives/Installation-Energy>.

For further information, please visit:

pewtrusts.org/cleanenergy

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