



SunShot Vision Study

A Comprehensive Analysis of the Potential for U.S. Solar Electricity Generation

In the 2012 State of the Union address, President Barack Obama emphasized the importance of developing clean and renewable energy resources—including solar—for the good of the nation. The president described a future where energy use and generation are efficient, secure, clean, and affordable.

The *SunShot Vision Study* provides the most comprehensive assessment to date of the potential for solar technologies to meet a significant share of electricity demand in the United States during the next several decades. The study explores a future in which the cost of solar technologies decreases by about 75% between 2010 and 2020. Achieving these aggressive price targets set by the U.S. Department of Energy (DOE) [SunShot Initiative](#) will make the cost of solar-generated electricity competitive with conventionally generated electricity. With a focus on photovoltaics (PV) and concentrating solar power (CSP) technologies, the *SunShot Vision Study* examines the potential pathways, barriers, and implications of achieving the SunShot Initiative price reduction targets and resulting market penetration levels.

The results of the study suggest that if DOE and industry partners meet the SunShot Initiative's goal, solar power could provide as much as 14% of U.S. electricity demand by 2030 and 27% by 2050.

Projecting Additional Solar Benefits

The study used two models developed by the National Renewable Energy Laboratory to evaluate a SunShot scenario, in which cost targets are achieved, and a reference scenario, which is modeled with moderate solar energy price reductions.

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% between 2010 and 2020. Achieving this target will reduce the total installed cost for utility-scale solar electricity to roughly 6 cents per

kilowatt-hour without subsidies, enabling 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.

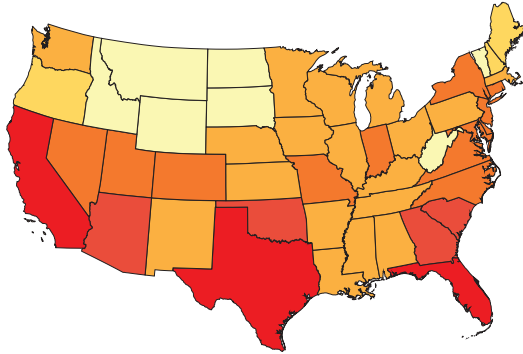
Realizing the price reduction targets of the SunShot Initiative would enable the nation to accelerate its evolution towards a cleaner, more cost-effective, and more secure energy system.

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:

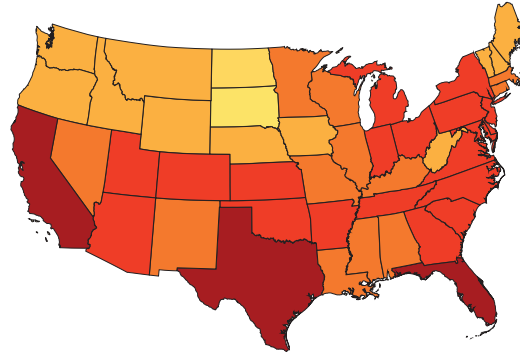
1. Technologies for solar cells and arrays that convert sunlight to energy;
2. Electronics that optimize the performance of the installation;
3. Improvements in the efficiency of solar manufacturing processes; and
4. Installation, design, and permitting for solar energy systems.

Cumulative Installed PV and CSP in the SunShot Scenario in 2030 and 2050

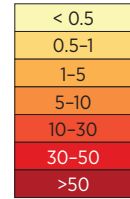
2030 PV Capacity: 302 gigawatts (GW)



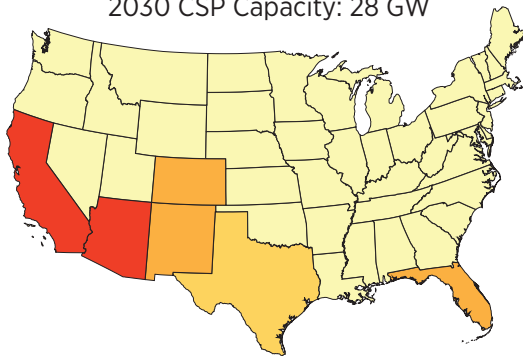
2050 PV Capacity: 632 GW



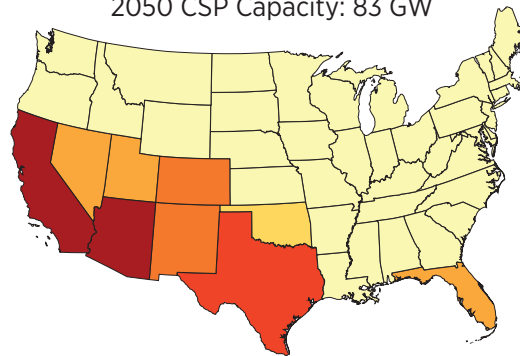
PV Capacity (GW)



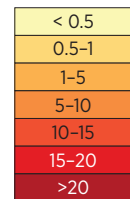
2030 CSP Capacity: 28 GW



2050 CSP Capacity: 83 GW



CSP Capacity (GW)



Key findings of the study include the following:

- Annual U.S. electricity-sector carbon dioxide (CO₂) emissions are projected to be significantly lower in the SunShot scenario than in the reference scenario: 8% (181 million metric tons) lower in 2030 and 28% (760 million metric tons) lower in 2050.
- Achieving the SunShot scenario level of solar deployment could support 290,000 new solar jobs by 2030, and 390,000 new solar jobs by 2050.
- Across all market sectors, the lower electricity prices in the SunShot scenario translate into about \$30 billion in annual cost savings by 2030 and \$50 billion in annual savings by 2050 compared to the reference scenario.
- Achieving the SunShot price reductions and projected deployment will require a combination of evolutionary and revolutionary improvements to PV and CSP technologies as well as significant manufacturing scale-up.

- The level of solar deployment envisioned in the SunShot scenario poses significant but not insurmountable grid integration challenges and could require substantial changes to electricity sector planning and operation practices.
- The availability of suitable installation sites will not constrain SunShot-level solar deployment, but it is important to improve site regulation processes and select sites carefully to provide access to transmission and minimize conflicts with environmental, cultural, and aesthetic interests.
- Financing the scale of expansion in the SunShot scenario will require significant but attainable new investments in the solar manufacturing supply chain and in solar energy projects.
- Various factors could influence the level of solar deployment envisioned in the *SunShot Vision Study*, such as more aggressive cost reductions in other renewable and conventional

electricity-generation technologies, fossil fuel prices, and electricity demand growth.

The maps above show the cumulative installed capacity for solar power generated by PV and by CSP in 2030 and 2050 in the study's SunShot Scenario.

Download the *SunShot Vision Study* at: www.eere.energy.gov/solar/sunshot/

Cover photo renderings by Joshua Bauer, NREL



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