

Installed price of solar photovoltaic systems in the US continues to decline at a rapid pace

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(Phys.org) —The installed price of solar photovoltaic (PV) power systems in the United States fell substantially in 2012 and through the first half of 2013, according to the latest edition of *Tracking the Sun*, an annual PV cost tracking report produced by the Department of Energy's

Lawrence Berkeley National Laboratory (Berkeley Lab).

Installed prices for PV systems in 2012 fell by a range of roughly \$0.30 per Watt (W) to \$0.90/W, or 6 to 14 percent, from the prior year, depending on the size of the system. "This marks the third year in a row of significant price reductions for PV systems in the U.S.," explains Galen Barbose of Berkeley Lab's Environmental Energy Technologies Division, one of the report's co-authors. Within the first six months of 2013, PV system prices in California fell by an additional 10 to 15 percent, and the report suggests that PV system price reductions in 2013 are on pace to match or exceed those seen in recent years.

The report indicates that the median installed price of PV systems completed in 2012 was \$5.30/W for residential and small commercial systems smaller than 10 kilowatts (kW) in size and was \$4.60/W for commercial systems of 100 kW or more in size. Utility-scale systems installed in 2012 registered even lower prices, with prices for systems larger than 10,000 kW generally ranging from \$2.50/W to \$4.00/W. The report also highlights the wide variability in PV system pricing, detailing the installed [price differences](#) that exist across states and across various types of PV applications and system configurations.

The market for solar PV systems in the United States has grown rapidly over the past decade. This sixth edition in Berkeley Lab's *Tracking the Sun* report series describes historical trends in the installed price of PV in the United States. The report is based on data from more than 200,000 residential, commercial, and utility-scale PV systems installed between 1998 and 2012 across 29 states, representing roughly 72 percent of all grid-connected PV capacity installed in the United States. The study is intended to provide policy makers and industry observers with a reliable and detailed set of historical benchmarks for tracking and understanding past trends in the installed price of PV.

Recent PV system price reductions driven by falling hardware costs, while "soft" costs persist

According to the report, recent installed price reductions for PV systems are primarily attributable to steep reductions in the price of PV modules. From 2008 to 2012, annual average module prices on the global market fell by \$2.60/W, representing about 80 percent of the total decline in PV system prices over that period.

Non-module costs—such as inverters, mounting hardware, and the various non-hardware or "soft" costs—have also fallen over the longterm but have remained relatively flat in recent years. As a result, they now represent a sizable fraction of the total installed price of PV systems. This shift in the cost structure of PV systems has heightened the emphasis within the industry and among policymakers on reducing non-module costs.

The report specifically highlights soft costs—which include such things as marketing and customer acquisition, system design, installation labor, and the various costs associated with permitting and inspections—as the most promising target for further PV system price reductions. "Soft costs are especially important from the perspective of public policy efforts," Barbose notes. "Unlike module prices, which are established based on global supply and demand, soft costs can be influenced more directly by local, state and national policies aimed at accelerating deployment and removing market barriers."

Adds co-author Ryan Wiser, also of Berkeley Lab: "There simply are limits to how much further module prices can fall, and so it stands to reason that continued reductions in PV system prices will need to come primarily from the soft cost side."

PV system prices in the United States higher than in other major markets

The report compares PV system pricing in the United States to a number of other major international markets, and finds that U.S. prices are generally higher. The differences are particularly stark in comparison to Germany, Italy and Australia, where the price of small residential PV systems installed in 2012 was roughly 40 percent lower than in the United States.

The report attributes much of the difference in PV system pricing to soft costs, citing the fact that the cost of PV modules and other hardware is typically similar across countries. "These international experiences suggest that deep near-term reductions in soft costs are attainable in the United States," says report co-author, Naïm Darghouth, also with Berkeley Lab. He adds: "Reductions in soft costs may naturally accompany growth in market size, as we've seen in some of the largest markets such as Germany and Italy, though other factors are also clearly important."

Price declines for PV system owners in 2012 offset by falling incentives

Rebates and other forms of cash incentives for residential and commercial PV systems are offered by state agencies and utilities in many regions. These incentives have declined significantly over time, falling by roughly 85 percent over the past decade. Within the span of just 2011 to 2012, median cash incentives from state and utility programs fell by \$0.40/W to \$0.60/W, depending on PV system size.

States and utilities have reduced incentives both in response to, and to encourage further, installed price declines. Cash incentives provided

through state and utility programs have also fallen over time as other sources of financial support for PV projects—most notably, increases in federal tax incentives and the emergence of solar renewable energy certificate (or SREC) markets in a number of states—have become more widely available or lucrative.

Wide variability in PV system pricing observed

The study also highlights the significant variability in PV system pricing. For example, among PV systems less than 10 kW in size and completed in 2012, 20 percent of systems had an installed price less than \$4.50/W while another 20 percent were priced above \$6.50/W.

This variability is partly associated with differences in pricing across states, where the median installed price of PV systems less than 10 kW ranged from \$3.90/W to \$5.90/W in 2012. The report points to an array of potential underlying drivers for these cross-state pricing differences, including market size, the size of incentives available and level of competition among installers, labor costs, customer characteristics, administrative and regulatory compliance costs and sales tax exemptions for PV.

The report also examines the variation in PV system pricing across various types of applications and technologies, including: systems with microinverters vs. central inverters, systems with Chinese vs. non-Chinese modules, systems with varying module efficiencies, residential new construction vs. residential retrofit, building-integrated vs. rack-mounted systems, rooftop vs. ground-mounted systems, and tracking vs. fixed-tilt systems.

The report, *Tracking the Sun VI: An Historical Summary of the Installed Price of Photovoltaics in the United States from 1998 to 2012*, by Galen Barbose, Naïm Darghouth, Samantha Weaver and Ryan Wiser, may be

downloaded [here](#).

A webinar presentation of key findings from the report will be conducted on Friday, August 16 at 11:00 am PDT. Register for the webinar [here](#).

Provided by Lawrence Berkeley National Laboratory

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