

# Are solar panels a good investment? New Berkeley study offers an answer

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Solar power panels have long seemed an appealing option in California, a state with lots of sunny days that adores its electronic gadgetry and environment, yet is saddled with the highest residential electricity rates

in the continental U.S.

But how much does going solar shave off those [electricity bills](#)? A major new study by scientists at Lawrence Berkeley National Laboratory that analyzed 500,000 households across the U.S. in 2021 offers the best snapshot to date on estimated savings of rooftop solar for American consumers.

The study found the median American household saved an estimated \$691 a year when all the costs and benefits were included.

"This is one of the most comprehensive, household-specific, national estimates of rooftop solar impacts on household [energy](#) burden," said lead investigator Sydney Forrester, a policy researcher in the Energy Markets and Policy Department at the Laboratory, a research and development center in the hills of Berkeley.

Much previous research has focused only on direct utility bill savings of solar power, which can be misleading. For instance, if the cost of installation is excluded, the median household would erroneously calculate \$1,987, not \$691, in savings.

The new study provides a more complete accounting because it includes upfront installation fees and ongoing loan or lease payments, as well as any solar incentives. And it compares the benefits reaped by households with different incomes.

Nationwide, installation of solar panels in [low-income households](#) reduced the proportion of the family budget spent on energy from 7.7% to 6.2%, an estimated savings of \$660 a year, the study said. In moderate-income households, it reduced the the proportion they spent on energy from 4.1% to 3.3%, saving \$674 a year. And in higher-income households, the amount spent on energy dropped from 2.4% to 1.9%,

saving \$711 a year.

The study did not look at actual savings, because that data is not available. Rather, it modeled the household savings based on estimates of income, household utility bills, local electricity prices and consumption. Almost everyone in the study was a single family homeowner, with a few multifamily or rental homes.

Not every home reaps a benefit from solar power, the researchers found. On average, solar adoption reduced the cost of energy for about three-quarters of U.S. households.

The benefits of solar power varied by region. In the West, especially California, high electricity prices and a competitive solar marketplace led to the greatest cost reduction. Homes in the Midwest experienced lower costs, although they were less pronounced. Homes in the Northeast also saw a benefit, although their overall energy costs remain high due to dependence on non-electric sources, such as propane and fuel oil.

In the South, solar power actually increased the overall cost of energy, because electricity prices from conventional sources are so low. For low-income Southern families, the cost of solar exceeded the benefit by \$435 a year.

Low-income residents in the U.S. West who have installed solar power experience the greatest benefit with the proportion of estimated household income spent on energy falling from 7.3% to as much as 5.7%, saving an estimated \$821 a year.

But low-income residents continue to need assistance to help reduce energy costs, the researchers added.

"Solar is a great strategy for reducing energy costs," Forrester said. But

he added that it "should be considered as a complementary strategy" along with bill assistance and "weatherization" that helps insulate homes.

And Forrester cautioned that "while low-income households benefit more than other groups, there is a risk if they fall behind on payments to finance the projects."

Power bills have been rising across the nation. The average price of electricity per kilowatt hour has jumped from 13 cents to over 17 cents over the past decade, according to data from the Bureau of Labor Statistics. California's residential rates are far higher—close to 30 cents, second highest in U.S. behind Hawaii.

Energy costs are typically a bigger burden for low-income households, which tend to spend a far larger percentage of their income on utility bills than higher-earning households, according to the Energy Department. Many live in old and drafty homes and cannot afford modern and more efficient appliances.

"I applaud the paper's overall goal, which is to raise awareness about the potential for rooftop solar to help alleviate energy burden for low-income disadvantaged community households," said Eric Daniel Fournier, research director of the California Center for Sustainable Communities at UCLA's Institute of the Environment and Sustainability.

"We strongly believe in the potential of rooftop solar... to address this important equity issue."

The benefits of rooftop solar for low income households are most prominent in areas with higher electricity rates, such as California, he added.

Stanford University's Ram Rajagopal, director of the Stanford

Sustainable Systems Lab, called the findings "extremely valuable."

"It shows that the cost of energy that you get from rooftop solar is very competitive for low and middle income consumers," he said. "It reduces their energy burden, given access to the right incentives."

The study is also important because it stresses the need for additional strategies, such as weatherization and bill assistance, said Rajagopal. His research, [published](#) in the March issue of the journal *Nature Energy*, has also shown that commercial and industrial rooftops, such as those atop retail buildings and factories, have large unused capacity to produce [solar power](#)—and could bring affordable clean energy to low-income communities around them, reducing "the solar equity gap."

The study falls short by not describing the practical barriers to the implementation of rooftop solar within low-income disadvantaged communities, Fournier noted. It also didn't include any savings created by energy storage components—backup battery systems, he added. California policy now encourages the parallel adoption of solar panels and power storage units.

In future work, the Laboratory team will study the potential of solar savings for a broader variety of homes, including renters and multifamily dwellers, Forrester said. She hopes to expand the study to include "community solar" and other strategies that don't require rooftop ownership.

What's missing, she added, are low-income residents who would like to save money on energy bills but couldn't afford the upfront costs.

"Any additional cost to solar adoption will increase the barrier," she said, "and this is more likely in the case of older homes or those with deferred maintenance."

**More information:** Moritz Wussow et al, Exploring the potential of non-residential solar to tackle energy injustice, *Nature Energy* (2024). DOI: [10.1038/s41560-024-01485-y](https://doi.org/10.1038/s41560-024-01485-y)

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