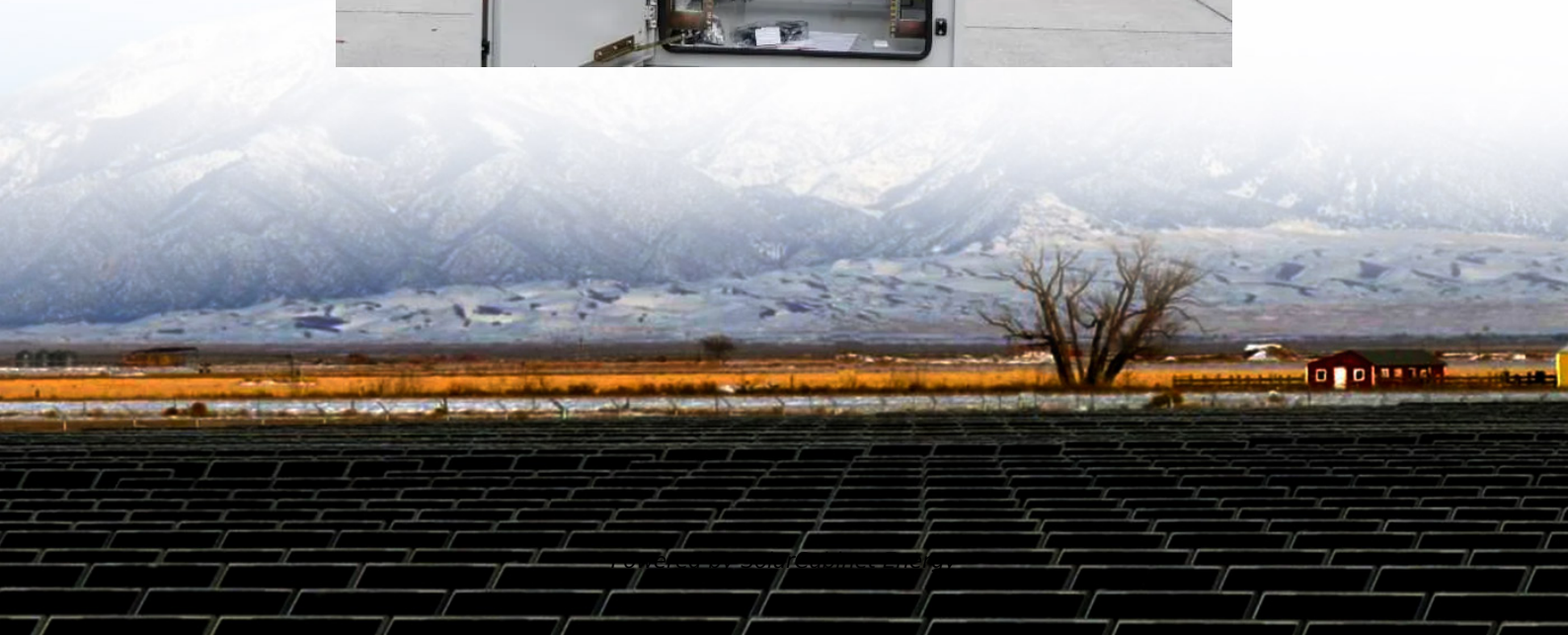


Photovoltaic Energy Storage Project Cost Standards





Overview

The National Renewable Energy Laboratory (NREL) publishes benchmark reports that disaggregate photovoltaic (PV) and energy storage (battery) system installation costs to inform SETO's R&D investment decisions. This year, we introduce a new PV and storage cost modeling approach. How much does a PV system cost?

Our operations and maintenance (O&M) analysis breaks costs into various categories and provides total annualized O&M costs. The MSP results for PV systems (in units of 2022 real USD/kWdc/yr) are \$28.78 (residential), \$39.83 (community solar), and \$16.12 (utility-scale).

How much does a PV system cost in 2022?

The current MSP benchmarks for PV systems in 2022 real USD are \$28.78/kWdc/yr (residential), \$39.83/kWdc/yr (community solar), and \$16.12/kWdc/yr (utility-scale, single-axis tracking). For MMP, the current benchmarks are \$30.36/kWdc/yr (residential), \$40.51/kWdc/yr (community solar), and \$16.58/kWdc/yr (utility-scale, single-axis tracking).

Will California's New PV rules affect PV-plus-storage systems?

In the longer term, analysts expect the new rules to constrain PV-only deployment in California and ultimately spur the deployment of PV-plus-storage systems, which have higher upfront costs (Wood Mackenzie and SEIA 2022b). Our interviews also indicated market and policy trends affecting system costs between Q1 2022 and Q1 2023.

Is solar PV cheaper than fossil fuels?

Solar PV LCOE almost halved between 2018 and 2023 alone, while over the 2014-2023 period, the global weighted-average levelised cost of electricity (LCOE) for utility-scale solar PV projects fell from \$0.16/kWh in 2014 to just \$0.044/kWh by 2023. By 2023, solar PV was 56% cheaper than fossil fuel alternatives.



How much would a PV system cost without a 45x credit?

Without the 45X credit eligible for domestically assembled modules, inverters, and battery packs the MMP of the residential PV and PV-plus-storage system would have been \$2.90/Wdc and \$4.93/Wdc, respectively.

What makes a PV system a market price?

Market prices can include items such as smaller-market-share PV systems (e.g., those with premium efficiency panels), atypical system configurations due to site irregularities (e.g., additional land grading) or customer preferences (e.g., pest traps), and specific project requirements (e.g., unionized labor).



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Best Practices for Operation and Maintenance of Photovoltaic and Energy

The goal of this guide is to reduce the cost and improve the effectiveness of operations and maintenance (O& M) for photovoltaic (PV) systems and combined PV and energy storage ...

[An assessment of floating photovoltaic systems and energy storage](#)

This sparked the discussion over whether land should be used for food production or energy production [10, 11], encouraging research into offshore renewable technologies [12], ...



[Operation and Maintenance of PV Systems: Data Science, ...](#)

Project Summary: This effort improves the effectiveness and reduce uncertainty in O& M cost through four primary objectives/tasks: 1) institutionalize standards for reliability and availability ...

[Standards and Requirements for Solar Equipment, ...](#)

Expressly defining solar energy systems in the "definitions" section of the zoning code, providing definitions for the energy system type



(e.g., rooftop, ground-mounted, and building-integrated), ...



[Solar and Storage Techno-Economic Analysis Tutorial for the ...](#)

Component Manufacturing Cost Modeling Review
bottom-up cost model templates across the PV supply chain: Thin film and c-Si module assembly, cell conversion, ingot and wafer production, ...

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