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Energy storage requirements for solar power plants in the United States



Overview

We found total land-use requirements for solar power plants to have a wide range across technologies. Generation-weighted averages for total area requirements range from about 3 acres/GWh/yr for CSP towers and CPV installations to 5.5 acres/GWh/yr for small 2-axis flat panel PV power plants.

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Abstract—The rapid deployment of large numbers of utility-scale photovoltaic (PV) plants in the United States, combined with heightened expectations of future deployment, has raised concerns about land requirements and associated land-use impacts. Yet our understanding of the land requirements of.

States can establish energy storage procurement targets to jump-start the development of energy storage systems. These targets set a required amount of energy storage, typically expressed in megawatts (MW), that must be developed or procured by a certain date. States often set interim targets to. How much area do solar power plants need?

Generation-weighted averages for total area requirements range from about 3 acres/GWh/yr for CSP towers and CPV installations to 5.5 acres/GWh/yr for small 2-axis flat panel PV power plants. Across all solar technologies, the total area generation-weighted average is 3.5 acres/GWh/yr with 40% of power plants within 3 and 4 acres/GWh/yr.

How much energy does a solar power plant generate a year?

Across all solar technologies, the total area generation-weighted average is 3.5 acres/GWh/yr with 40% of power plants within 3 and 4 acres/GWh/yr. For direct-area requirements the generation-weighted average is 2.9 acres/GWh/yr, with 49% of power plants within 2.5 and 3.5 acres/GWh/yr.

How much land do solar power plants use?

For direct land-use requirements, the capacity-weighted average is 7.3 acre/MWac, with 40% of power plants within 6 and 8 acres/MWac. Other published estimates of solar direct land use generally fall within these ranges.

What is the average size of a solar power plant?

On a capacity basis, the total-area capacity-weighted average for all solar power plants is 8.9 acres/MWac, with 22% of plants within 8 and 10 acres/MWac. For direct land-use requirements, the capacity-weighted average is 7.3 acre/MWac, with 40% of power plants within 6 and 8 acres/MWac.

Which states have installed utility-scale storage in the United States?

The installation of utility-scale storage in the United States has primarily been concentrated in California and Texas due to supportive state policies and significant solar and wind capacity that the storage resources will support. By Q3 2024, Texas had installed 2,283 MWh of storage capacity, while California had installed 5,992 MWh of capacity.

How much land-use does a PV system need?

Figure 4 shows generation-based total and direct land-use results. Direct land-use requirements for PV installations range from 1.6 to 5.8 acres/GWh/yr, with a generation-weighted average of 3.1 acres/GWh/yr. Direct land-use intensity for CSP installations ranges from 1.5 to 5.3 acres/GWh/yr, with a generation-weighted average of 2.7 acres/GWh/yr.

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