PDEOZE PowerContainer

Source Grid Load Storage Wind and Solar

Overview

Can a solar-wind system meet future energy demands?

Accelerating energy transition towards renewables is central to net-zero emissions. However, building a global power system dominated by solar and wind energy presents immense challenges. Here, we demonstrate the potential of a globally interconnected solar-wind system to meet future electricity demands.

Are solar and wind resources interconnected?

Theoretically, the potential of solar and wind resources on Earth vastly surpasses human demand 33, 34. In our pursuit of a globally interconnected solar-wind system, we have focused solely on the potentials that are exploitable, accessible, and interconnectable (see “Methods”).

What is a source-grid-load-storage IES?

Therefore, this paper designs a “source-grid-load-storage” complementary IES consisting of GSHP, PS, and lead-acid battery, which improves the flexibility of energy storage and optimizes the capacity allocation through orderly energy scheduling.

What is a source-grid-load-storage multi-energy complementary IES?

The “source-grid-load-storage” multi-energy complementary IES proposed in this paper effectively coordinates the advantages of RES, ESS, and HPS. Compared with scenario 1, scenario 3 reduces the wind and solar power abandonment rate in winter by 13.9 %, and the RES utilization rate in summer is as high as 99.86 %.

What happens if solar-wind generation exceeds net power demand?

When solar-wind generation within a grid exceeds its net power demand (i.e., total demand minus baseload), surplus power is first transferred to interconnected grids experiencing shortages, with the remaining surplus stored until capacity is reached. Any surplus beyond storage capacity is curtailed.

Where do grid-boxes contain solar and wind resources?

In densely populated regions such as western Europe, India, eastern China, and western United States, most grid-boxes contain solar and wind resources apt for interconnection (Supplementary Fig. S1). Nevertheless, these regions exhibit modest power generation potential, typically not exceeding 1.0 TWh/year (Fig. 1a).

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