

Solar PV Versus Wind Energy in India's Renewable Transition (2010–2025): Comparative Growth Trajectories, Cost Dynamics, and State-Level Concentration

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Abstract

India's energy transition is among the most consequential globally, requiring simultaneous progress on energy security, climate goals, and access for 1.4 billion people. This paper provides a descriptive comparison (2010–2025) of India's two leading renewable technologies – solar photovoltaic (PV) and onshore wind – across growth trajectories, cost dynamics, state-level concentration, and alignment with SDG 7. Drawing on published capacity statistics from the International Renewable Energy Agency (IRENA) and India's Ministry of New and Renewable Energy (MNRE), the paper traces installed capacity growth, general cost trends under a standard levelized cost of electricity (LCOE) framework, and the geographic concentration of deployment across states. Solar PV grew from a negligible base in 2010 to roughly 90–106 GW by 2025, while wind expanded from about 13 GW to roughly 47–52 GW over the same period; both technologies are now understood to be cost-competitive with new coal generation in India. Three broad policy directions follow: continuing to scale solar PV in high-irradiance interior states, shifting wind policy toward repowering and hybridization in already-developed corridors, and evaluating procurement design beyond headline tariff. These observations are relevant to India's stated target of 500 GW of non-fossil capacity by 2030.

Keywords

India, renewable energy, solar PV, wind energy, energy transition, SDG 7.