# THE ROLE OF WIND-SOLAR HYBRID PLANTS IN MITIGATING RENEWABLE ENERGY-DROUGHTS

Renewable (wind and solar) capacity is increasing rapidly worldwide as it is essential to decarbonise the electricity grid. When there is no renewable generation, balancing the electricity demand with the available generation in a renewable-rich grid can be challenging. We define these days as “energy-drought” days. Here, we analyze India’s wind, solar, and hybrid energy droughts for the first time using a stochastic weather generator. While the previous studies use short time series data, we simulated 5000 years long possible wind solar generation dataset to estimate energy drought. Our analysis shows that wind droughts are more intense than solar droughts in India. We examine wind-solar hybridization’s role in offsetting low wind energy episodes. The benefits of hybridization are regionally dependent. In South India, hybrid plants have advantages over either wind or solar plants alone. In comparison, for Rajasthan, the benefits of hybridization are limited. Further investigation shows that when one of the regions has a renewable drought, the other region has only a 10% probability of having a similar drought. Our findings highlight the need for having robust inter-regional grid connections to mitigate regional-level renewable droughts. The figure below shows the complementary nature of energy drought phenomena for India’s wind, solar, and hybrid plants. The legends indicate the fraction of days different regions face energy drought while the region marked with white boxes (Rajasthan and South India) faces energy drought. Wind, solar, and combined droughts are defined as less than 1%, 50%, and 25% of maximum generations from respective sources.

*Reference:* A. Gangopadhyay, A.K. Seshadri, N.J. Sparks, R. Toumi, The role of wind-solar hybrid plants in mitigating renewable energy-droughts, Renewable Energy, Volume 194, 2022, Pages 926-937, ISSN 0960-1481, https://doi.org/10.1016/j.renene.2022.05.122.

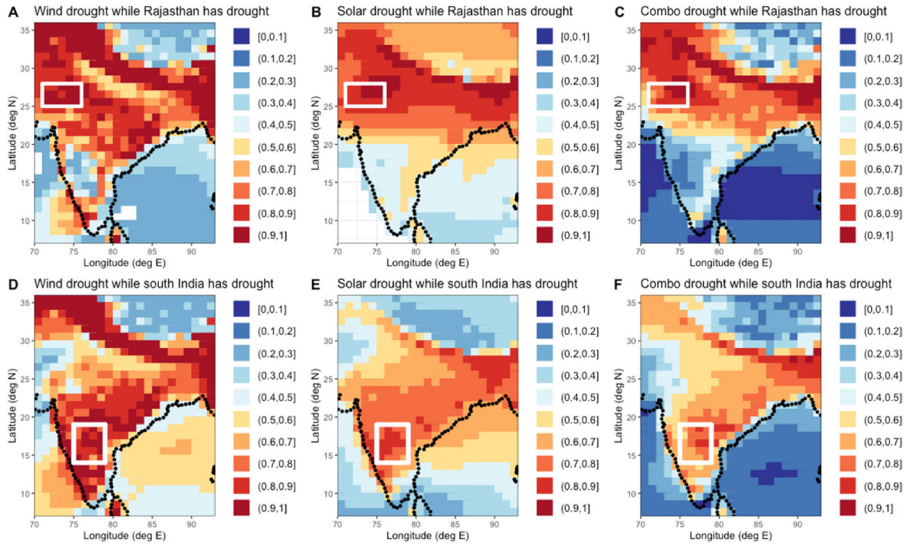


**Figure:** Figures A, B, and C show wind, solar and combined droughts (as the fraction of days) when Rajasthan has energy-drought. Figure D, E, and F. show wind, solar and combined droughts (as the fraction of days) when South India has an energy drought.