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Water-Energy Nexus: Vulnerability Assessment of Power Generation due to Water Stress Condition

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Economic development in India has put tremendous demand for energy requirement in the country. For instance, in the last six years (2011-2017) the total power production by coal-fueled thermal power plants in India has increased by 64.82%. This demand in energy has precipitated into enormous increase in the demand of freshwater for consumptive use in these thermal power plants. Numerous plants are facing shutdown, due to the waning water availability in the recent decades. In the present study we analyze the vulnerability of 132 coal-fueled thermal power plants with respect to freshwater availability trends in India. The power plants are classified according to their power generation capacity ratio using past records. The reported changes in the power production is corroborated with the basin-wise water availability computed using 'Variable Infiltration Capacity' (VIC), a land surface model run over India. To observe the trends of freshwater availability, statistical significance is estimated for different confidence intervals (99%, 95% and 90%) using nonparametric 'Mann Kendall' (MK) test. Our results suggest that about 50% of India's total coal-fueled thermal power plants are situated in regions with reducing trends of freshwater availability. This could further impel the shutdown of thermal power plants under 200 MW capacity in the water stressed regions of India. Overall, our study suggests the need of an integrated basin level approach to improve the water management policy for thermal energy production in India.