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Techno-Economic Analysis of Pumped-Hydro-Energy Storage as Peaking Power Plants in India for High Renewable Energy Scenarios

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Abstract

Existing pumped-hydro-energy storage (PHES) plants in India are inadequately utilised and hence have low economic benefits. With high renewable energy (RE) penetration expected in the coming years, energy storage systems will gain prominence. One of the most economical, available, mature, and bulk energy storage mechanisms is PHES. However, PHES plants are capital-intensive and topographically dependent. Hence, to encourage the setting up of PHES plants, a suitable techno-economic analysis needs to be presented for peaking hours so that more PHES capacity could be integrated into the grid. This paper analyses the techno-economics of a RE integrated PHES plants in India. The peaking operation of the PHES is analysed during high RE scenarios. A case study of Uttarakhand is discussed in detail. The levelised cost of storage for the Uttarakhand PHES plant comes around 6.7 Rs/kWh when charged only through the excess RE available in the grid during off-peak hours and used as a peaking power plant.

Keywords

Levelised cost of storage, Peaking power plant, Power grid, Pumped-hydro-energy storage, Renewable energy