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Impact of climate change on combined solar and run-of-river power in Northern Italy

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Moving towards energy systems with high share in variable renewable energies requires a good understanding on climate change impacts on the energy penetration. For doing so, most of the impact studies consider climate projections available from Global Circulation Models (GCM). Other studies apply sensitivity analyses on the climate variables that drive the system behavior to inform how the system changes should the climate changes. In the present work, we apply the Decision Scaling approach, a framework merging these two approaches, for analyzing a renewables-only scenario for the electric system of Northern Italy where the main renewable sources are solar and hydropower. Decision Scaling explores the system sensibility to a range of future plausible climate states. GCM projections are considered to estimate probabilities of the future climate states. We focus on the likely future energy mix within the region (25% of solar photovoltaic and 75% of hydropower). We also carry out a sensitivity analysis according to the storage capacity. The results show that run-of-the river power generation from this Alpine area is expected to increase although the average inflow decreases under climate change. They also show that the penetration rate is expected to increase for systems with storage capacity less than one month of average load and inversely for higher storage capacity.