Stochastic optimal scheduling of hydropower compensation for wind and photovoltaic power output considering multiple uncertainties

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Multiple uncertainties, including from the uncertainty of a single power (wind power or photovoltaic power) output forecasting to the uncertainty of the combined power output of wind and photovoltaic power output forecasting to the power shortage after hydropower compensation for wind and photovoltaic power output, exist in the wind-photovoltaic-hydropower system. Furthermore, as the forecast is updated, the above uncertainty will evolve accordingly. Revealing the evolution of multiple uncertainties is of great significance for the hydropower compensation for the combined power output of wind and photovoltaic. We use a generalized martingale model of forecast evolution to describe the uncertainty of a single power output. We then superimpose the single power output to obtain the combined power output of wind and photovoltaic, we establish a stochastic programming with recourse model for optimal scheduling of the hydropower compensation for wind and photovoltaic power output. The results indicate that the uncertainty of the combined power output of wind and photovoltaic forecasting is less than that of wind power output forecasting, and greater than that of photovoltaic power output forecasting. After hydropower compensates for combined power output of wind and photovoltaic, compared with the uncertainty of combined wind and photovoltaic power output forecasting, the uncertainty of power shortage is greatly reduced by 90\%, which has significant benefits. And with the dynamic update of the forecast, the uncertainty of the single power output forecast, the uncertainty of the combined power output forecast, and the uncertainty of the power shortage will decrease accordingly.