

## An empirical model for ramp analysis of utility-scale solar PV power

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### Abstract

Short-term variability in the power generated by utility-scale solar photovoltaic (PV) plants is a cause for concern for power system operators. Without quantitative insights into such variability, system operators will have difficulty in exploiting grid integrated solar power without negatively impacting power quality and grid reliability. In this paper, we describe a statistical method to empirically model the ramping behavior of utility-scale solar PV power output for short time-scales. The general validity of the model is confirmed through the analysis of power output data from a MW-scale solar PV plant located in the state of Karnataka, India. The empirical parameters of the model are investigated for different time-intervals and solar datasets. The proposed model is able to satisfactorily approximate the actual distribution of PV ramp events and can be an effective tool in smartly planning additional resources for PV ramp control.

Keywords: Solar PV; Ramp events; Empirical model; Short-term variability

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