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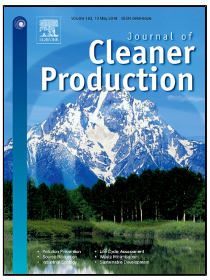

Markov Chain Model for Solar Farm Generation and Its Application to Generation Performance Evaluation

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Markov Chain Model for Solar Farm Generation and Its Application to Generation Performance Evaluation

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***Abstract*: Solar profile and component outage create considerable impact on solar generation. This paper proposes a Markov chain model that incorporates both factors into solar generation. This model considers the solar farm as a generating unit with multiple generation states, where each state is characterized by generating photovoltaic arrays, ambient temperature, and solar radiation. The probability, frequency, and transition rate between generation states are obtained from collected solar profile samples and component reliability parameters. Three generation performance indices that describe the solar generation from the perspective of energy, time, and frequency are defined and estimated from the proposed model. The accuracy and efficiency of the proposed model is verified by a sequential Monte Carlo simulation approach using collected solar profile samples from six distinctive sites in North Dakota, USA. Influence of component reliability parameters, seasonal solar profile pattern, and photovoltaic module type on solar generation is investigated in details.**

***Key words*: Solar farm, Markov chain, Solar generation, Performance evaluation**

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