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Data-driven approaches for generating probabilistic short-term renewable energy scenarios

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Abstract-

Renewable energy sources (RES) are becoming increasingly prevalent in power systems, but their intermittent and unpredictable nature challenges deterministic optimal generation scheduling. Stochastic planning or operating methodologies offer superior performance compared to deterministic approaches, making renewable energy generation scenarios increasingly valuable inputs for multistage decision-making problems. In this paper, we introduce and compare three data-driven approaches for generating probabilistic renewable energy scenarios. Numerical results from both simulated and real-world datasets demonstrate the accuracy and computational efficiency of these methods. Our proposed approaches provide a powerful tool for creating precise and efficient probabilistic renewable energy scenarios, which can enhance optimal generation scheduling in power systems with high RES penetration.

Index Terms- Bayesian linear regression; Gaussian processes; Probabilistic sampling; Probabilistic scenario generation; Solar-photovoltaic power; Wind power

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