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Novel multi-stage stochastic DG investment planning with recourse

S. F. Santos, D. Fitiwi, A. W. Bizuayehu, M. Shafie-khah, M. Asensio, J. Contreras, C.M.P. Cabrita, J.P.S. Catalão

Abstract— This paper presents a novel multi-stage stochastic distributed generation investment planning model for making investment decisions under uncertainty. The problem, formulated from a coordinated system planning viewpoint, simultaneously minimizes the net present value of costs rated to losses, emission, operation and maintenance, as well as the cost of unserved energy. The formulation is anchored on a two-period planning horizon, each having multiple stages. The first period is a short-term horizon in which robust decisions are pursued in the face of uncertainty; whereas, the second one spans over a medium to long-term horizon involving exploratory and/or flexible investment decisions. The operational variability and uncertainty introduced by intermittent generation sources, electricity demand, emission prices, demand growth and others are accounted for via probabilistic and stochastic methods, respectively. Metrics such as cost of ignoring uncertainty and value of perfect information are used to clearly demonstrate the benefits of the proposed stochastic model. A real-life distribution network system is used as a case study, and the results show the effectiveness of the proposed model.

Index Terms— Distributed generation, investment planning, distribution network systems, stochastic programming, uncertainty.

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