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Load modeling of active low-voltage consumers and comparative analysis of their impact on distribution system expansion planning

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Abstract-

This paper proposes a new probabilistic model for active low-voltage prosumers suitable for distribution expansion planning studies. The load uncertainty of these consumers is considered through a range of load profiles by segmenting the energy consumption according to the different energy uses. Then, consumption adjustments are simulated using a nonhomogenous Poisson process based on the energy usage preferences and the financial gains according to the tariff scheme. A case study based on the modified IEEE 33-Bus test system with real data collected from a Brazilian distribution company is performed in order to analyze the impact of the load profiles in scenarios with high penetration of renewable distributed generation (DG). The experiments carried out reveal that considerable monetary savings in the expansion of the distribution grid can be achieved for this case study (up to 37%) as compared with the alternative with no active demand (AD) by exploiting the flexibility associated with the active behavior of prosumers as a response to price signals and/or by permitting adequate levels for the integration of DG into the distribution grid.

Index Terms- active demand, demand response, distributed generation, nonhomogeneous Poison process, stochastic load modeling

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