

An equilibrium approach for modeling centralized and behind-the-meter distributed generation expansion

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Abstract-

Power systems will face important structural changes in the near future due to the empowerment of consumers, who may resort on self-consumption, and reduce their purchases of electricity from the grid. The avoided costs of purchasing energy, as compared to the investment costs of installing their own self-generation capacity, could be one of the drivers of the consumers' decision making. The system expansion will therefore result from the interaction of the traditional market agents, maximizing their profits by investing in and operating centralized generation assets, and the new active consumers, minimizing their expenses while meeting their energy needs. This paper presents a Nash equilibrium model that considers centralized and behind-the-meter distributed generation expansion, by representing the operation and investments decisions of both types of agents with their own conceptually different strategies. To simplify the resolution, the equilibrium model is transformed into an equivalent minimization problem from its Karush-Kuhn-Tucker conditions. The model application to Spain-like system case example allows to assess the impact of the network access-tariff (whether being mainly volumetric-based or power-based) and the impact of the big industrial market power on the generation expansion, for the time horizon 2019-2037.

Index Terms- Generation expansion; Distributed generation expansion; Nash equilibrium; Optimization

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