Problem statement

Evaluation of generation system (adequacy) consists of steps of obtaining a risk model, creating a combined generation capacity model and that of load model so that adequacy index can be calculated. It is difficult to describe a temporal stochastic process such as a power system, let alone modeling that process using a simple mathematical formula. For this reason different models are built, starting from the load side, to provide the minimum data set required to establish and/or meet the need for reliability scenarios. Primary load data used often represent information regarding percent maximum monthly load or weekly load per annum. For chronological load profile represented by the primary load data measures load within 24 hours (a day) or the maximum load of each day in a week.

The aforementioned challenges indicate that it is infeasible to get a reliable adequacy index. Moreover, deregulated market policies juxtaposed to limited infrastructural improvement is encouraging ever-increasing load demand and making the aged electrical power grid more fragile and contingency-prone. With these facts in the background, the major challenges to efficient utility operation still continue to be accurate power supply PREVIEW 9 prediction and demand trends [19–20], besides chronological load profiles, management of peak periods (demands) and Demand Response (DR) activities planning. The effects of loading on system reliability are established and well understood [21], but the evidence of equilibrium phenomena (local security and reliability) and load characteristics in the case of EV load has not been established in all studies.

This issue is further complicated by the idea that a feeder in the distribution system circuit serves a residential load-mix, small industrial, commercial, and residential customers. Besides the time variation of the structural nature of a residential load mix, the location, time of the day, week and season of the year affect characteristics of the load mix. Therefore, one of the load profiles used for analysis represents the aggregate low voltage (LV) for residential customers on average and depending on the loading conditions. Thus, the most difficult aspect of this method is finding accurate statistical information on the load mix and connected load devices, and how this varies on a daily, weekly and/or seasonal basis. Moreover, limited knowledge exists as regards strength between EV interactions (in the presence of other connected loads) with local transformers. While many factors contribute to degrade distribution system reliability, the new and atypical EV load, which extracts high-peak and stochastic power demand has received little attention [22]. Technologies and development associated with

advanced sensors, scalable processing, renewables and energy storage provide solutions to facilitate energy use optimization.