Abstract

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Uncertainty Cost Functions in Climate-Dependent Controllable Loads in Commercial Environments

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Abstract

The economic dispatch of electrical energy is an activity of great relevance within the sector. In this, the fulfillment of the energy, technical and economic expectations of the different agents that participate in the entire process of energy production, transport and consumption are sought. For this reason, when an energy dispatch is carried out, it is sought to be optimal, to meet the objectives of the different agents, considering the efficient use of infrastructure resources with minimal associated costs. Now, with the inclusion of agents that bring uncertainty variables within the energy system such as renewable generators or electric vehicles, it is necessary that they also be considered when carrying out the economic dispatch of energy, and even more, that methodologies be developed so that this dispatch is optimum. A recent methodology that seeks the inclusion of agents with random behavior in the economic dispatch is the development of uncertainty cost functions. This methodology allows us to obtain analytical cost equations, starting from probability density functions that describe the stochastic nature of these agents. Now with these equations it is possible to carry out analytical economic dispatches that include all types of agents and that seek the optimization of both objectives and resources in all the main activities of the energy sector.

Therefore, we carried out the development, simulation and validation of the uncertainty cost functions for a commercial building with climate- dependent controllable loads, located in the state of Florida, United States. For its development, statistical data on the energy consumption of the building in 2016 was used, along with the deployment of Kernel Density Estimator to characterize its probabilistic behavior. For validation of the uncertainty cost functions, the Monte-Carlo simulation method was used, to make comparisons between the analytical results and the results obtained by the method. The cost functions found show differential errors of less than 1 \%, compared to the Monte-Carlo simulation method. With this, there is an analytical approach to the uncertainty costs of the building that can be used in the development of optimal energy dispatches, as well as a complementary method for the probabilistic characterization of the stochastic behavior of agents in the electricity sector.

Biography

Daniel Losada Rabelly is an electrical engineer by profession and works in the substations control and protection sector. He holds a professional career in Electrical Engineering and is currently finishing a Master of Electrical Engineering degree with Optimum Economic Dispatch emphasis. Daniel has 2 years of private practice as a substation control and protection engineer. Daniel grew up in Bogotá, the capital city of Colombia and is passionate about the colombian electrical market, the economic dispatch and the control and protection of substations.