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Probabilistic Algorithm considering Confidence Intervals Levels of Voltages for Optimal Probabilistic Grid Operation under a High Penetration of Photovoltaic Generation and Electric Vehicles

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Type of talk: Invited talk

Abstract:

Worldwide clean energy policies to zero-carbon emission are fostering the transition towards renewable-based energy systems and electrified transportation into the electrical distribution network. Although this innovation not only addresses environmental concerns and brings opportunities to customers and utilities, it may pose technical issues regarding the system operation. For example, these issues can be thermal overloading, overvoltage and reverse power flow mainly due to the fact that traditional distribution networks were not designed to operate under a high penetration and an increasing variability and uncertainty of generation and demand. Some ways to deal with these technical issues is through active power curtailment schemes, on-load tap changers, reactive power capability of PV inverters, battery energy systems and demand response. Nevertheless, this approach has been tackled conservatively without a probabilistic approach and, thus, reducing potential generated energy. For this reason, probabilistic tools become adequate and suitable to cater for uncertainties and to capture a more realistic network representation. Thus, enabling the system operator to evaluate higher or lower values of probability for state variables system, asset utilizations and mitigate the impact of these uncertainties on the grid operation. Therefore, the need for a probabilistic approach to optimize the use of distributed energy resources and to counteract carbon emission in an uncertain environment are essential for an efficient grid operation. In this pathway, this presentation will describe a probabilistic optimization framework tackling technical issues by considering confidence levels for voltages respecting their operational limits as well as minimizing the cost of energy imported, photovoltaic generation and carbon emission under the presence of high penetration of photovoltaic generation and Electric Vehicles. Furthermore, it will be presented the probabilistic optimization framework based on different probabilistic techniques as well as their pros and cons regarding computational time and statistical information accuracy for practical applications.

Related References:

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