Big Data in Urban Power Distribution and Consumption Systems

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Abstract

Big data is a data-driven cognitive approach; it perceives the world through data—it works out the statistical correlations in-dedicated by high-dimensional parameters using a non-parameter model. Data in power systems are increasing dramatically, leaving gaps and challenges; data processing has become a major concern and its urgency increases with data growth.

The presentation introduces CEPRI's research on big data, especially on big data in urban power distribution and consumption systems. It has four parts. Firstly, our perspective on big data is presented. Secondly, CEPRI's progress in big data is over-viewed, including big data universal platform development, scenario design and requirement analysis for big data application and related strategy research. Thirdly, two use cases for big data application in urban power distribution systems are introduced. Finally, the practice in applying random matrix theory (RMT) in big data analytics in urban power distribution system is also introduced.

It is important to guarantee high power supply reliability, especially during some festival holidays, such as Chinese spring festival holidays, national holidays. We want to know whether people's vacations and travels change the load characteristics and further result in overloading of some transformers. Historic operating data and data analytics based on the data provide effective ways to do this. This is one of use cases for big data application in urban power distribution system. The other use case is to analyze the overall operating efficiency, overloading or under-loading of primary equipment, transformers and distribution lines based on data from the operating and supervision systems in 33 cities in SGCC service area. In this use case the rationality of investment in distribution equipment is also estimated and the recommendation on future investment is given.

Traditional analysis methods for power system are typically model-based—they use equations, expressions, formulas, or simulations to describe the operation regulations and interaction mechanisms of the complicated system. On the other hand, more and more readily accessible data become an important or even prime driving force to achieve insight into the grid. The data-driven methodology, as the alternative ,will play more important role. As one kind of typical data driven method used in data analytics for big data, RMT has attracted much attention. The presentation introduces how to use RMT to identify the weakness of power distribution system and the main influencing factors. It proves it is effective to use RMT in big data analytics for power distribution systems.