スマートマイクログリッドにおける再生可能エネルギーのインテリジェントマネジメント管理と柔軟な利用戦略

Intelligent Management and Flexible Utilization Strategy of Renewable Energy in Smart Microgrids

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ABSTRACT

Nowadays the world is facing energy crisis and the destruction of the global environment, fossil energy with high carbon emission will be gradually replaced by renewable energy with low carbon emission. With the economic development and social progress, the traditional power generation methods can no longer meet the requirements of today's power users for the reliability and stability of electricity. Micro-grid, which provides electricity and thermal energy to the region with distributed power sources such as wind, solar, storage, micro gas turbine, fuel cell and energy storage systems, can effectively improve the quality of electricity and clear energy consumption, enhance the security and stability of the grid, alleviate the energy crisis and reduce environmental pollution, and even increase the financial income in the local area. Although microgrid systems are a hot topic in the power sector, the optimal scheduling of distributed micro power sources in microgrids is still a complex technical problem, and the random volatility of wind and solar power generation also poses certain safety risks to the microgrid itself. This means that microgrids not only need to realize flexible and efficient application of distributed energy at the level of low-voltage distribution system and solve the problems of seamless access and grid-connected operation of large and diverse distributed energy sources, but also need precise, intelligent, flexible, safe and reliable energy management and monitoring. The rapid development of information technology makes all this possible. This thesis, starting from distributed power supply, the relationship between the placement of photovoltaic panels and power generation is studied. It is found that the M-shaped arrangement of solar panels reduces the total power generation. However, the difference between the two becomes smaller as the latitude of the placement location decreases. As the latitude increases, the area used by the M-shape decreases significantly. Then the difference between S- and M-shape power generation is compared from the residents' consumption. In off-grid operation, S-shape will outperform M-shape, but the difference is small with minimal affect. In grid-connected operation, the difference between the two is essentially the same after a household electricity strategy is developed using the PSO optimization algorithm. Then an optimal operation model based on electric vehicle charging stations is also developed in the thesis. Using the MILP optimization algorithm, the optimal dispatching strategy was developed. The advantages and disadvantages of the dispatching strategy in the microgrid will directly affect the economy of microgrid operation and the reliability of power supply, and it has important theoretical value for the study of microgrid optimal dispatching theory. The optimization of equipment combination of microgrid is an important reference standard in the early stage of construction. Due to the rapid development of electric vehicles and the concentration of people using electric vehicles, the charging time will also be very concentrated. Therefore, it is necessary to consider the impact on the grid caused by the concentrated time charging of electric vehicles when constructing the microgrid. In this regard, the thesis uses Monte Carlo thinking to build the corresponding model and gives charging recommendations.