Review of Active and Reactive Power Sharing Strategies in Hierarchical Controlled Microgrids

Microgrids consist of multiple parallel-connected distributed generation (DG) units with coordinated control strategies, which are able to operate in both grid-connected and islanded mode. Microgrids are attracting more and more attention since they can alleviate the stress of main transmission systems, reduce feeder losses, and improve system power quality. When the islanded microgrids are concerned, it is important to maintain system stability and achieve load power sharing among the multiple parallel-connected DG units. However, the poor active and reactive power sharing problems due to the influence of impedance mismatch of the DG feeders and the different ratings of the DG units are inevitable when the conventional droop control scheme is adopted. Therefore, the adaptive/improved droop control, network-based control methods and cost-based droop schemes are compared and summarized in this paper for active power sharing. Moreover, nonlinear and unbalanced loads could further affect the reactive power sharing when regulating the active power, and it is difficult to share the reactive power accurately only by using the enhanced virtual impedance method. Therefore, the hierarchical control strategies are utilized as supplements of the conventional droop controls and virtual impedance methods. The improved hierarchical control approaches such as the algorithms based on graph theory, multi-agent system, the gain scheduling method and predictive control have been proposed to achieve proper reactive power sharing for islanded microgrids and eliminate the effect of the communication delays on hierarchical control. Finally, the future research trends on islanded microgrids are also discussed in this paper.