

Analysis and Comparison of Security and Stability of Strong-DC-strong-AC Power Grid and Strong-DC-weak-AC Power Grid

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Abstract

China is a vast country, it's necessary to utilize advanced long distance transmission technologies of large capacity and high efficiency because of the characteristics of primary energy and load demand of reverse distribution. UHVDC and UHVAC are two kinds of important new technologies. In recent several years, the application of UHVDC didn't give rise to big disputation while UHVAC give rise to big disputation. In the paper, Hunan power grid is selected as a typical receiving-end power grid with UHVDC project and UHVAC project in the planning grid. Security and stability of Hunan power grid with or without the commissioning of Jiuquan-Xiangtan UHVDC project or Jingmen-Changsha UHVAC project are simulated and compared, effective short circuit ratio (ESCR), critical short circuit ratio (CSCR) and boundary short circuit ratio (BSCR) are calculated, and then the relation between transmission capacity limit and strength of power grid structure is analyzed. By simulation and research on the real power grid, the conclusions are obtained: strong-dc-strong-ac power grid has better security and stability performance than strong-dc-weak-ac power grid, includes frequency stability and voltage stability. In a receiving-end power grid, if the ESCR is smaller than the CSCR, the transmission capacity of DC system is limited by AC system, if the ESCR is larger than the CSCR, the transmission capacity of DC system is limited by BSCR, which is decided by DC system itself, for example the commutation angle of DC converter; The commissioning of Jingmen-Changsha UHVAC project can not only increase the receiving capacity of Hunan power grid, but also increase transmission capacity of Jiuquan-Xiangtan UHVDC project. In 2017, the receiving limit of Hunan power grid is about 2800MW without the commissioning of Jiuquan-Xiangtan UHVDC project and Jingmen-Changsha UHVAC project, the receiving limit is about 6600MW with the commissioning of Jiuquan-Xiangtan UHVDC bi-polar project, and the receiving limit is about 14000MW with the commissioning of Jiuquan-Xiangtan UHVDC bi-polar project and Jingmen-Changsha UHVAC project. So, it's reasonable to coordinated develop the UHVDC and UHVAC in a huge receiving-end power grid. The conclusions have been used to guide the 13th five years plan of Hunan power grid.