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Transient Analysis and Mitigation of Capacitor Bank Switching on a Standalone Wind Farm

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Abstract : There exist significant losses on transmission lines due to distance, as power generating stations could be located far from some isolated settlements. Standalone wind farms could be a good choice of alternative power generation for such settlements that are far from the grid due to factors of long distance or socio-economic problems. However, uncompensated wind farms consume reactive power since wind turbines are induction generators. Therefore, capacitor banks are used to compensate reactive power, which in turn improves the voltage profile of the network. Although capacitor banks help improving voltage profile, they also undergo switching actions due to its compensating response to the variation of various types of load at the consumer’s end. These switching activities could cause transient overvoltage on the network, jeopardizing the end-life of other equipment on the system. In this paper, the overvoltage caused by these switching activities is investigated using the IEEE bus 14-network to represent a standalone wind farm, and the simulation is done using ATP/EMTP software. Scenarios involving the use of pre-insertion resistor and pre-insertion inductor, as well as controlled switching was also carried out in order to decide the best mitigation option to reduce the overvoltage.

Keywords : capacitor banks, IEEE bus 14-network, pre-insertion resistor, standalone wind farm
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