

Impact of converter losses on the optimal power flow solution of hybrid networks based on VSC-MTDC

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Abstract— This paper studies the impact of Voltage Source Converter (VSC) losses on the solution of the Optimal Power Flow (OPF) of hybrid AC/DC systems with a multi-terminal configuration. The motivation of this analysis is that the expected development of High Voltage Direct Current (HVDC) systems will entail an increase of the number of converter stations, and consequently, converter losses might not be negligible when compared with conventional transmission losses of AC and DC lines. Towards this end, an extended OPF model is proposed considering a combination of VSC based Multi-Terminal HVDC grids (VSC-MTDC) and AC systems. The OPF model represents converter losses according to the state-of-the-art modeling where different expressions are used when the converter functions as an inverter or as a rectifier. Three simpler alternative approaches are also implemented and the obtained OPF solutions are assessed. In order to compare the OPF solutions, a comparison metric is proposed. Obtained results show that modeling the converter losses in a simplified way could lead to very different power flow solutions, especially for the DC branches.

Index Terms— Optimal Power Flow, Multi-Terminal HVDC, AC/DC Transmission System, Cost Minimization, Converter Losses

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