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# Implementation of LMP-FTR Mechanism in an AC-DC System

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#### Abstract:

This paper analyzes the implementability of locational marginal price (LMP) and financial transmission right (FTR) mechanisms in the presence of high voltage DC (HVDC) lines in the regulated (i.e., under the control of system operator) network. The established framework of LMP-FTR mechanism assumes that the system under regulation is fully AC. Unregulated (or private) HVDC lines are taken into account within this framework through proxy-transaction bids from the line owners. However, as the flow over a regulated HVDC line has to be controlled by the system operator himself, the existing LMP-FTR framework becomes insufficient if the system contains or is expanded with regulated HVDC lines. The augmentation that should be made to the existing framework to include regulated HVDC lines is explained in this paper. It is shown that the flow over a regulated HVDC line can be modeled as a non-chargeable bilateral transaction without causing any threat of negative congestion surplus. For this power dispatch model, revenue adequacy of FTRs can be still ensured by means of the conventional simultaneous feasibility test (SFT) model. By utilizing the capacities of dc lines, a more general SFT model is further developed. The modified auction problem is discussed and tested for the non-negativity of net auction collection. The process of revenue adequate issuance of auction revenue rights is explained. Finally, the relative merit of a regulated HVDC line over a private HVDC line is discussed through a case study.

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