

Optimal energy and reserve scheduling of pumped-storage power plants considering hydraulic short-circuit operation

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Abstract— This paper presents a mixed-integer model for the hourly energy and reserve scheduling of a price-taker and closed-loop pumped-storage hydropower plant operating in hydraulic short-circuit mode. The plant participates in the spot market and in the secondary regulation reserve market, taking into account the regulation energy due to the real-time use of the regulation-up and -down reserves. The proposed model is used to compare the maximum theoretical income of the plant with and without considering hydraulic short-circuit operation. Numerical results demonstrate that the operation in hydraulic short-circuit mode could help significantly to enlarge the income of the power plant and that the secondary regulation reserve market might be the main source of revenue in a realistic setting characterized by a high level of renewable energy sources in the generation mix.

Index Terms— Pumped Storage Plant, Secondary Regulation Service, Hydraulic Short-Circuit Technology.

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