

## Impact of the Electricity Market Prices during the COVID-19 Pandemic on Energy Storage Operation

**Authors :** Marin Mandić, Elis Sutlović, Tonći Modrić, Luka Stanić

**Abstract :** With the restructuring and deregulation of the power system, storage owners, generation companies or private producers can offer their multiple services on various power markets and earn income in different types of markets, such as the day-ahead, real-time, ancillary services market, etc. During the COVID-19 pandemic, electricity prices, as well as ancillary services prices, increased significantly. The optimization of the energy storage operation was performed using a suitable model for simulating the operation of a pumped storage hydropower plant under market conditions. The objective function maximizes the income earned through energy arbitration, regulation-up, regulation-down and spinning reserve services. The optimization technique used for solving the objective function is mixed integer linear programming (MILP). In numerical examples, the pumped storage hydropower plant operation has been optimized considering the already achieved hourly electricity market prices from Nord Pool for the pre-pandemic (2019) and the pandemic (2020 and 2021) years. The impact of the electricity market prices during the COVID-19 pandemic on energy storage operation is shown through the analysis of income, operating hours, reserved capacity and consumed energy for each service. The results indicate the role of energy storage during a significant fluctuation in electricity and services prices.

**Keywords :** electrical market prices, electricity market, energy storage optimization, mixed integer linear programming (MILP) optimization

**Conference Title :** ICAE 2022 : International Conference on Applied Energy

**Conference Location :** Istanbul, Türkiye

**Conference Dates :** May 05-06, 2022