

ANNUAL COST RECOVERY OF MERCHANT UTILITY-SCALE STORAGE UNDER DAY-AHEAD ARBITRAGE: A CROSS-TECHNOLOGY BENCHMARK FOR MIBEL (2021 – 2024)

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Extended Abstract

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Abstract Summary

Utility-scale electricity storage is widely expected to support power systems with high shares of variable renewables, but whether day-ahead arbitrage alone can sustain investment remains unclear. This paper develops a cross-technology benchmark of annual cost recovery for three utility-scale storage technologies in the Iberian Electricity Market (MIBEL): pumped-storage hydropower (PSH), lithium-ion batteries (LIB), and power-to-hydrogen-to-power with fuel cells (P2H2P-FC). A deterministic mixed-integer linear programming dispatch model with rolling perfect foresight is applied to observed hourly day-ahead prices, between 2021-2025. Dispatch-based net market revenues are compared with exogenous annualised capital recovery and fixed operating costs to assess revenue sufficiency in an arbitrage-only, price-taker setting. Results show that day-ahead arbitrage is sufficient for PSH, leaves LIB close to but below cost recovery, and remains far from supporting P2H2P-FC under prevailing spreads. Counterfactual price-dispersion scenarios further show that LIB economics depend not only on the level of intraday spreads but also on their structure, with higher per-cycle margins mattering more than higher cycling frequency. The findings clarify when arbitrage alone can sustain merchant storage and when additional revenue streams or complementary policy support are likely to be required for each technology. Policy implications are technology-specific and should focus on reducing non-market barriers for PSH, facilitating revenue stacking for LIB, and prioritising targeted innovation and demonstration for P2H2P-FC under current cost and efficiency constraints.

Presenting Author Biography

Manuel is a first-year PhD student at the Universidade de Vigo with a background in Energy Engineering. His research focuses on techno-economic energy system modelling and optimisation for analysing decarbonisation pathways. He previously gained three years of

professional experience in an energy think tank and two years as a research assistant in economics research groups.