Battery Dispatch Model - Summary

In this optimization model, I have aimed to maximize profits by strategically charging and discharging a battery across three wholesale electricity markets while adhering to operational constraints. The model assumes the battery is a price-taker and trades based on given market prices. Charging and discharging are optimized under a relaxed relative MIP gap of 2% to improve computation time. The battery can charge or discharge in half-hourly intervals for Markets 1 and 2 and daily intervals for Market 3, with the constraint that simultaneous charging and discharging are not allowed. To enhance solver performance, I have ignored the **storage volume degradation rate**, as its impact (5% over 5000 cycles) is negligible. Additionally, due to the lack of pricing data for solar, wind, coal, and gas generation, the model is designed to buy electricity from the markets and sell it back at the given prices. The final model was implemented using **MathOpt (OR-Tools) with the HiGHS** solver.

The results indicate that the optimization model **does not allocate any charging or discharging to Market 3**. This is likely because participating in a 24-hour fixed cycle is less profitable than dynamically optimizing cycles in Markets 1 and 2. The total number of cycles used is ~ **4360 out of the 5000 available**, suggesting that while the model maximized profit, there were still potential opportunities for additional cycles that were not taken. The battery's state of charge (SOC) is tracked dynamically, ensuring feasibility, while lifetime cycle constraints are imposed to prevent excessive degradation.