

# Maximizing Storage Arbitrage Opportunities with Forecasting and Optimization

The next wave of energy storage is coming: ERCOT is expected to see over a 20-fold increase in storage capacity by the end of 2024\*. While ancillary services (AS) in the short term may provide significant revenue, as more assets come online, increasing competition for AS and decreasing prices for those services will require storage assets to partake in wholesale energy markets (aka 'wholesale arbitrage'). As evidence of this, a recent study by Aurora Energy Research suggests that ~70-80% of revenue will come from wholesale arbitrage over the lifetime of a storage asset\*.

Capturing arbitrage opportunities will require storage assets to have foresight into price spikes, so they can position themselves to capture the best possible returns. Gaiascope's bid optimization and forecasting software can help them achieve that - showing the ability to **nearly double returns when using both arbitrage and AS, compared to just AS markets alone.**

## Case Study for Storage Arbitrage

As a case study, we'll look at a 10 MW 2-hour duration storage asset that settles at Hub Houston in ERCOT.

Partaking in AS markets alone, this asset could expect to capture roughly \$300k in annual revenue, assuming the asset partakes in AS markets for every hour of the day\*\*.

Using Gaia's day-ahead nodal price forecasts, a simple strategy leveraging DAM bidding and RTM arbitrage shows the ability to approximately double total revenue by participating in arbitrage at most 4 hours of the day, as shown in Figure 1. **Combining arbitrage with AS is the optimal return maximization strategy for storage assets.**



*Figure 1. Cumulative Revenue for Gaia Simple Strategy for Storage Arbitrage (Graph shows revenue added from storage arbitrage and does not include additional AS revenue)*

This simple strategy determines which hours to bid to buy and sell power into the DAM. Each day, it looks at the four highest and lowest forecasted price hours to potentially sell or buy energy. Of that subset of hours, it then chooses which hours to buy and sell, while respecting the state of charge requirements. Subsequently, it bids the mean expected nodal price into the DAM. In the case of selling energy, the bid clears if the bid price is greater than the day-ahead price. When buying energy, the bid clears if the bid price is less than the day-ahead price. If it clears, the storage asset pays/receives the DAM price for all volumes bought/sold into the DAM market. If the bid does not clear, the same charging/discharging action takes place in real-time, and the storage asset pays/receives the real-time market (RTM) price.

This simple strategy demonstrates an expected baseline revenue from arbitrage and there is room for additional refinement and improvement. Partaking in arbitrage does not preclude the asset from also bidding into AS markets at the other hours of the day. AS revenues can be added on top of these arbitrage opportunities to maximize return. Additional performance improvements could also be seen by updating the dispatch plan in real-time or spreading the charging and discharging across more hours of the day.

### ***About Gaiascope***

Gaia has spent the last three years building models to lend transparency to complex electricity markets and developing bidding and hedging strategies to help maximize returns. At Gaia, it's our core belief that the best way to accelerate the clean energy transition is by making renewables and storage assets the most profitable options. We want to help you maximize your returns.

\*Note: Aurora Energy Research

\*\*Note: Using an average price for AS of \$3-4/MW

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