KYOS Energy Analytics

Webinar: Optimal value-stacking with batteries - FAQs

Is PowerBot planning to offer market access to aFRR/mFRR/FCR markets?

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General questons regarding battery storage

Q: What are some of the main reasons that countries like the Netherlands have trouble getting batteries into the grid?

A: Some of the main challenges are:

- Difficulty of getting network access (congested networks)
- Network fees, these are quite high for the Netherlands, although there are signs of this changing
- The Netherlands have fully merchant access which means there is a need to convince financers of revenue potential. This requires realistic (and profitable) value stacking approaches.

Q: As battery owners, how do we get access to the performance of several BESS optimizers?

A:It is up to each optimizer to decide how much of its own performance to make public. Even then, it is difficult to compare the published metrics, given the incentives to select the best results for publication and not adjust them for the riskiness of the strategy, or the specific characteristics of the asset. One of our main goals with developing a benchmarking methodology is to circumvent these problems.

Q: How does co-location with wind or solar affect trading strategies for BESS?

A. 1. Restrict discharge capacity when the co-located asset produces a lot.
2. Potentially serve as a source of free charging that would otherwise be curtailed.

Q: If you have a fully automated trading bot is there any reason (as an asset owner) to use a third party asset optimiser?

At the most basic level, the answer depends on the (risk-adjusted) performance/price ratio of the bot and the third-party optimizer, as well as any extra services that you expect in the process.

A good parallel from the financial world may be ETFs vs managed investment funds. Currently we are not yet aware of off-the-shelf power trading algorithms that would optimize a battery across all the different markets that it can participate in. Human-managed optimizers still have a sizeable edge overall. The question is, for how long?

One additional advantage of using both: the trading bot can provide a performance benchmark that can considerably strengthen the negotiating position of the asset owner towards the third-party optimizer. Even if the optimizer dispatches the battery and earns more money than the bot can, the profit sharing conditions can be different with a good benchmark.

Questons regarding the Real-time battery optimizer

your mentioned you track the cycle of the battery. Do you calculate with any variable degradation cost during trading decision making?
Anonymous Attendee Yes. We can impose both a fixed cycle limit for the remaining tradable delivery periods and a "virtual

Q: Is the impact on battery lifetime, or degradation also taken into account in the real-time optimizer?

A: Yes. We track and limit the cycles that the battery makes.

Q: Do you calculate with any variable degradation cost during trading decision making?

A: Yes. We can impose both a fixed cycle limit for the remaining tradable delivery periods and a "virtual cost" on throughput. The latter allows the optimizer more flexibility to adjust the daily cycles to how profitable a given day is.

Q: Which physical parameters are taken into account?

A: What we have seen as important battery features in financial valuations are:

- charge / discharge power
- energy capacity
- RTE
- charge/discharge costs
- and various cycle limits

These might potentially change over time. Our algorithm accounts for these. The battery is, of course, a more complex physical system, but not everything about that complexity is worth including in a financial optimization. However, the important point is that the algorithm can adapt to real-time changes to these characteristics if it is able to communicate with the battery via an API. For example, if the RTE is sensitive to the environmental conditions (e.g. temperature), then the algorithm can be updated with the latest RTE values and forecasts, sidestepping the need to include the nature of the environmental sensitivity in the optimization process itself.

Q: Does the model optimizes only on portfolio level or it can also optimize on asset level? if yes, then is there any accuracy discrepancy?

A: It optimizes on the asset level. For an actual battery, we take into account the minimum bid step size (e.g. 0.1 MW) and the resulting imbalance costs (arising from cycling losses).

Q: With your price taking strategy, how do you make sure you are not buying/selling multiple times bids that are linked (coming from the same asset)?

A: The orders we submit are fill-or-kill, which means that we would not be transacting with our own orders at a later point in time. Whoever else it is that we are trading with, even multiple times, should not matter for the asset. The approach might, of course, be different if we already have a portfolio in the market. But that is not a direction we are interested to explore at this point.

Q: How does the optimizer consider in realtime the technical availabity/performance of the BESS?

A: There are two possibilities. The simpler one (from the user perspective) is to provide an API through which the algorithm can query the state and the scheduled actions of the battery in real time and adjust the trading strategy to achieve the user-provided objectives (e.g. manage the state of charge following FCR or aFRR participation). The alternative is to provide this information to the Powerbot platform in the form of "signals", which the algorithm can read and react to.

Q: You mention trading against ID1 and using Bid/Ask from historical orderbooks. Can you explain which price infos are used?

The energy storage reports that we have been publishing (https://www.kyos.com/energy-storage-report/) are created with our long-term valuation model (KyBattery). They use the ID1 price index (of EPEX) with a simplified trading strategy. The real-time optimizer, on the other hand, uses real-time bids and offers from the order books and does continuous trading (or shadow trading), submitting order to the exchange via Powerbot.

Q: Is the trading based on essentially only historical behavior of the market and the ID1 index? Or does KYOS feed real-time market insights to pinpoint periods of higher earning potential?

A: Trading is based on real-time market information (order book data). The optimizer can also run in a backtesting mode on historical order book information, which is how the presented results were generated. But the primary use case is to operate in real time.

Q: How long does it take to run one realtime optimisation and why did you opt to only run it once every 5 minutes?

A: One round of optimization takes about 2-3 seconds, including reading the order book info and submitting the resulting orders via the API. Running it every 5 minutes in a backtest over 4 months of data still takes a long time, though. In real-time (shadow) trading, we would be running it much more often, of course.

Q: How much time does it take to run historical back-test over, say, a month worth of intraday data on a liquid market (e.g. Germany)?

A: About 20 minutes with one optimization per 5 minutes. This assumes that the order book revision data is already downloaded and pre-processed to create snapshots of best buys / asks.

Q: Is it virtual cycling supported in your trading strategy? When do you trigger virtual Cycling algorithm? Are there any specific scenarios for that?

A: Yes, virtual cycling is a built-in feature. It is triggered automatically by relative price changes in the market.

Q: Can you explain what Churn/Virtual trading is with an example?

A: Suppose we have a 1 MW, 1-hour battery, and 3 hours to trade in. Best bid/ask quantities are 1 MW each time.

- Best bid prices: 50 €/MWh [1], 60 €/MWh [2], 90 €/MWh [3].
- Best ask prices: 60 €/MWh [1], 70 €/MWh [2], 100 €/MWh [3].

It is clear that we should buy 1 MW in [t=1] and sell it in [t=3], making a profit of 30 €. Now suppose that time goes on and the prices in [t=2] drop by 30 €/MWh. We can then sell 1 MW in [t=1] and buy 1 MW in [t=2], making another 10 € in the process.

Net positions are still 1 MW buy and 1 MW sell, but we have bought and sold another 1 MW. This second quantity is what we referred to as churn / virtual trading, although there might also be other terms to describe this part of the turnover. Essentially, we are talking about the difference between the total buys (or sells) and the net buys (or sells).

Q: Does the model also optimize between the uses (ancillary services, balancing mechanism, market arbitrage)?

A: Not yet. We are first focusing on the intraday market, but will shortly be able to take participation in other markets (e.g. ancillary services) into account as a real-time input.

Q: Can you help to optimize between FCR and Intraday continuous?

A: Our battery valuation model (KyBattery) can optimize between FCR and intraday trading at the day-ahead stage (block-by-block), given a price forecast for FCR and ≈potentially- a multitude of price simulations of an intraday price index. The intraday trading strategy in KyBattery is simplified, but as we showed in the presentation, it tracks quite well what a real-time intraday optimizer can achieve, which makes KyBattery a useful tool the day-ahead decision making.

Alternatively, we can also use the model "in reverse" to derive an FCR bidding strategy based on the opportunity cost of not fully participating in the intraday market. Either way, once the FCR auction results are known, the real-time optimizer can provide trading advice / benchmark in the continuous intraday market, perhaps even taking the FCR actual activations into account.

Q: Do you take "slippage" into account, e.g. the fact that the algo may not be able to execute the positions you intend to, which may result in an imbalanced position and hence imbalance costs?

A: Not in the backtest, although the battery is small and trades infrequently, so this is unlikely to change the numbers noticeably. When running in a real-time shadow trading mode, we do take slippage and imbalance costs into account.

Q: Will you include aFRR energy to the real time optimizer anytime soon?

A: We have no plans yet to connect the algorithm to the aFRR energy market, but we can adapt to real-time updates about battery operations, which could include aFRR energy provision. For example, if the algorithm gets notified of aFRR actions, it can already start buying or selling energy to manage the state of the battery.

Q: Do you have insights how do the earnings scale with increase in battery size? Surely one can't expect simple linear scaling due to orderbook depth/liquidity effects.

A: For this battery size, the simulated PnL is conservative. We optimize infrequently and do not look beyond the surface of the order books. For a battery up to, say, 10 MW, we believe we could earn a similar amount by refining the trading (more frequent optimization, deeper look into the order books). For an even larger battery, it is hard to say without running the algorithm for the battery itself in a shadow trading environment.

Q: Products are usually quite illiquid several hours before delivery. Does the algo takes this explicitly into account?

A: Yes. The illiquidity would show up in high spreads between the best bids and asks, which the algorithm works with directly. The order book might also be "thin" in illiquid periods, meaning that a premium would have to be paid for trading larger quantities. We have it on our short-term development roadmap to account for this premium in the optimization.

Q: How does you model allow for model cannibalisation? If everybody uses the same model then everybody would result in the same position.

A: Everybody uses some model for trading, and all useful models are generally based on buying at a low price and selling at a high price. More batteries in the market will therefore lead to narrowing spreads across delivery periods, irrespective of the specific model used for trading.

Cannibalization is primarily related to dispatching more assets and not to the similarity of the dispatch algorithms. Even the same algorithm with twin assets would have to make different choices for the two assets, because market orders are executed sequentially.

Q: Do you use more traditional optimization techniques like MILP or are you also trying more recent techniques likes reinforcement learning?

A: Currently, we use traditional methodologies. Our first goal is to offer a realistic intraday benchmark, where we think the transparency of the applied optimization algorithm is important.

Q: Does the model take into account any price forecasts for the upcoming gates while running to anticipate better SOC management?

A: Not yet, but this feature is on our roadmap. We can already take into account predicted future bid-ask spreads.

Q: Is this algorithm/model also applicable to other storage technology (for eg CAES)?

A: It depends on the cost structure of the technology, but the general answer is "no". CAES operation, for example, may involve inventory-dependent charge and discharge costs (or losses) and one-time startup costs at discharge. None of these would be easy to implement in the current optimization framework. Our KyBattery model does, on the other hand, work with a dynamic programming approach and handles CAES optimization, but only simulates a simplified version of intraday trading in return.

Questions for PowerBot

Q: Is PowerBot planning to offer market access to aFRR/mFRR/FCR markets?

A: Currently, PowerBot focuses on being the go-to solution for wholesale energy trading at European short-term physical power markets (day-ahead, intraday auctions and intraday continuous). This also includes prioritizing the geographic expansion to eventually cover all European exchanges for these markets. Thus, integration of FCR/aFRR/mFRR interfaces is not on the immediate roadmap for the time being.

Q: What are Powerbot next goal markets besides Slovenia?

PowerBot already offers connectivity to Slovenia via BSP SouthPool. It also covers markets such as EPEX Spot, Nord Pool, SEMOpx (Ireland), TGE (Poland), CROPEX (Croatia), IBEX (Bulgaria), HUPX (Hungary), BRM (Romania) and the Georgian Energy Exchange. We are also actively working on integrating further markets; the exact ones will be publicly announced in due time.

Q How can I contribute and start with this model?

We invite companies to start testing our real-time optimizer. This allows you to do you own benchmarking. Our exact offerings are not finalized yet. We aim for a start by mid of July. Please let us know your interest and we will keep you updated with more news.

For more information: info@kyos.com

We can share more in a personal conversation or demo, so feel free to contact us: *info@kyos.com*

Please also check our website, the knowledge center is a great resource for the latest news, where we publish interesting articles and reports.

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