

Unleashing the potential of battery storage

BESS optimization

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London – 25 Sep 2024



Agenda

- BESS valuation
- BESS backtesting
- BESS optimization



KYOS, our analytics, your advantage



Analytical models

Wide range of models for valuation, optimization and risk management.

Realistic simulations and advanced optimization of assets and contracts.

Provide you with the best basis to take decisions.



E/CTRM software.

A complete system for Energy/Commodity Trade & Risk Management

Combines physical commodity management with financial reporting.

Includes price analytics, valuation and advanced risk management tools.



Advisory services

We are specialists in valuation, optimization and risk management.

From a one-off deal valuation to assessing the risks of diverse portfolios.

An experienced expert team working together with you.



Subscriptions

Live or End-of-day market price forward curves (PFC)

Fundamental long-term (>30 year) power price scenarios and Monte Carlo simulations across Europe.

Market reports for BESS, PPA and interconnectors

KYOS Energy Analytics

- International client base across Europe, plus Americas and Japan (MPX)
- 40+ people, headquarter Haarlem, The Netherlands
- Combine quantitative background with practical solutions
- More than 100 corporate clients for its software services



BESS Investments

BESS Valuations



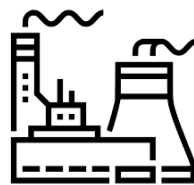
Energy storage -> strong growth expected

- Strong increase in renewable generation, phase out of conventional
- European Market Outlook for Battery Storage*:
 - Cumulative up to 404 GWh in 2028
 - 35-45% utility scale



**Need for accurate
BESS valuations!**

Flexibility sources



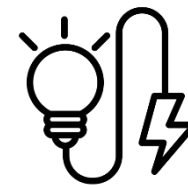
Conventional capacity

With co-firing of biomass or H₂



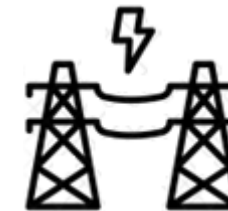
Storage

Pumped-hydro or batteries



Demand/supply response

Flexible demand



Interconnectors

Transporting electricity between two market zones

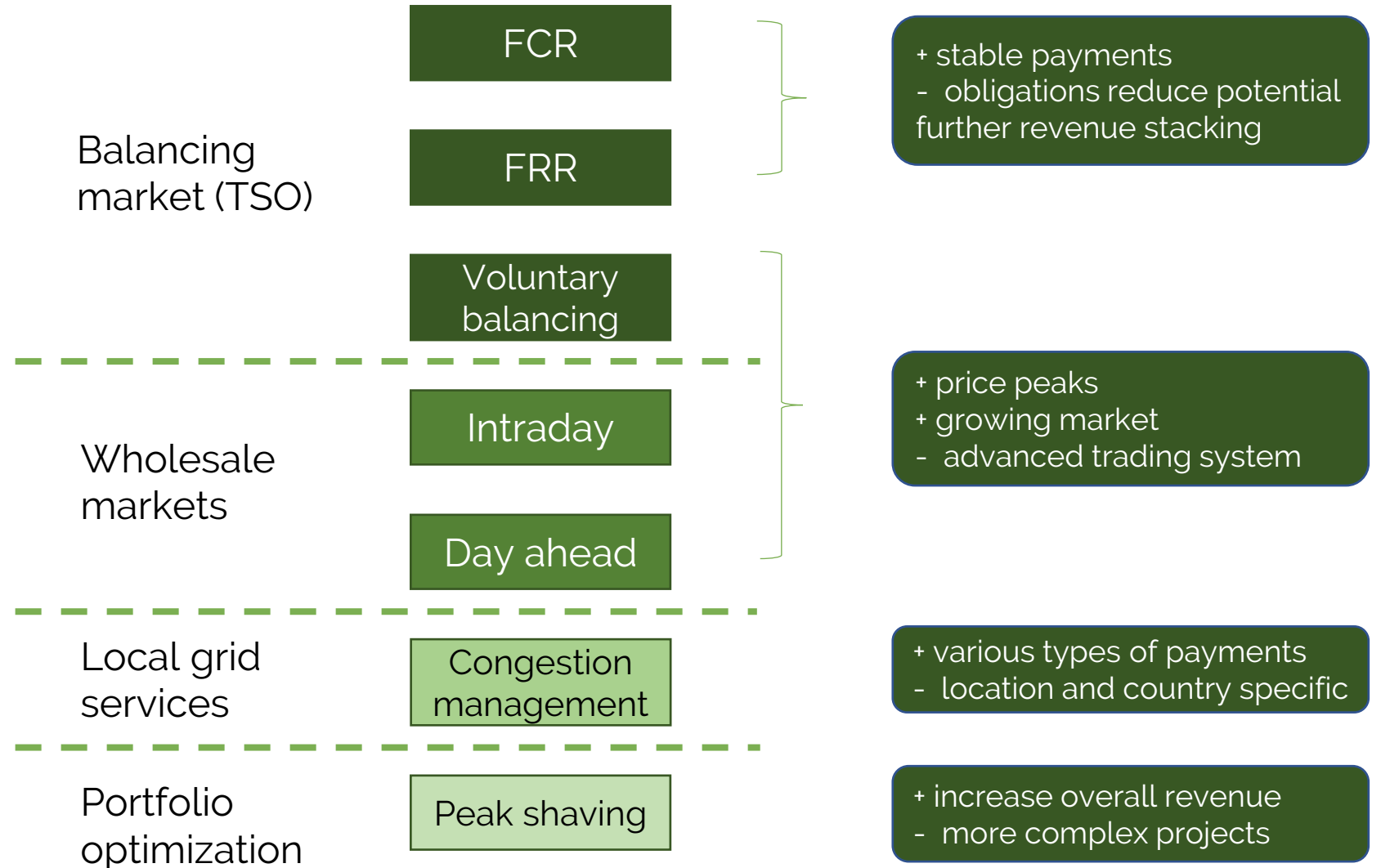
* SolarPower Europe (2024): European Market Outlook for Battery Storage 2024-2028

Energy storage – not as easy as PV or wind



A battery business case has to include a combination of revenue streams

Full value can only be realized with active trading activities



KYOS BESS valuation approach (KyBattery)



- Calculates future market value, **stacking revenue streams**:
 - Day-ahead, intraday, passive imbalance or a combination
 - Combine with optimizing in FCR or aFRR market
 - Stand-alone or co-located asset

- **Advanced trading strategies**

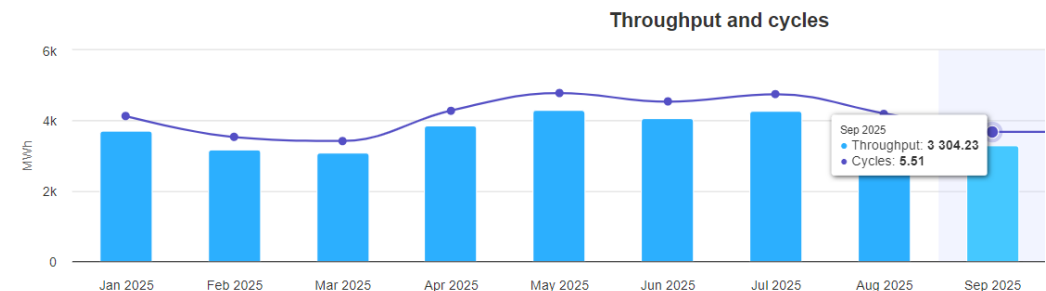
- **Realistic price simulations**

- **Expected value and risk distribution**

Battery: VPS - constrained [60]	Capacity: 17.5 MW / 25 MW / 600 MWh	RTE: 70%
Swiss Power [49]	Valuation method: LSMC (100 sim)	Start date: 2025-01-01
Day-ahead (primary)		KySim ID: 145
Job ID: 81567	Created at: 2024-08-29 12:24:19	By: KYOS Valerio Avenoso

Value Transactions **Cycles** State of charge Distributions

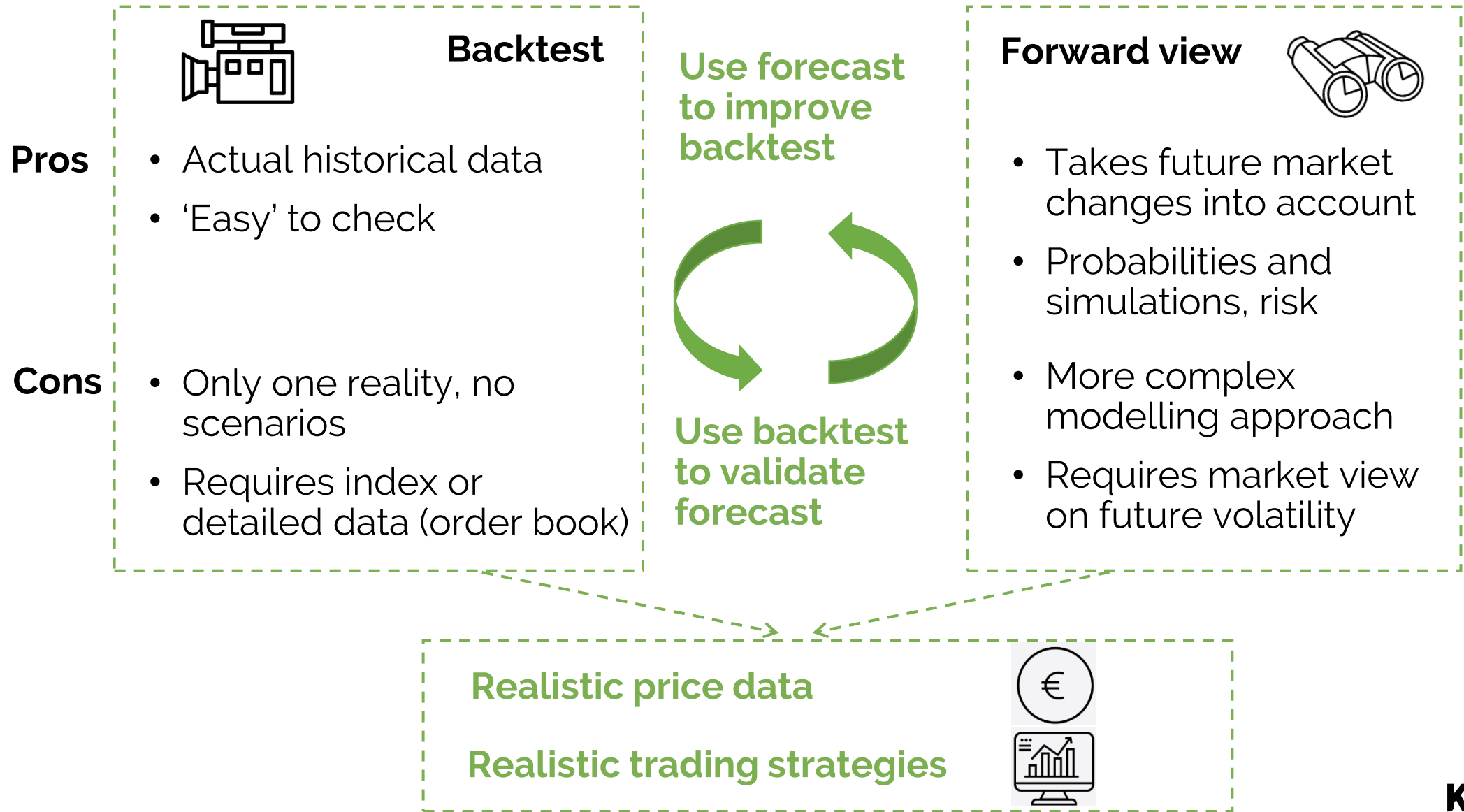
Model run Aggregation
 Intrinsic Simulations Monthly Yearly



BESS backtesting



How good are the BESS valuations?



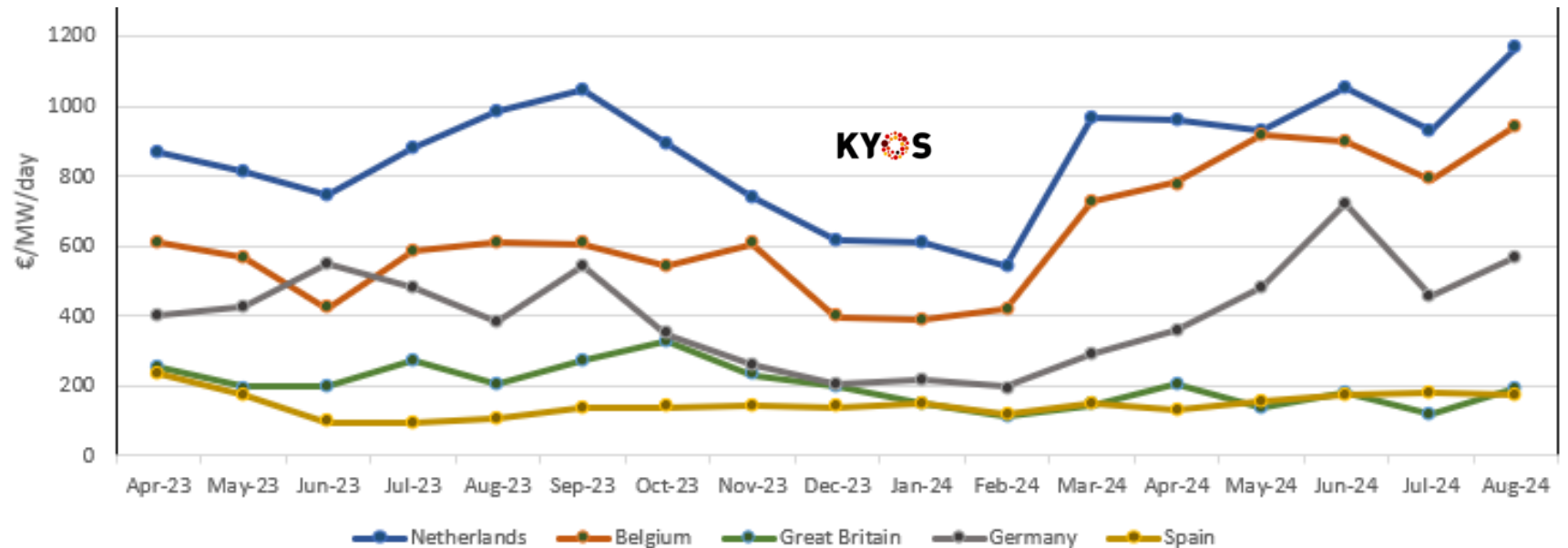
Example backtest: KYOS Battery Index



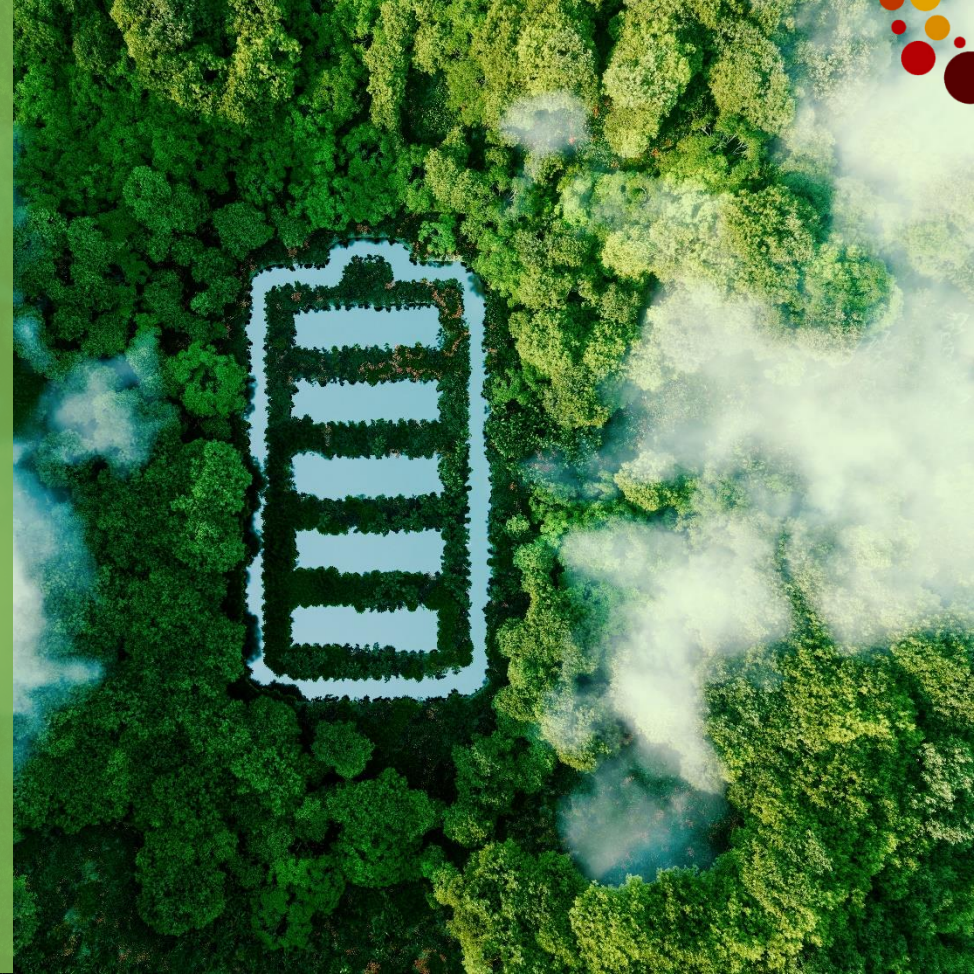
- Assumptions:
 - Mix of intraday trading (100% of capacity) and passive imbalance trading (max 30%)
 - Intraday prices are ID1 (= index of average prices)
 - Intraday prices can be perfectly forecasted
- Main advantages:
 - Can be validated relatively easily
 - Similar approach with ID1 prices can be used for forward valuation
(Forward valuation uses simulations and can be run with non-perfect foresight)

Shows historical revenues for a 2-hour battery.

Calculated with **KyBattery software**



BESS optimization



Going beyond: real-time battery optimizer

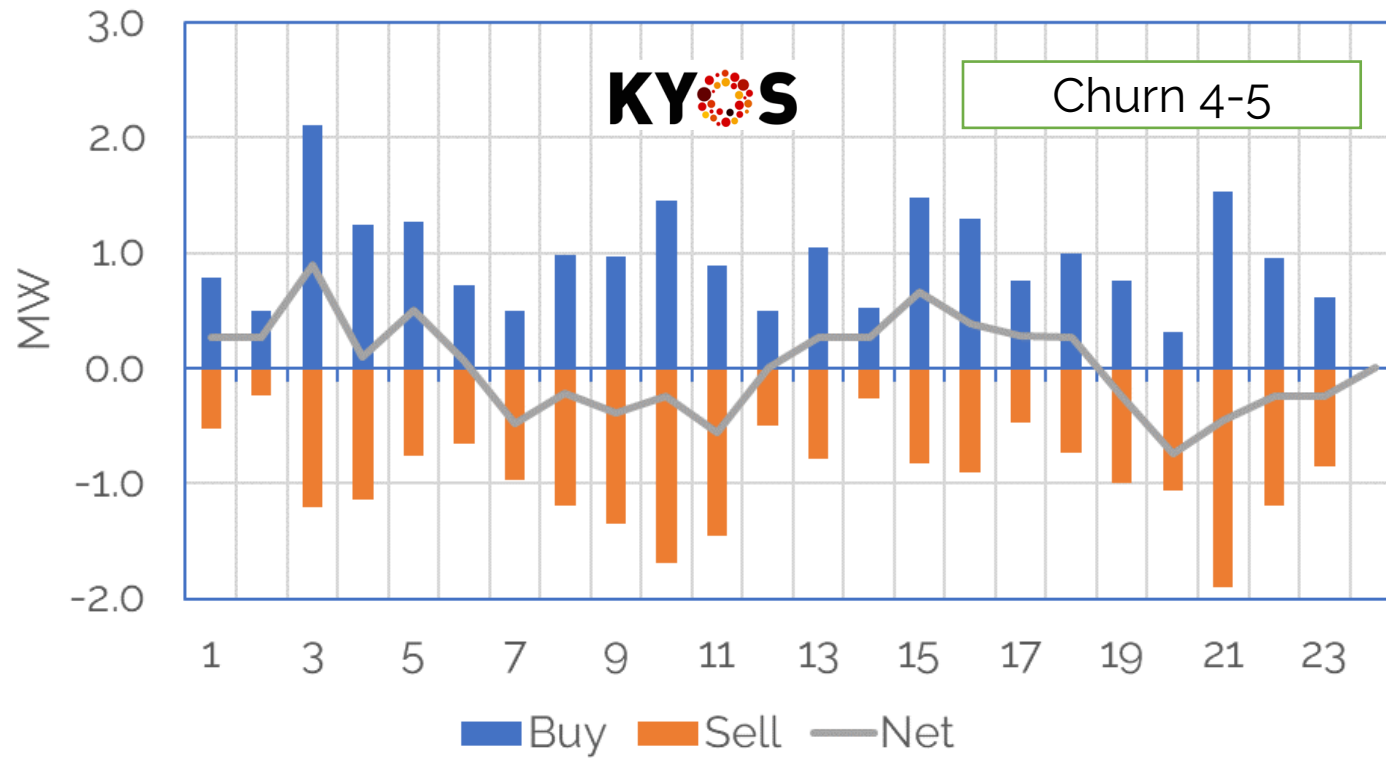
- KYOS offers **real-time battery optimization software**
- Partnership with Powerbot for easy market access
- Very real trading performance: orderbook instead of ID1 index
- Can be run **real-time**, in **shadow-trading** or in **backtest** mode



Example of traded position: 2 April 2024



Positions

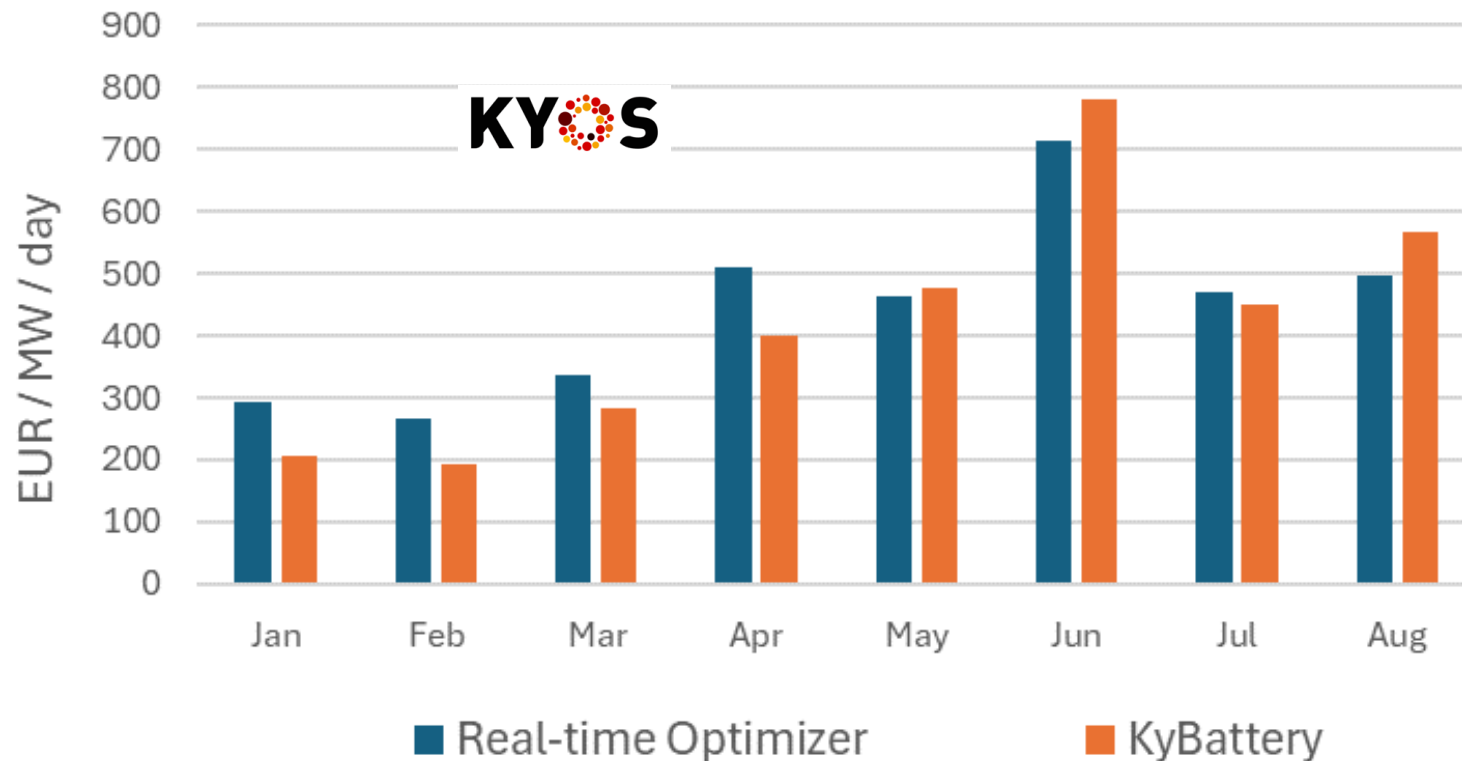


Real-time optimizer performance

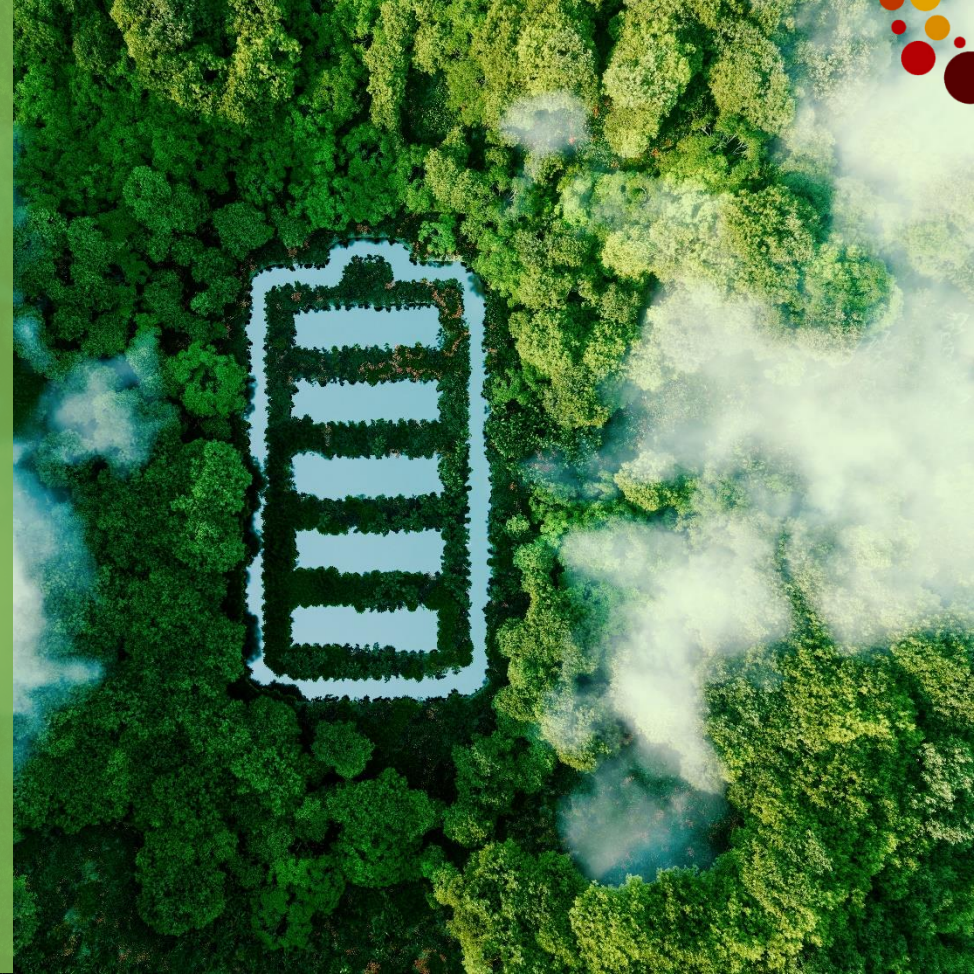


- Is the P&L of the real-time battery optimizer (intraday orderbook, shadow trading) in line with the KyBattery backtest (ID1, 'known prices')?
- Example results on the German intraday market

Realized Earnings - KYOS battery models



Getting the best BESS



How to get there with KYOS?

1

- Bankable BESS assessments and reports
- Asset-specific calculations, incl. co-located assets



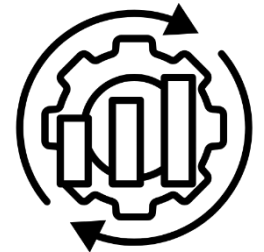
2

- KyBattery Valuation software
- Make your own assessments across Europe



3

- KYOS real-time battery optimizer
- Optimize & benchmark wholesale trading strategies



Questions and Answers



Q&A!

KYOS Energy Analytics: quarterly publications



Free publications



See: <https://www.kyos.com/knowledge-center/>

Contact us



We look forward to supporting you with the right data, tools and advice!



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Bruk Nur

