KYOS Energy Analytics

Webinar: Optimal value-stacking with batteries - FAQs

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Q: Any estimates or references for levelized cost of energy for peak off peak arbitrage, provision of FCR, aFRR that would represent the wear and tear related to cycling the battery for this use?

A: We specialize in making revenue forecasts for batteries (and other energy assets). We are not experts on the cost side of batteries.

Q: What are the chances and challenges of batteries in aFFR market?

A: One of the challenges for the optimization in aFRR is that the actual charge and discharge of a battery depends on activation of aFRR bids by the TSO. That makes it harder to stack value with other revenue streams.

Q: Have we reached the point where further battery projects will canabalise market margins?

A: New battery projects can indeed influence the revenue potential of other projects. Most likely this will first affect the FCR market, which has a very limited market size. Other revenue streams and especially ones based on energy trading (for example intraday trading) are expected to remain interesting for battery projects. To analyze the effect of adding additional battery projects on the business case of these project, it is important to have access to a model. The KYOS fundamental model KyPF allows the user to run own scenarios (e.g. with additional battery projects or different growth rates for renewable generation) and see the impact on the hourly prices.

Those generated price forward curves can then be used in our battery valuation model KyBattery. This allows the users to fully understand the sensitivity of their business case to underlying assumptions.

Q: How does one optimize value-stacking when the battery only charges from a wind or solar resource but not directly from the grid?

A: If the battery can only charge from a renewable generation asset, then it is not likely to be a valuable business case. Participation in other market segments, and stacking value, is likely to be very limited then. However, we would need to have more details to understand the business case better.

Q: Do you expect the ancillary services prices relevant to batteries, i.e. FCR and delta (aFRR, mFRR) to recover after 2030 thanks to coal phase-out and missing rotating mass for TSO ballancing or stay as low as the cost+ value of batteries?

A: It all depends on the timing of the phase-out and the speed by which battery capacities will roll out. In most of our advisory work, we assume no particular uptake after 2030. If such an uptake would be expected, that would probably lead to more battery investments.

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Q: Which different value elements should be taken into account when building a battery business case? And what is there approximate share in the revenues?

A: All revenue streams should be taken into account when building a business case. In our modelling projects we focus primarily on the revenues that the battery can make with trading in the day-ahead, intraday and (when allowed) imbalance market. In parallel we include also participation in the FCR market in our modelling.

Q: Which markets will be covered in this session? or will it be a high level discussion?

A: The main examples are about the Netherlands, but our clients (and we) use the methodologies for battery valuation e.g. in Germany, Belgium and UK as well. So, what we present is generally applicable to various markets.

Q: How shall I understand the figures 57GW by 2030 but now 34GW requested in NL?

A: A large part of the 34 is likely not to be realized.

Q: We are speaking only about batteries? what about storage through hydrogen?

A: Storage through hydrogen will probably become important as well, but mainly for longer durations (and green hydrogen for other applications). Because many market players now look at batteries more than hydrogen, the webinar focuses on batteries.

Q; Is Grid congestion a driver for co-located batteries compared to Stand-alone?

A: It can be really both used for co-located and standalone battery projects. Whereby standalone batteries are typically easier to use for this purpose.

Q: What does FCR and FRR abbreviations stand for?

A:
FCR = primary reserve = frequency containment
FRR = secondary reserve = frequency restoration

Q: Do the 4 hour bidding blocks apply for Denmark?

Yes. Denmark is currently part of a common FCR market together with Austria, Belgium, The Netherlands, Germany, Slovenia and Switzerland. The FCR product in those countries is therefore the same and based on 4 hour blocks. See for more information: https://energinet.dk/El/Systemydelser/indkob-og-udbud/FCR/ and https://www.entsoe.eu/network_codes/eb/fcr/

Q: What other tech can do FCR and respond in 30sec?

Conventional generation capacity (e.g. gas fired generation) are traditionally used to deliver FCR.

Q: So the FCR payments are essentially availability payments? And is it the same market for services increasing and decreasing the grid frequency?

A: Yes and Yes

Q: Can you comment how you project/forecast changes in price distribution in time (during a day, week) for the year 2030 when there will be much greater penetration of batteries in the EU market?

A: We have our own fundamental power model that takes future developments of the energy system into account. for example changes in generation mix, electricity consumption and indeed also batteries. The result is in the end an hourly price curve reflecting these structural changes in the market.

Q: Using a battery for a PPA (PV + Battery) to provide a smoothed energy profile over a day is more and more requested. Adding a battery to solar increases the LCOE of the plant and therefore the PPA cost. If we use the battery in FCR and aFRR markets, we can reduce the PPA price but this revenue is risky (exposed to the market). So, how can we "hedge" this revenue stream to maintain a fixed price over 15 years?

A: It is quite impossible to hedge the battery revenue streams.

Q: In a co-located asset, how do you model and forecast the imbalance factor applied to PV that is calculated by RVO to arrive at the SDE++ correction price?

A: For that imbalance factor estimate, we take an average of (future) solar production in the Netherlands, and its correlation with power prices, assuming only assets are included without battery storage.

Q: Are the DA vs ID trading strategies separate options for the battery to choose from?

A: At the moment our model (KyBattery) evaluates the following combinations:

- day-ahead (DA) only,
- intra-day (ID) only,
- FCR only,
- passive imbalance (IB) only,
- ID + IB,
- ID + FCR,
- ID + IB + FCR.

We are currently adding DA + IB and DA + IB + FCR. Thereafter we have to see if it is feasible to model combinations of DA and ID. Note that all of the strategies can be optimized as stand-alone batteries or in combination with a generation asset and/or a network constraint.

Q: What capacity assumptions for generation on the grid do you use to assume out until 2040 horizon of results?

A: We have our own fundamental power model. our base case market scenario basically reflects different known policies/plans of the different European countries.

Q: Can you coment during the session on the key expectation how the price distribution could be changed?

A: There are various parameters in our model which affect the price distribution. For example, there are forward and spot volatilities, but also parameters which allow the user to test results with a higher or lower intra-day price spread (distribution) with day-ahead prices.

Q: How do you calibrate your MC simulation to ever increasing penetration of battery storages say 5 years from now?

A: We start our analysis for mid to long-term projects with an hourly price forward curve from our fundamental model KyPF. This ensures that the structural changes in the energy system and its effect on the electricity price and especially the hourly shape are correctly taken into account. This price curve is the basis for our MC simulations. We can run this fundamental curve for different weather years (or base years). The hourly shape used in the simulations is derived from the different weather year runs of the fundamental curve. This secures the effect of increasing penetration of (for example) batteries on the hourly price shape.

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Q: Can we know approximatively the repartition in % of each revenue stream (FCR, aFRR, DA, ID, BM) considering the value-stacking strategy?

A: This is very much dependent on the exact configuration of the asset and the market in which the asset is located. We suggest that you contact us to schedule a call to further discuss this in more detail.

Q: Do you take into consideration for your simulations also state of charge management?

A: Yes, the user can define certain parameters that are related to charge management. Examples are a maximum number of cycles, as well as charge and discharge costs which depend on the state-of-charge.

Q: How would you compare the way you model battery storage to the way other providers approach it (e.g. Baringa, Aurora)? If you did have the considerations yet.

A: There are definitely differences. From what we have seen from competitors, they generally rely on just a few scenarios, like base case, low and medium (with some variations). We have a more rigorous approach involving both fundamental modelling of future power markets, but especially detailed Monte Carlo simulations of many future price paths for the various market segments (day-ahead, intra-day, imbalance, FCR). Our model finds the optimal trading strategy on all of these price paths, hence providing a more realistic insight in the future revenue streams and sensitivities.

Q: Why are the value intr different accross the 3 lines? (we are just looking at the forward curve)?

A: The results are generated with Monte Carlo simulations. The bottom line shows the 5% lowest outcome, the top line the 95% highest outcome, and the middle line the expected outcome.

Q: How long does one forward simulation for KyBattery and for one year take approximately?

A: We typically use a large number of Monte Carlo price simulations for a forward valuation of battery asset. Typical run time for a 1 year battery project with 1000 simulations is less than 5 minutes

Q: Do you model regional variations within the Netherlands, and if so, how?

A: In KyBattery we assume that there is one electricity price in The Netherlands. Location specific constraints (e.g. on grid connection capacity) can be modelled.

Q: How do you trade in passive Imbalance market? In this valuation example of using FCR + DA, did you take into account the ~34 GW battery cap that's in the pipeline for the NL market?

A: It is 'passive' trading. So you actually charge or discharge a certain volume which is different from what you traded. For this to be profitable, you must make a forecast of the imbalance price in that particular PTU. This can be done with data from the TSO in combination with other data sources and techniques. Note that KYOS does not provide such imbalance price forecasts. Our model assumes a certain forecasting accuracy, including a certain forecasting error which is either a random number or taken from historical forecast errors.

Q: Could you re-elaborate on the intrinsic value vs. 'total' value - correctly understood that this is basically considering the battery as a an option?

A: The intrinsic value is the maximum profit (cash-flow) you can generate if the prices are equal to the prices on the forward curve. It essentially assumes there is no price uncertainty. The 'total' or 'simulation' value is indeed like an option value; it is the average you make on a large number of price simulation paths. The difference is the extrinsic value.

Q: Could KyBattery simulate revenues for a battery in DK?

A: Yes, we can. Please contact us for more details.

Q: As there is lack of long-term income stability for battery (lack of credible long-term price curves in the market), how the lenders will feel comfortable of providing debts? What elements the battery investors need to be aware?

A: Important here is to include lenders already early on in the process and explain them the underlying assumptions and methodologies of the valuations used for the business case.

Furthermore we think it is essential to not only work with "simple" market scenarios as "base", "low" and "high". Creating a large number of price simulations around those market scenarios is important to understand the full risk the battery is exposed to.

Based on this the lender can for example look at the a low probability revenue scenario (e.g. P5) to get an idea of the down side of the business case. Our KyBattery model together with our KyRisk risk management model use this methodology and give sponsor and lender full visibility on the risks over the life time of the project.

We have supported sponsors with discussions about the business case of (merchant) battery project with lenders. Please contact us for more information how we can help you.

Q: In a co-located asset, how do you model and forecast the imbalance factor applied to PV that is calculated by RVO to arrive at the SDE++ correction price?

A: Our model can provide projections on the profile factor of PV assets. The imbalance factor is more difficult to model. We advise here to start looking at historical values and add some own views on future developments.

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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