



OPTIMIZING **BATTERY BID STRATEGY** WITH YES ENERGY

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With most state legislatures fixated on carbon-free energy generation, the focus on renewables is at an all time high. But due to their intermittency, renewables alone cannot support the electric grid with baseload generation; we also need storage resources in the grid to pick up the slack when renewables cannot. Most battery operators these days function as operating merchants, trading in the markets day-to-day to optimize their revenue, and providing the electric grid with much needed resiliency. At Yes Energy, we are uniquely positioned to provide the information that helps battery operators make better decisions surrounding their bid strategy, and generally be more efficient in their daily workflow. In this paper, we are going to look at some of the most useful tools that Yes Energy has to offer to answer various questions regarding optimizing battery bid strategies. Also note that this type of analysis could be applicable to any asset owner trying to optimize their bid strategy.



ANCILLARY SERVICES MARKET OR ENERGY MARKET?

Batteries are such a flexible resource that they are very well suited for both ancillary services markets and energy markets. Ancillary services markets are typically less volatile than the latter; and on the other hand, bidding into energy markets, particularly the real time (RT) energy markets carries high risk, but has the significant upside of higher profit margin. So, the day before every trading day, one of the most important questions that needs to be answered is: “Do I bid exclusively in the ancillary service market, or do I save some MWh to bid in the RT energy market?” Now, with the ancillary service market being relatively stable, we need to take a look at the RT energy market to understand if it will be profitable to set aside some MWh to bid into this market. 1



MARKET-WIDE TRENDS

Let's look into a step-by-step approach to decide whether to bid into the Energy market tomorrow. For example, one of the most basic analyses we can do is to look at the ISO-wide net load. So for example, if our plant is in PJM's footprint, we can look at PJM's forecasted net load in Yes Energy's modules. We can overlay that with our last seven day's net load data, combined with historical real-time prices, and we can get a rough estimate of what prices might look like in our zone tomorrow. We can of course bring in generation outage forecasts as well. If we see any obvious markers of estimated tight margin, we can decide that the energy market deserves some investigation for tomorrow.

Let's evaluate bid strategies for June 13th, 2022, for a battery near the Brandon Shores plant in PJM. Let's say our battery is connected to the grid at the BRANDONSH price node; today is June 12th, 2022, and we are trying to figure out if it is worth saving some MWh for the RT energy market tomorrow, June 13th, 2022.

Figure 1: PJM Net Load (Purple) and BGE RTLMP (Green) Timeseries. 6/5 - 6/13.

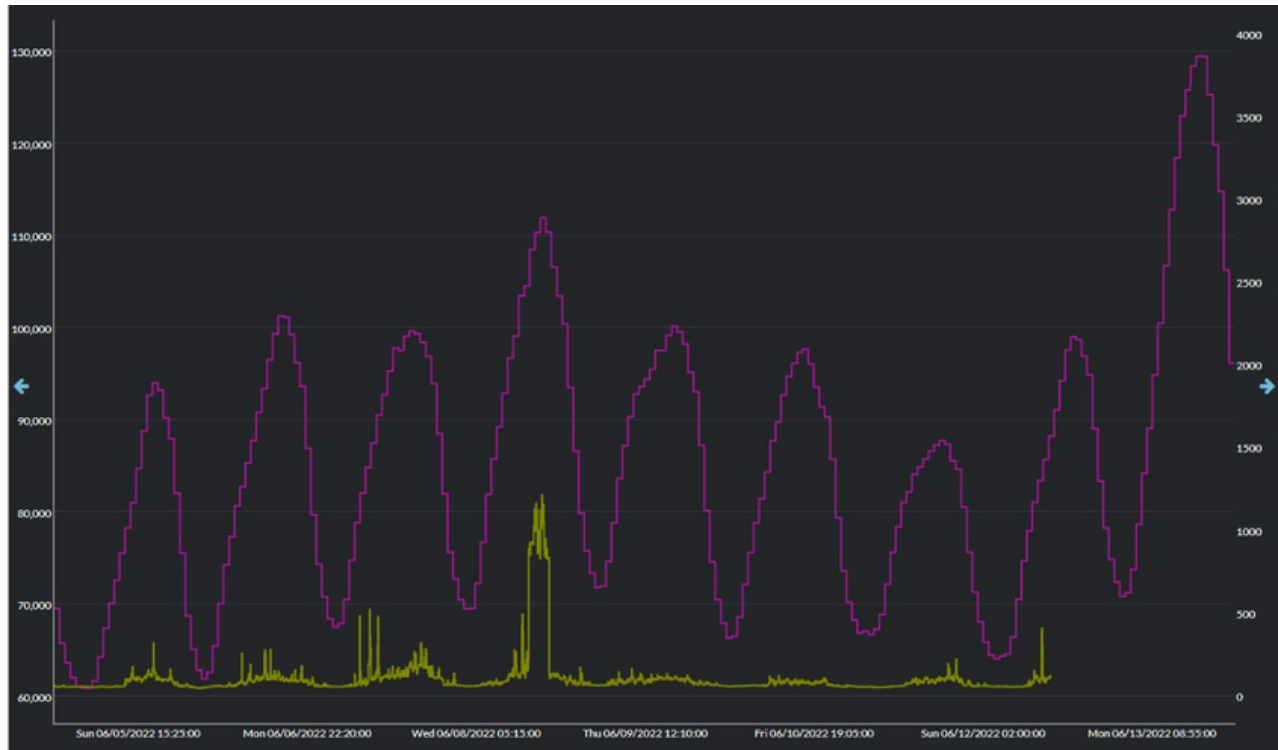
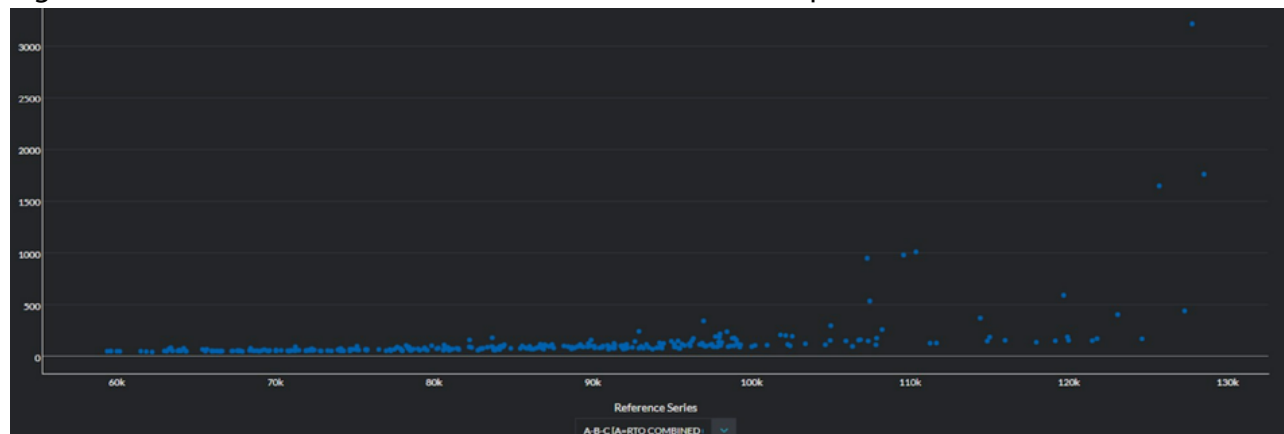


Figure 2: PJM Net Load (X Axis) v. BGE RTLMP (Y Axis) Scatterplot

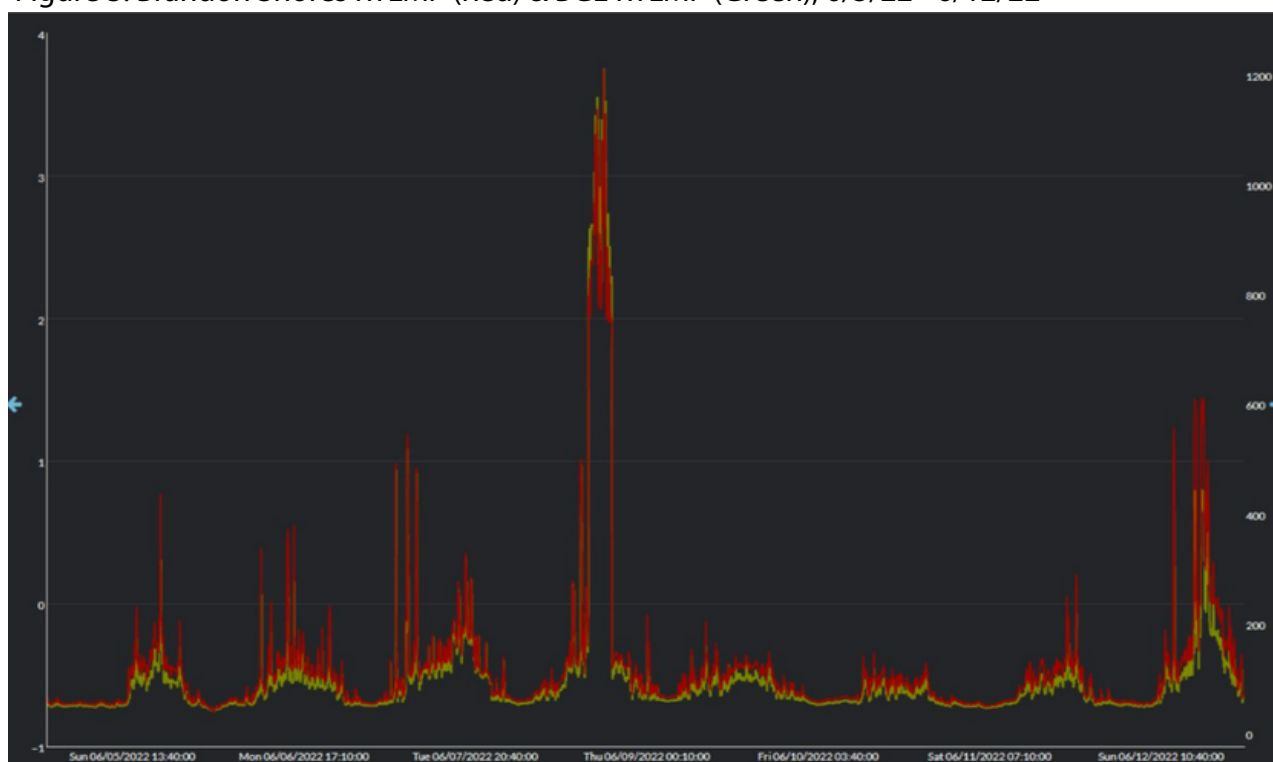


In Figure 1 we have net load in PJM in purple (total load - renewable generation) and RT LMP of Brandon Shores (where our battery is located) in green. We do immediately see a trend, whenever the net load is above 110,000 MWs, RT LMP spikes. And we do see a high net load forecast for tomorrow, so it does look like the energy market deserves some more investigation.

LOCAL TRENDS

Now that we've got an idea of ISO-wide price supply tightness for tomorrow and how that might impact prices in our zone, let's look to see if congestion is driving any trends around our specific generation node. We can easily look at local volatility by overlaying PJM's zonal LMP (BGE) with BRANDONSH's LMP. If we see any significant differences in the trends of the two in the last seven days, we can be confident that some local congestion exists, and that we need to drill into those situations.

Figure 3: Brandon Shores RTLMP (Red) & BGE RTLMP (Green), 6/5/22 - 6/12/22



Here we have the RT LMP of the BGE zone for the last seven days in green, and the RT LMP of BRANDONSH in red (Figure 3). We do not see any significant differences between the two, which tells us that recently BRANDONSH has not been experiencing any significant localized congestion. There are some slight differences today (6/12), even those aren't that significant, but it never hurts to check.

We can use Yes Energy's congestion analysis tools to take a look at which constraints have bound in the last seven days that have impacted BRANDONSH. We can easily sort these by their shift factor exposure, which tells us the average dollar impact of each constraint on our price node.

Figure 4: Impact of PJM Congestion on Brandon Shores, 6/5 - 6/12

Constraint	From Zone	To Zone	Shift Factor ↓ Exposure
HIGHRIDG-SANDYSPR 2314 B 230 KV	BGE	BGE	6.97
NOTTINGH 230 KV NOTTINGHM 2-3 SER DEV	PECO		4.41
CONASTON-NORTHWES 2310 B 230 KV	BGE	BGE	2.75
NOTTINGH 230 KV NOTTINGHM 2-3 SER DEV	PECO		1.14

In the above example (Figure 4), we find that only a few significant constraints have bound in the last week that impact the BRANDONSH price node. We see that impacts of significant individual constraints on our price node range from about \$7 to about \$1.

Once we have identified the important constraints that are affecting our node's price, we can further drill into those individual constraints to understand what drives them. Are they driven by specific market conditions like load or generation, or perhaps transmission outages. We can then determine if these conditions are likely to occur tomorrow and factor that into our decision.

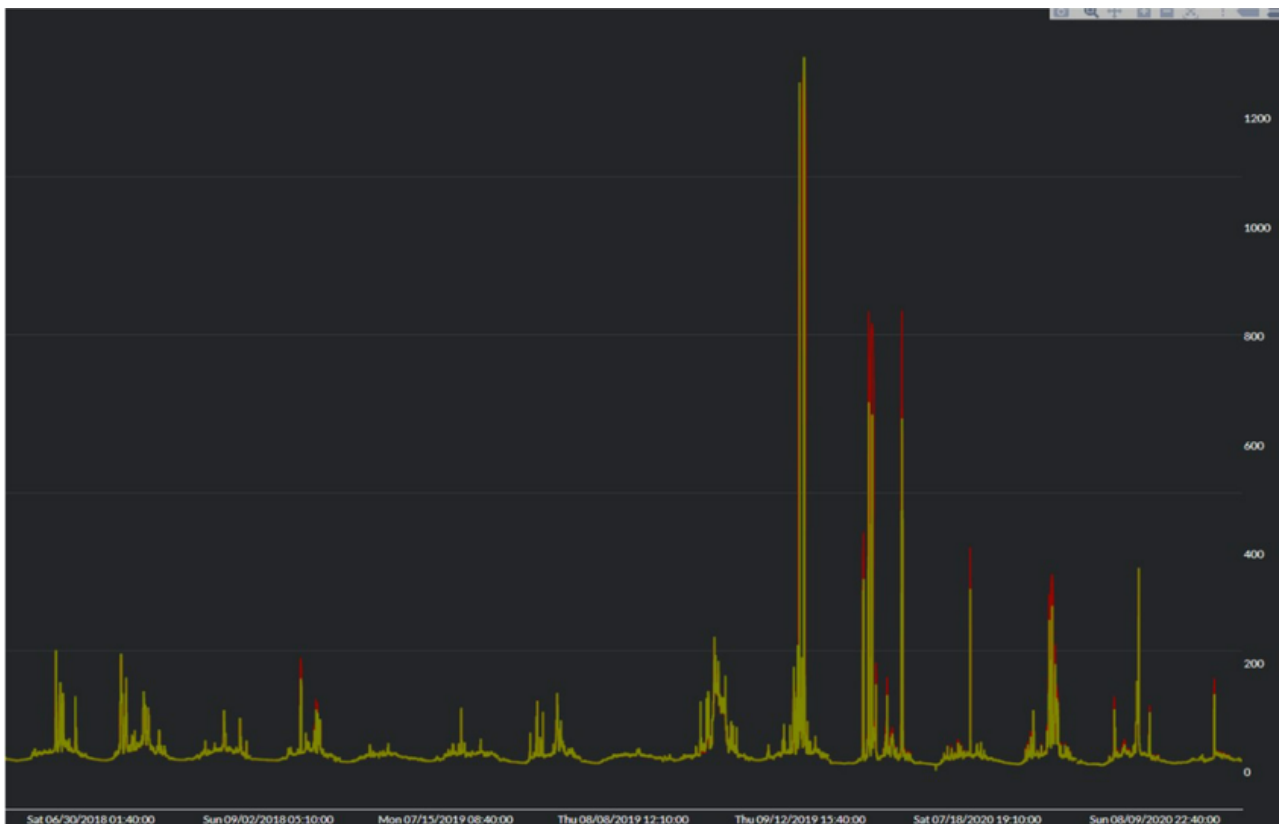
In this case, all of the congestion we've identified as likely to occur tomorrow has a positive impact on our price node (Figure 4), further reenforcing our decision to withhold some capacity from the ancillary services market for the RT energy market.

ROUNDING OUT THE ANALYSIS: COMPARING TOMORROW TO SIMILAR HISTORICAL DAYS

Once we have completed our ISO wide and local congestion analysis, we can do a third analysis, finding historical days that have similar market conditions to tomorrow, and analyzing price trends on those days.

For this example, we have used Yes Energy tools to identify a set of 15 historical days with similar load, weather, wind and solar gen and outages as tomorrow. We can then look at prices at both the BGE Zone and the Brandon Shores generation node over these days, and we can see that many of the historically similar days experienced real time price spikes (Figure 5). This again provides more evidence that we should save some capacity in our battery for RT energy markets.

Figure 5: Brandon Shores (Red) and BGE (Green) LMP on Historical Days with Conditions Similar to Tomorrow

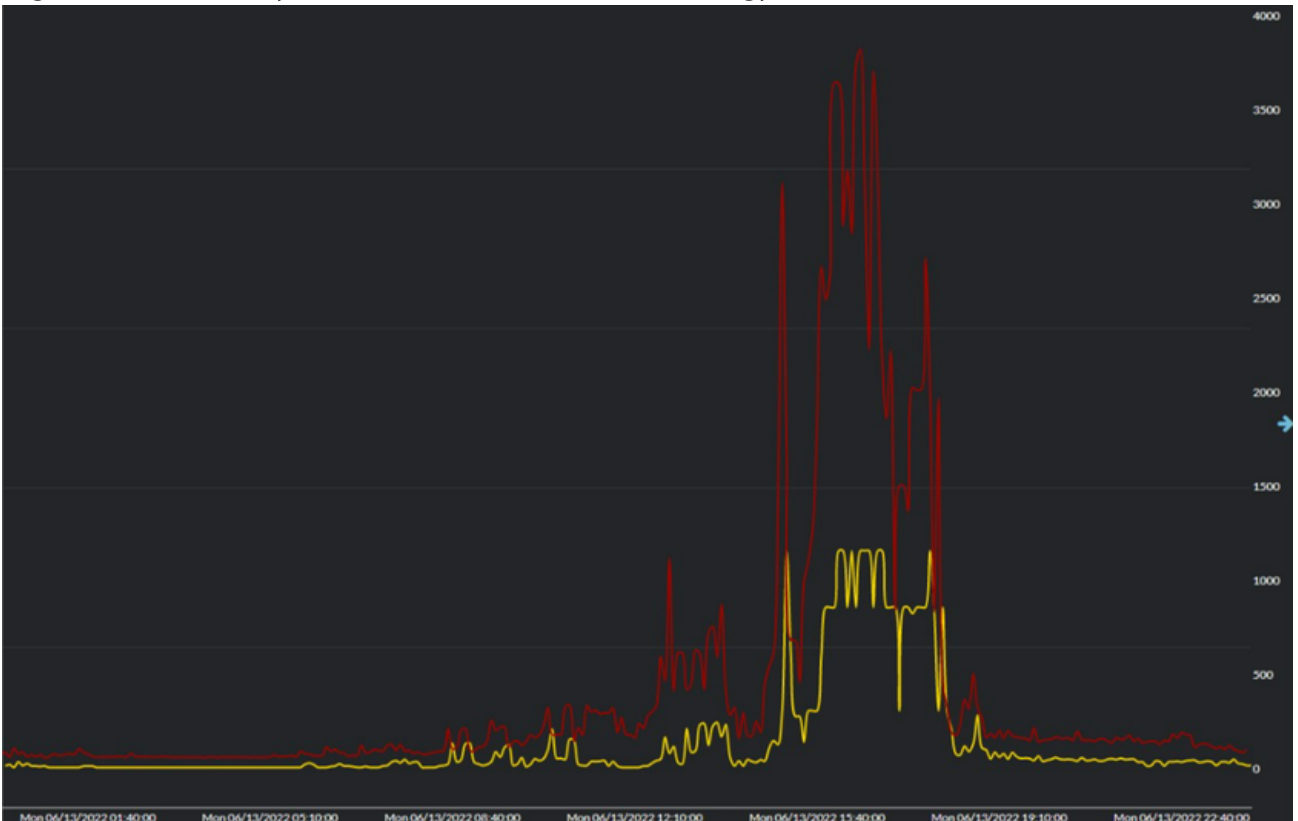


LOOKING BACK ON OUR DECISION

So, since it is a few days after June 13th, let's check back on our decision. If we remember, we decided that it would be a good idea to bid into the energy market on June 13th, and did not just bid exclusively in the Ancillary Services Market.

As we can see from Figure 6, on 6/13/22, RT Energy prices were much higher than DA Ancillary services prices, and we made some additional money by saving some of our capacity for the RT energy markets.

Figure 6: DA Ancillary Services Prices (Yellow) v. RT Energy Prices (Red) on 6/13/22



CLOSING THOUGHTS

Batteries are incredibly flexible resources. As such, flexibility is needed when we are planning our bids. There are pros to staying only in Ancillary Services Market with our bids – we get almost guaranteed revenue with very little risk – but the biggest con of the same is that the revenues are only modest. On the other hand, the energy market has high risks, but our chances of gaining much larger revenue is also higher. There are also new opportunities on the horizon from the likes of NEISO or IESO in the form of transmission resources (keep an eye out for our upcoming white papers). With the help of Yes Energy's tools, battery operators can easily evaluate the most profitable potential for them and then accordingly decide their bids for the next day.

1 Asset operators could also be deciding between Day Ahead Energy, Real Time Energy, and a variety of Ancillary Services products, but to keep this example simple we are making a decision between RT Energy, and Frequency Regulation.

Learn more about how Yes Energy can support your successful participation in these evolving and complex markets by requesting a [complimentary consultation or demonstration](#).



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