COUNTERFLOW
BY STEVE HUNTOON

Grid Batteries & Kool-Aid, Once More with Feeling

By Steve Huntoon

Huntoon

I'm taking a break from trashing the Department of Energy's Notice of Proposed Rulemaking to return to another of my favorite punching bags: grid batteries.

Sorry, I Lied a Little

But before punching grid batteries again, can I drive another stake in the heart of the DOE proposal?[1] It's a PJM press release from last week.[2] Here are a couple of my favorite sentences (emphasis added):

"Mild or severe weather, no matter what the winter brings, we are prepared and expect to have *more than enough* power available to meet consumers' demand for electricity." And: "PJM expects to have *184,926* MW of electric resources to meet the forecasted peak demand of *135,526* MW." By my math, that's about *50,000 MW to spare, the equivalent of 60 large power plants.*

So consumers should pay billions to subsidize clunkers and destroy markets that work?

It's not too late for Energy Secretary Rick Perry to say "never mind." Not that I'm holding my breath.

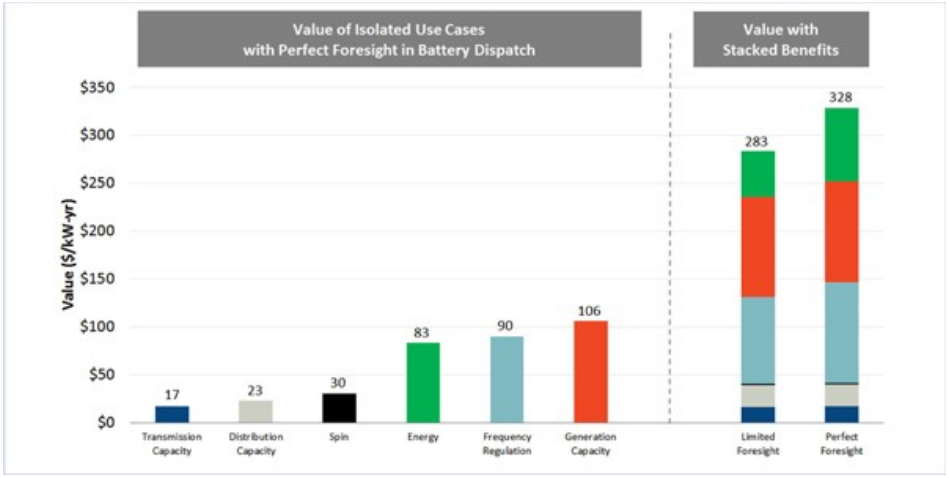
Back to Grid Batteries

OK, where was I? Oh yeah, grid batteries.

The Brattle Group recently joined the herd for "stacking" (adding) the values of batteries for different functions.[3] The study, even called "Stacked Benefits," finds that the stacked values are equal to or more than the cost of batteries.

This conclusion then prompts the search for "barriers" to batteries — if they're so darned valuable, why aren't more getting deployed? And this relative inactivity then supports a call for mandates and subsidies so that the supposedly true economic outcome is imposed by fiat.

Yikes, didn't I puncture the battery fantasy a couple years ago? Yes, I did.[4]



| *The Brattle Group*

But let's hit the high points again. I will try to be succinct.

The figure from the Brattle study above is what we'll focus on.

Brattle adds up almost all of the individual "values" left of the dotted line to get the total "Value with Stacked Benefits" to the right.

There are at least four screaming errors in the Brattle analysis: (1) adding energy arbitrage value and generation capacity value, (2) energy arbitrage value, (3) generation capacity value and (4) magnitude of frequency regulation market.

Adding Energy Arbitrage and Capacity Values

As I pointed out in the earlier article, a battery can provide energy arbitrage value or capacity value — *but not both*. This is not rocket science.

A battery cycled daily for energy arbitrage is going to be partially or totally discharged most of the time, and thus cannot be relied upon to provide its rated capacity on demand in the event of a capacity emergency. It's just that simple.

Some may claim that the need for capacity will neatly match up with the highest energy prices, so that a battery can be assumed to be discharging when capacity is most needed. This is just wrong.

To see why, please take a look at the chart of actual capacity emergencies in PJM below.[5]

Continued on page 4

Date	Performance Region	Emergency Procedure	Start Time (EPT)	Stop Time (EPT)	Number of Performance Assessment Hours
March 4, 2014	PJM RTO	Emergency Load Management	5:30 AM	8:30 AM	4
January 30, 2014	Mid-Atlantic Dominion (MAD)	Maximum Emergency Generation Action	5:51 AM	9:07 AM	5
January 30, 2014	PJM RTO	Voltage Reduction Warning	6:50 AM	7:35 AM	2
January 24, 2014	Mid-Atlantic Dominion (MAD)	Emergency Load Management	5:30 AM	8:45 AM	4
January 23, 2014	Mid-Atlantic Dominion (MAD) + AP	Emergency Load Management	3:00 PM	7:00 PM	4
January 23, 2014	Mid-Atlantic Dominion (MAD) + AP	Emergency Load Management	5:30 AM	8:30 AM	4
January 8, 2014	PJM RTO	Emergency Load Management	6:00 AM	7:00 AM	1
January 7, 2014	PJM RTO	Emergency Load Management	4:00 PM	6:16 PM	3
January 7, 2014	PJM RTO	Primary Reserve Warning	12:55 AM	12:14 PM	13
January 6, 2014	PJM RTO	Voltage Reduction Warning	7:27 PM	9:23 PM	3
September 11, 2013	Mid-Atlantic Dominion (MAD)	Emergency Load Management	2:00 PM	6:30 PM	5
July 18, 2013	PJM RTO	Emergency Load Management	2:40 PM	6:00 PM	4
July 18, 2012	Mid-Atlantic	Voltage Reduction Warning	2:40 PM	3:30 PM	2
July 18, 2012	Mid-Atlantic	Emergency Load Management	3:22 PM	5:34 PM	2
July 17, 2012	PJM RTO	Emergency Load Management	3:08 PM	7:05 PM	5
July 22, 2011	PJM RTO	Emergency Load Management	1:30 PM	7:37 PM	7
June 9, 2011	Mid-Atlantic	Primary Reserve Warning	3:54 PM	6:15 PM	4

Capacity emergencies | *PJM*

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Continued from page 3

Please note from the far right column all the emergencies that lasted more than four hours. A battery with four hours of maximum discharge — like that of the sponsor of the Brattle study — cannot possibly provide its rated discharge capacity for more than four hours.

And even for emergencies of four hours or less, a battery discharging for four hours of maximum energy price would have discharged prematurely for two other emergencies, and thus not been able to cover the emergency period.

In other words, batteries would have failed to provide reliability in seven of the 17 emergencies (these seven are highlighted). And this generously, and unrealistically, assumes that the battery operator could each day predict the four highest-priced hours (supposedly the highest-risk hours) of the next day — which it can't as discussed later.

Now let's look at the individual benefits that Brattle stacks up.

Energy Arbitrage Value

For energy arbitrage, even in what it calls the "Limited Foresight Case," Brattle assumes that the battery operator can, each day, predict the four highest-priced hours of the next day for discharge, and pick the lowest-priced hours of the next day for charging.[6]

This is not possible. There is no forward hourly energy market revealing day-ahead prices in advance. Brattle should have simulated a realistic *attempt* to forecast the highest- and lowest-priced hours, and then used the actual day-ahead prices at those hours to estimate energy arbitrage revenue.[7]

Generation Capacity Value

The discussion above about adding energy and capacity value applies here as well. A four-hour battery simply can't provide capacity value because capacity emergencies often are longer.

(Of course, a battery shouldn't need to have 90 days of charge like the DOE proposal implies, but definitely more than four hours.)

Frequency Regulation

Brattle is correct that a battery can provide frequency regulation. But what Brattle leaves out is that frequency regulation is a small niche market that, for example, is already saturated in PJM. And that a battery providing frequency response can't provide other benefits like energy arbitrage at the same time — no multitasking!

And From the Land Down Under

I suppose this is as good a place as any to lambaste the media hype around the Tesla battery project in South Australia. The blackout precipitating that project had nothing to do with inadequate resources.[8] The events in the blackout involved many hundreds of megawatts, whereas the Tesla battery is only 100 MW of capacity. And its 129 MWh of energy means it would last for little more than an hour.

Last week, after the battery was energized, *The New York Times* led the media fawning, calling it "one of this century's first great engineering marvels." Can anyone seriously compare stringing together a bunch of off-the-shelf battery cells with, say, the tallest building in the world (Burj Khalifa), the biggest dam in the world (Three Gorges Dam), the tallest bridge in the world (Millau Viaduct), the Mars rovers, the mapping of the human genome, the Large Hadron Collider, smartphone proliferation, Wi-Fi proliferation, 3D printing, re-floating of the Costa Concordia, Bluetooth, ride-sharing, home-sharing, Google — all marvels of this century? C'mon *Times*, get a grip.

And in the category of "you can't make this stuff up": The day after the battery was brought online, bad weather brought down power lines causing blackouts in areas around the battery.[9] The battery was no help.

Bottom Line

Grid batteries aren't useless. They are an excellent way to separate utility customers from their money. And they come in shiny boxes.

Steve Huntoon is a former president of the Energy Bar Association, with 35 years of experience advising and representing energy companies and institutions. He received a B.A. in economics and a J.D. from the University of Virginia. He is the principal in Energy Counsel, LLP, www.energy-counsel.com.

[1] If you're interested in my five prior columns trashing the DOE proposal, they're available in gruesome detail here: http://www.energy-counsel.com/recent-publications.html.

[2] http://pjm.com/-/media/about-pjm/newsroom/2017-releases/20171129-winter-readiness-release.ashx.

[3] http://www.brattle.com/system/publications/pdfs/000/005/494/original/Stacked_Benefits_-_Final_Report.pdf?1505226490.

[4] http://www.energy-counsel.com/docs/Battery-Storage-Drinking-the-Electric-Kool-Aid-Fortnightly-January-2016.pdf.

[5] http://pjm.com/-/media/committees-groups/committees/elc/postings/performance-assessment-hours-2011-2014-xls.ashx?la=en (highlighting added and footnotes omitted).

[6] "In the Limited Foresight case, the battery is operated with realistic constraints around the ability to predict prices. Specifically, the battery dispatch schedule is optimized across all [day-ahead] value streams *with perfect foresight into prices over the next 24 hours*." (page 8, emphasis added).

[7] It is important to note as well that efficiency losses are uncertain and vary widely by battery technology. And typically the reported efficiency factors do not include "parasitic load" (cooling system, etc.) which can significantly reduce actual system efficiency. http://www.networkrevolution.co.uk/wp-content/uploads/2014/12/CLNR_L163-EES-Lessons-Learned-Report-v1.0.pdf (page 38).

[8] https://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2017/Integrated-Final-Report-SA-Black-System-28-September-2016.pdf

[9] http://www.theaustralian.com.au/news/south-australia-storms-power-blackouts-as-tesla-battery-is-turned-on/news-story/de20d9518b40191381e9534eca722980