Considerations for Synchronized Reserves from Solar-Battery Hybrids

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Solar-Battery Hybrids and Synchronized Reserves: Summary

- Solar-battery hybrid: solar and a battery at the same site operating in markets as a single unit.
  - Generally the combined power capability of the solar and battery exceeds the plant export capability (e.g., exceeds the Point of Interconnection transformer rating).
- **Question**: should solar-battery hybrids ("hybrids" in this slide deck) provide Synchronized Reserves (SR) by default?
  - Status quo: solar resources and battery resources are expected to have zero MW SR.
- **Primary Considerations:**
  - Are solar-battery hybrids physically capable of reliably providing SR? What are the implications of uncertainty?
  - Are Capacity hybrids obligated to offer and provide the SR they are capable of under the SR must offer rule?
  - Who quantifies SR and how?

Uncertainty Considerations

1. Synchronized Reserve is a reliability product, uncertainty should be approached conservatively.
2. Solar resource availability is uncertain.
3. Bidding behavior related to battery constraints may vary among participants.
4. Today, the output of solar units is not always related to their economic basepoint. Will all hybrids follow their basepoint in practice?
5. Does providing SR require a steady, controlled output before and after events?
6. Are solar-battery hybrids physically capable of reliably providing SR?

Implications of SR Quantities

1. Are Capacity hybrids obligated to offer and provide the Synchronous Reserves they are capable of under the SR must offer rule and the reserve market proposal?
2. LMP during shortage intervals will be set by reserves quantities.

2020 PJM Reserve Market Proposal Docket EL19-58-002

"Offers to Supply Synchronized and Non-Synchronized Reserves By Generation Resources in the Day-ahead and Real-time Reserve Markets

Market Sellers owning or controlling the output of a Generation Capacity Resource that … is capable of providing Synchronized Reserve or Non-Synchronized Reserve as specified in the PJM Manuals… shall submit offers or otherwise make their 10-minute reserve capability available to supply Synchronized Reserve … in an amount equal to the available 10-minute reserve capability of such Generation Capacity Resource. …

[next paragraph]…provided, however that hydroelectric generation resources and Energy Storage Resources are not automatically deemed available to provide reserves based on the submission of an available energy offer but may submit offers to supply Synchronized Reserve and Non-Synchronized Reserve, as applicable. …

Determination of Available Synchronized Reserve Capability of Generation Resources

For each offer to supply reserves by a synchronized resource, the Office of the Interconnection shall determine the MW of available Synchronized Reserve capability offered in the Day-ahead Energy Market and Real-time Energy Market, in accordance with the PJM Manuals; except, however, that the Office of the Interconnection will not make such determination for hydroelectric generation resources or Energy Storage Resources."

[Recall that current CBIR proposal defines open-loop hybrids as an Energy Storage Resource]

https://www.pjm.com/directory/etariff/FercDockets/4617/20200706-el19-58-002.pdf

Manual 18 Section 4.2.1:

- “Tier 1 estimates for other resource types that cannot reliably provide Synchronized Reserve service shall be set to zero MW during the market clearing process. Such resource types include, but are not limited to: Nuclear, Wind, Solar, Energy Storage Resources, and Hydro units. Owners of any specific resource(s) or these resource types may request an exception from the default zero MW estimated value of their resource(s) if they notify PJM that the resource(s) are able to reliably provide Tier 1 Synchronized Reserve. PJM only grants such requested exceptions on a prospective basis. A resource is only credited for Tier 1 Synchronized Reserve if the resource was considered during the market clearing process, unless such resource actually provides Tier1 Synchronized Reserve during a Synchronized Reserve Event”
- “A non-emergency generation capacity resource that cannot reliably provide Synchronized Reserve service may submit an offer quantity of zero MW. The participant responsible for a given resource must be able to justify a zero MW offer quantity. Certain unit types including, but not limited to, Nuclear, Wind, Solar, and Energy Storage Resources, are expected to have zero MW Tier 2 Synchronized Reserve offer quantities.”
- Note: resources are eligible for the Tier 1 SR adder regardless of whether they contribute to the Tier 1 estimate or not.

Considerations of Quantifying SR

1. Who quantifies SR? How to ensure the quantity is valid?
2. SR performance is measured for events longer than 10 minutes as: delta between average output at time “t” of call (averaged over 2 minutes) and average output over duration of event (t+10min until end).
3. If the hybrid participates in markets as a single unit, should the SR be identified and measured on the basis of the behavior of the single unit?
   - If ECOMAX is increasing, is that SR? E.g., when solar availability is increasing in the morning.
   - If the output of a unit does not go up during an SR event, can that be SR response? E.g., when solar availability is dropping faster than the battery can compensate.
   - Would the SR quantity from hybrids be flexible SR (recalculated for each 5 minute interval) or inflexible SR (assigned a quantity for an entire hour).

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