

Demand Side Response in the Synchronous Reserve Market Background & Education

Operating Committee
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The current PJM tariff limits:

- The amount of DR to 25% of the total amount of each Ancillary Service (day ahead scheduling reserves, synchronized reserves, regulation) requirement.
 - The amount of batch load DR resources to 20% of the Synchronized Reserve Requirement
 - Currently only the SR market is seeing participation near the 25% cap
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- **Tariff and Manual References**
 - 25% DR Limit:
 - Tariff: Attachment K – APPENDIX, Section 3.2.3A.01
 - Manual 11: Sections 3.2.7, 4.2.9, and 11.2.2
 - 20% Limit on Batch Load Resources:
 - Tariff: Attachment K – APPENDIX, Sections 1.5A.8, 3.2.3A, 3.2.3A.01
 - Manual 11: Section 4.2.9 and 11.2.2

- **Batch Load Demand Resources :**
 - have a cyclical production process that at most times during the process it is consuming energy, but at consistent regular intervals, ordinarily for periods of less than ten minutes, it reduces its consumption of energy for its production processes to minimal or zero megawatts.
 - are limited to providing 20% of the Synchronized Reserve requirement
- PJM currently has discretion to reduce the percentage of Batch Load Resources to 10% in a given hour in case of reliability concerns.

1. Confirmed Economic Registration in eLRS
2. The DSR resource must have a minimum synchronized reserve capability of 0.1 MW
3. CSP must complete mandatory Ancillary Service training on [pjm.com](http://www.pjm.com)
4. CSP is required to receive PJM's All Call for Synchronous Reserve notification.
5. One Minute interval metering that can be submitted to PJM within one day
 - CSP must provide a brief description of the meter installation process and quality assurance plan
6. Completed Meter Qualification Form
 - <http://www.pjm.com/markets-and-operations/etools/~media/etools/elrs/20090904-dsr-customer-owner-meter-qualification-form.ashx>
7. Successful Meter Data Review by PJM
 - The file needs to include 24 hours of one minute interval readings from the CSP owned Customer Meter and EDC Meter readings (at any interval) for the corresponding 24 hours.

- Resource responses are verified by the PJM Performance Compliance Dept following each event
- Actual responses compared to assignments at start of Synchronized event used to determine penalties
- Metering data to be submitted via eLRS on one day lag
 - One minute meter data is submitted in eLRS

- Non-batch load resources response is calculated as the difference between:
 - (a) The consumption at the start of the event and
 - (b) The consumption ten minutes after the start of the event, and every minute thereafter for events longer than 10 minutes
- If a batch load resource is operating at the minimum consumption level of its duty cycle, the magnitude of the response will be measured as the difference between:
 - (a) the resource's consumption at the end of the event and
 - (b) the maximum consumption within a ten (10) minute period following the event provided that all subsequent minutes following that minute are no less than 50% of the consumption in that minute.

- No penalties exist for Tier 1 (payment made for actual response only)
- Tier 2 units that fail to respond to a Synchronized event when assigned or self-scheduled at the beginning of the event are penalized as follows:
 - Unit forfeits Tier 2 revenue for the amount of non-response over the contiguous hours the unit was assigned Tier 2 when the event occurred
 - The CSP incurs a synchronized reserve obligation in the amount of the shortfall for the three (3), consecutive, same-peak days occurring at least three (3) business days following the event. The shortfall is prorated over the minutes of the event
 - Obligation penalty may be offset by over-response from other registrations assigned or self scheduled Tier 2

Penalty structure is the same for Generation and Demand Response

- **Complete DSR Ancillary Training Materials**
 - <http://www.pjm.com/training/~media/training/core-curriculum/ip-dsr/dsr-in-the-ancillary-service-markets.ashx>
- **Business Rules**
 - PJM Manual 11:
 - <http://www.pjm.com/~media/documents/manuals/m11.ashx>
 - Section 4.1 and 4.2
- **Synchronized Reserve Accounting**
 - Operating Agreement Accounting - PJM Manual 28:
 - <http://www.pjm.com/~media/documents/manuals/m28.ashx>
 - Section 6

- Review existing RFC and SERC reliability requirements with respect to participation limits of DR.
- Discuss modifying or eliminating the existing 25% limit on DR participation and/or the 20% limit on batch load demand resources in the Synchronous markets.

APPENDIX

	T-1	T0	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13
Energy	-10	-10	-10	-10	-10	-10	-10	-9	-8	-6	-4	-3	-2	-1	-2.5
Response			8	8	8	8	8	8	8	8	8	8			

- 1) Calculate Consumption at Start of Event
 $= \text{Min}(T-1, T0, T1) = -10$
- 2) Calculate Consumption after 10 minutes
 $= \text{Max}(T9, T10, T11) = -2$
- 3) Calculate Response for 1st 10 minutes of event
 $= (1) - (2) = 8$
 Response applied to each of the first 10 minutes

	T-1	T0	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13
Energy	-10	-10	-10	-10	-10	-10	-10	-9	-8	-6	-4	-3	-2	-1	-2.5
Response			8	8	8	8	8	8	8	8	8	8	8	8	7.5

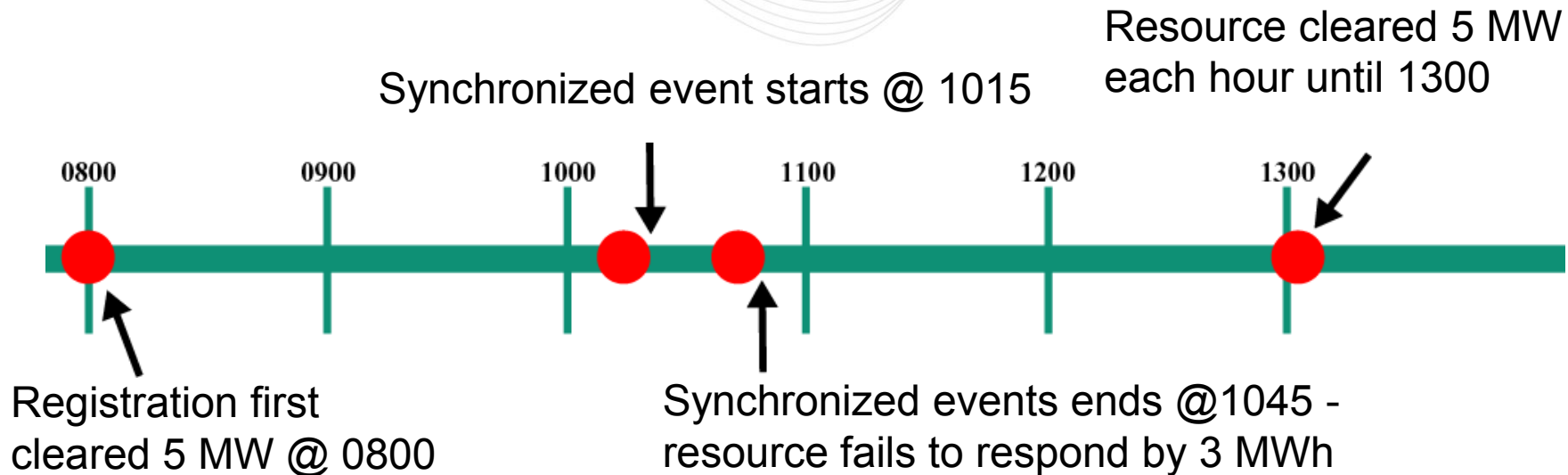
4) Calculate Response for each additional minute over 10

= Consumption at T(n) – (1)

Value is capped at Response for 1st 10 minutes (3) and value cannot be positive

5) Calculate Total Response

= (Response for 1st 10 minutes * 10 minutes + Response for each additional minute) / duration of event (in minutes) = $(8 * 10 + 8 + 8 + 7.5) / 13 = 7.96$



Penalties:

- 1) Resource will forfeit 3MW worth of Tier 2 credit from 0800 until 1300
- 2) Company will incur 1.5MW (3MW*30minute event/60 minutes) additional obligation for future three same peak days (Similar profile days)

Participation	Payment to CSP	Cost to Energy Market	Risks to CSP
<ul style="list-style-type: none"> • Ten-minute reduction requirement • One-minute interval metering • Minimum .1 MW offer • 24-hour All-Call availability <p>Tier 1: Voluntary reduction during a PJM Synchronized Reserve event</p> <p>Tier 2: Offers that clear in hourly market. Mandatory reduction during PJM Synchronized Reserve event</p>	<p>Tier 1: PJM pays \$50 premium above event LMP = MW * (\$50 – Avg. LMP during Event) – Hourly LMP</p> <p>Tier 2:</p> <ul style="list-style-type: none"> • PJM pays Synchronized Reserve Market Clearing Price (SRMCP) * MW assigned • Economic payment for reduction during event 	<p>Synchronized Reserve costs allocated to load servers:</p> <p>Tier 1:</p> <ul style="list-style-type: none"> • Based on percentage share of total Tier 1 credits paid <p>Tier 2:</p> <ul style="list-style-type: none"> • Based on obligation share 	<p>Nonperformance:</p> <p>Tier 1: No Penalties</p> <p>Tier 2:</p> <ul style="list-style-type: none"> • Forfeiture of Tier 2 revenue over contiguous hours assigned • Additional obligation in the amount of shortfall for next three same-peak days