PJM ERPIV Proposal: Reserve Pricing

Key Components

- Implementation of real-time 30-minute Operating Reserve (RT OR) Market with Operating Reserve Demand Curve

- Tweaks to the existing DASR market to incorporate known additionally scheduled resources

DASR Requirement

- Current DASR requirement is 6.27% of peak load
  - 2.11% average load forecast error
  - 4.16% average forced outage rate
- A portion of these reserves is used to meet the existing Primary and Synchronized reserves needs during the operating day
- PJM's proposal is to price resources scheduled in excess of these requirements to articulate the need for such resources and reduce uplift
- Scheduling additional resources typically only occurs during emergency conditions

- Real-time market only cleared on when capacity scheduled beyond typical reserve requirements in Section 2.3.2 of M-13 (existing 6.27%)
  - On all other days the requirement will be zero
  - Likely only occurs during emergency conditions
    - HWA
    - CWA
    - Maximum Generation Alert
    - Weather/Environmental Emergency (i.e., Hurricane Sandy)
    - Sabotage/Terrorism Emergency

Trigger for RT OR Market

1. HWA, CWA, Max Gen Alert, Weather/Environmental/Sabotage/Terrorism Emergency

AND/OR

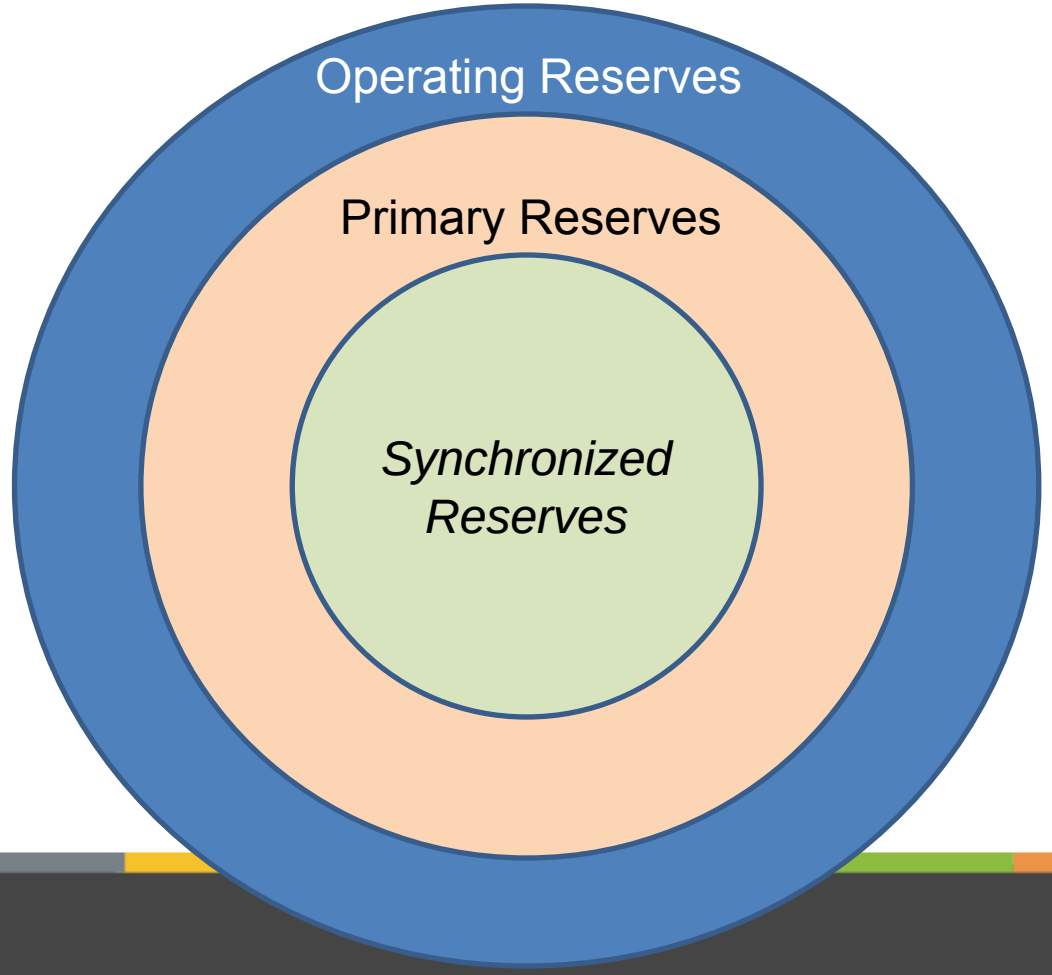
2. PJM schedules an additional 0.5% capacity beyond the default DASR requirement based on peak load forecast
   - 0.5% of 160,000 MW is about 800 MW
   - Based on the sum of the economic mins of the additional resources scheduled
     - Generators scheduled for reserve and anticipated to run at min
     - These resources offset economically scheduled generation by that amount
     - Once dispatched from min they are no longer extra capacity

RT OR Market Components

- RTO-wide
  - no locational component
- Requirement
  - Calculated once for the on and off peak period of the day
    - 2300 the day prior for the off-peak (0000-0459)
    - 0400 the day of for the on-peak (0500-2359)
  - Based on the additional resources scheduled
    - ∑ (Economic min + 30 minute reserve capability)
    - Need to consider incorporation of existing DASR requirement

RT OR Market Components (cont'd)

- RT OR requirement would be nested with existing Primary and Synchronized Requirements



Reserve Requirement Interpretation

- Requirements (example only)
  - 5,000 MW Operating Reserve (30 minute on/offline)
  - 2,000 MW Primary Reserves (10 minute on/offline)
  - 1,300 MW Synch Reserves (10 minute online)

- 5,000 MWs of total 30 minute reserve capability of which
  - 2,000 MW can be loaded within 10 minutes
  - 1,300 MW is synchronized and can be loaded within 10 minutes

- Requirements are nested, not additive

RT OR Market Components (cont'd)

- Availability based on energy availability
  - All resources available for energy that have 30 minute reserve capability
- All offers are $0
  - Clearing based on joint optimization of energy and reserves and determined by the marginal resource's opportunity cost
- Shortage pricing demand curve
  - Single step curve
    - Consistent with existing curve shapes for PR/SR
    - Analysis will be based on DASR prices observed during peak periods

RT OR Market Components (cont'd)

- Eligible capacity
  - Same eligibility rules as DASR (Section 11 of M-11)
  - Further discussion required for Pre Emergency DSR inclusion

- Resource capability
  - *Online resources*: Lesser of (Eco Max – Dispatch point) and (Segmented energy ramp rate * 30 minutes)
    - Similar to SR capability
  - *Offline resources*: Lesser of Eco Max and [Eco Min + (30 minutes – (startup time + notification time)) * Segmented energy ramp rate]
    - Similar to NSR capability

Tweaks to DASR Market

- Increase requirement by known amount of additionally scheduled capacity using the same trigger point
  - Increase would be based on the (economic min + 30 minute reserve capability) of such resources
- Change 30 minute reserve capability to be capped at economic max instead of the current emergency max
  - Current DASR requirement is based on average forced outage rate and average load forecast error
  - Using emergency capacity as part of the resource's capability assumes that when we see average load forecast error and average forced outage, we will deploy emergency capacity. ***This is inconsistent with how PJM operates.***

Items Still Under Discussion

- How settlement with existing DASR mechanism will work
  - Balancing settlement only?
- Use of Pre Emergency demand response
- Demand curve penalty factor
- Finalizing the RT OR requirement
- Non-performance penalties
- Cost allocation
  - Load?
  - Deviations?
  - Something else?