Locational Reserve Modeling

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Issue Summary

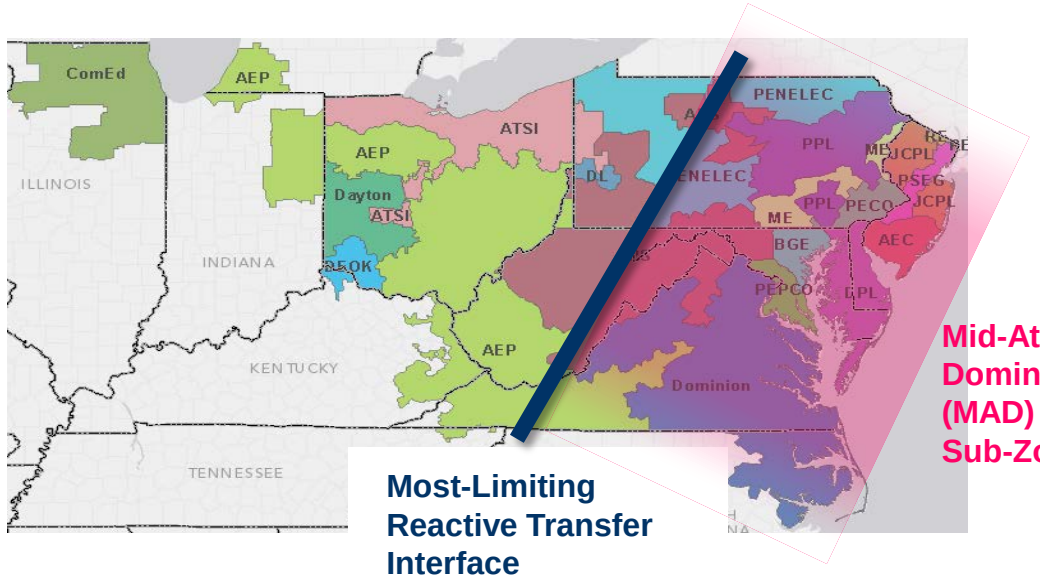
- The current, static reserve zone modeling approach (RTO reserve zone with MAD sub-zone) does not always accurately reflect the constraints dispatch is most concerned with overloading
  - Leads to reserve prices that may be misaligned with the reliability value of those locational reserves

Approaches Being Pursued

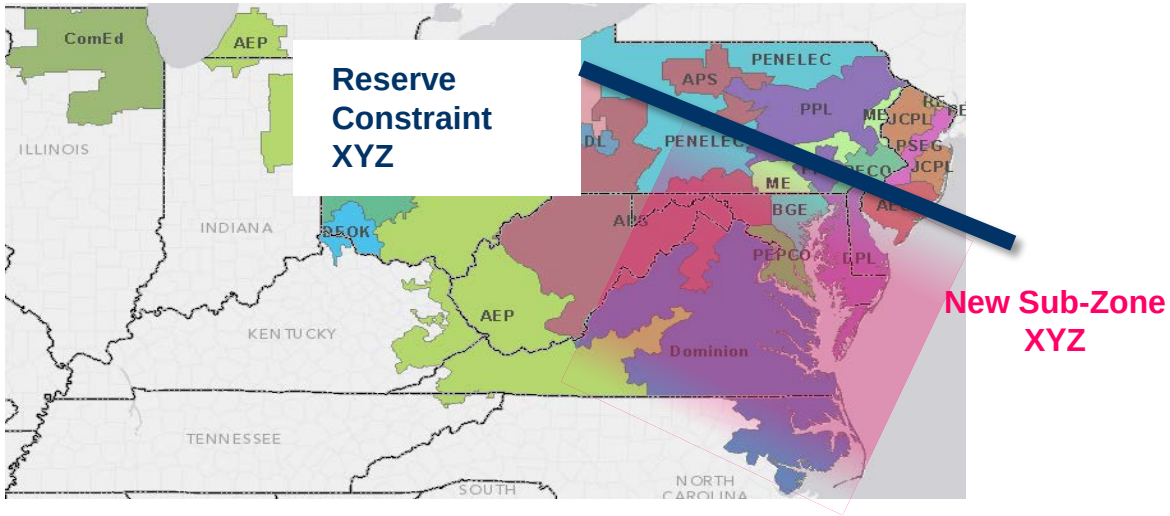
- Nodal Reserve Pricing
  - Model a single RTO-wide reserve demand curve
    - No locational demand curves necessary
  - Monitor one or more transmission constraints for overload if reserves are deployed
  - Assign reserves to resources that will not result in constraint overloads
  - Capture cost of redispatch in nodal reserve congestion component
    - Yields nodal reserve clearing prices
  - *Preferred approach, but requires additional investigation to confirm feasibility*

Approaches Being Pursued

- More Flexible Reserve Sub-Zone Modeling
  - Keep existing RTO reserve zone with closed loop sub-zone structure, but allow flexibility to change the location of the sub-zone
  - Define several reserve sub-zones, of which only one will be used at a time



OR



Path Forward

- Continue investigating feasibility of implementing nodal reserve pricing
  - Bring additional detail to the EPFSTF as soon as feasible

- Continue building detail around flexible sub-zone approach in case nodal reserve pricing is not feasible
  - Gather stakeholder feedback on the flexible sub-zone approach to date

Flexible Sub-zone Approach Details: Defining new sub-zones

- Define several reserve sub-zones, of which only one will be used at a time

- New reserve sub-zones may be defined for constraints in these three categories:
  - Reactive transfer interfaces (AP South, BED-BLA, etc.)
  - 345kV or above actual overload constraint (i.e. Conastone-Peach Bottom 500kV actual overload)
  - Contingency overload exceeding the load dump limit on a 345kV or above facility
- New reserve sub-zones will be defined as far in advance as possible
  - Model process after guidelines for notifying participants of new closed loop interfaces
    - Notification to PJM stakeholders of any new reserve sub-zone should be made as far in advance as possible, but no later than X days prior to use
- New reserve sub-zones will not be created on a same-day basis

Sub-zone Composition

- Sub-zones will be defined as all buses that have a 3% or greater distribution factor on the associated transmission constraint
  - Definitions will be posted on pjm.com
  - Reserve sub-zone definitions will be re-evaluated and published quarterly in advance of the network model builds

Defining the Sub-Zone ORDCs

- Each reserve sub-zone will have its own ORDC for each product (SR or PR)
- Methodology for defining the sub-zone curve will be consistent with that of the RTO reserve zone curve.
  - Maximum price will be consistent with the maximum price on the RTO demand curve ($850)
  - Minimum Reserve Requirement will be equal to the real-time output of the largest single contingency in the reserve sub-zone
  - Downward sloping section will be set by Probability of falling Below the Minimum Reserve Requirement (PBMRR) times the Max Price
  - Curve will be adjusted for operator actions, consistent with practices applied to RTO demand curve

Flexible Sub-zone Approach Details: Changing the location of the sub-zone

– Keep existing RTO reserve zone with closed loop sub-zone structure, but allow flexibility to change the location of the sub-zone

- The reserve sub-zone to be used for a given operating day will be determined on a day-ahead basis and will apply for the entire operating day.
  - Will be the reserve sub-zone associated with the most limiting of the defined reserve constraints, as determined by day-ahead or other forward reliability studies
  - Notification of changes to the reserve sub-zone to be used will be made as far in advance as possible, but no later than prior to the close of the day-ahead market (notification method TBD).
- Changes to the reserve sub-zone in use can be made after the close of the day-ahead market (including intraday) on an exception basis.
  - Stakeholders will be notified of all switches in the modeled reserve sub-zone as soon as possible (notification method TBD).

Enhancements to Reserve Deployment Communications

- Enhancements to spin event notifications / instructions will be necessary if the sub-zone in use can change
  - Send spin event notification to units within the impacted sub-zone via ICCP
  - Investigate adding requested spin event response MW to energy basepoint instruction sent via ICCP