# Locational Reserve Modeling

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# Issue Summary

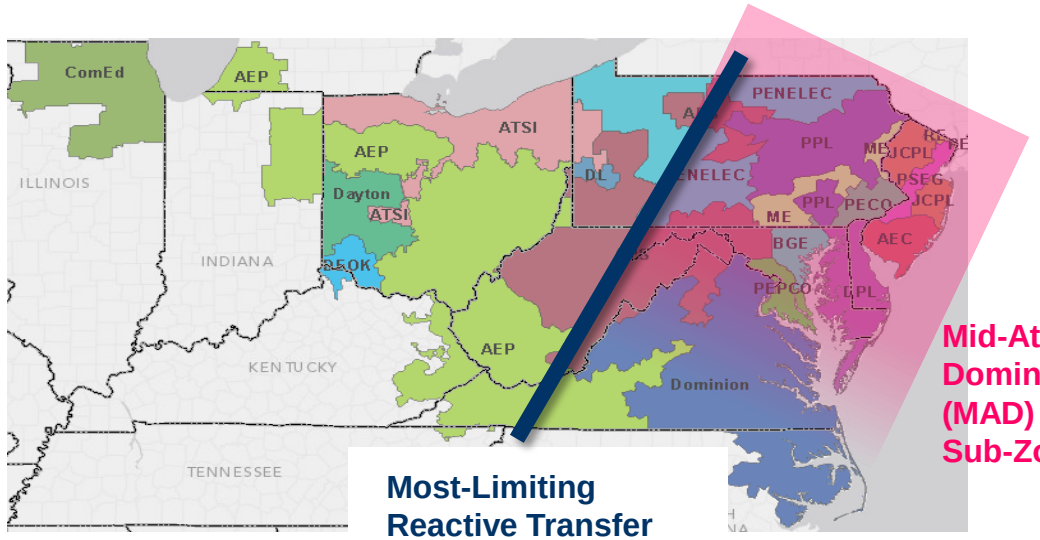
- The current, static reserve zone modeling approach (RTO reserve zone with MAD sub-zone) does not always accurately reflect the constraints dispatch is most concerned with overloading
  - Leads to procurement of reserves in locations that could exacerbate constraints when deployed
  - Leads to reserve prices that may be misaligned with system conditions and the reliability value of those reserves

# Update on Nodal Reserve Pricing

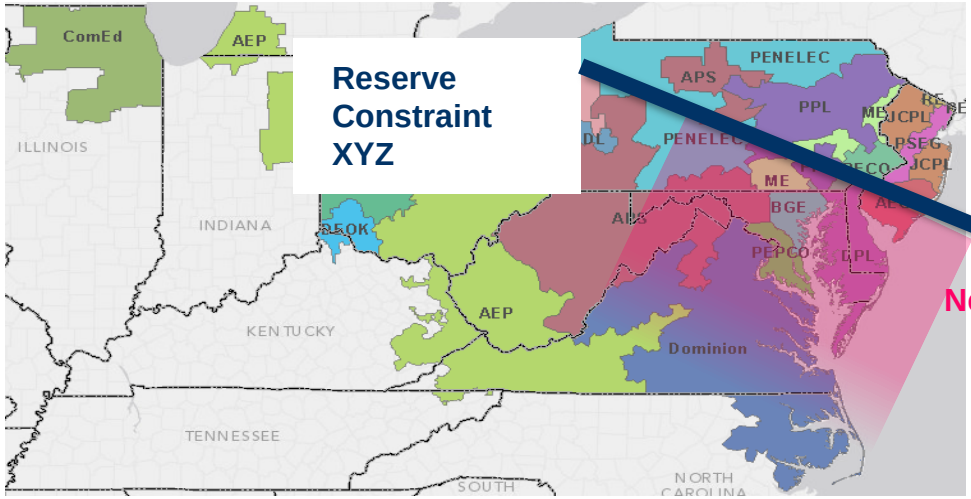
- Nodal Reserve Pricing
  - Model a single RTO-wide reserve demand curve
    - No locational demand curves necessary
  - Monitor one or more transmission constraints for overload if reserves are deployed
  - Assign reserves to resources that will not result in constraint overloads
- Initial discussions indicate this is a feasible alternative; more investigation required
- Requires significant further discussion with stakeholders
- PJM recommendation:
  - Move nodal reserve pricing to the EPFSTF's mid-term scope of work
  - Include more flexible sub-zone modeling in the short-term scope of work

# Flexible Sub-Zone Modeling

- 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



# 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 the 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 one day 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 ORDC will be consistent with that of the RTO reserve zone ORDC.
  - 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
    - If load forecast does not exist for the sub-zone area, then use the load forecast error for the area the sub-zone is contained within and scale it down using the sub-zone's ratio share of actual load in that area
    - Thermal forced outage, and wind and solar forecast uncertainties can be derived using the uncertainties associated with the units located within the sub-zone.
  - Curve will be adjusted for operator actions taken within the sub-zone, consistent with methodology 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.
- 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

# Enhancements to Reserve Deployment Communications

- Enhancements to spin event notifications / instructions will be necessary if the sub-zone in use can change
  - PJM is currently investigating adding requested spin event response MW to a resource's energy dispatch instructions so resources receive a single base point to follow.
    - This enhancement is a pre-requisite to the implementation flexible sub-zone modeling