



# PJM Circuit Breaker High-Level Design Approaches

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- PJM has been discussing high-level approaches for implementing a Circuit Breaker (CB) in the reserve price formation construct.
- There are several approaches which can be used to implement a circuit breaker. Each has its own Pros and Cons.
  - Need to balance risk exposure with ability to recover investment
- PJM has been investigating two styles of circuit breaker triggers:
  - Monetary Trigger – Utilize pricing in some fashion (\$ threshold and/or time duration prices exceed X) to trigger the application of the CB.
  - System conditions based trigger - Using some emergency actions such as Voltage reduction or Load Shed to trigger the activation of the CB. Explore including the use of anticipatory operations data (Conservative operations, Gas Contingency, projected load forecast > X etc...)

- Prolonged shortage event where in Real Time (RT) the total number of 5 minute pricing intervals is  $\geq X$  in an operating day or across two consecutive operating days with the active sub-zone SRMCP  $\geq X$ .
  - Intervals can be consecutive or non-consecutive
- In Day Ahead (DA) the prolonged shortage event is defined as  $\geq X$  hours in a market day or across two consecutive market days with the active sub-zone SRMCP  $\geq X$ .
  - Hours can be consecutive or non-consecutive
  - If the CB is activated based on DA results the CB will be active in RT

- Pros:
  - Provides transparent threshold for activation
  - Implementation difficulty is low
  - Activation is objective once threshold is determined
- Cons:
  - Price level and time duration are subjective

- Potential trigger(s) which could be used for activation
  - Sustained Emergency Procedures at X level
  - PJM declaration of Conservative Operations
  - Planned or unplanned gas pipeline interruption requiring the activation of a gas contingency
  - PJM Operations projects tight system conditions where emergency action may need to be implemented over a period of X or more operating days

- Pros:
  - Attempts to target actionability of prices more directly, but not tied to monetary threshold
- Cons:
  - Trigger based on operator action
  - May provide less notice to market participants when Emergency Action will be called
  - Or may not allow for proper protection if Emergency Procedure triggered not often enough

## De-activation of Circuit Breaker Logic

- No active emergency procedures (Alerts do not apply) and X consecutive Days with no approved cases having reserve shortages
- X day threshold is analogous to a minimum duration applied to the Circuit Breaker once triggered
- Minimize or reduce the occurrence of price swings for a multi-day event

- When Circuit Breaker is Triggered (either approach):
  - Lower penalties (\$2000/MWh) on the Operating Reserve Demand Curve (ORDC) to use the 1<sup>st</sup> step penalty from the **current** two-step demand curve.
  - Synchronous Reserve penalty \$850/MWh
  - Primary Reserve penalty \$850/MWh
  - Secondary Reserves penalty \$850/MWh
- Lowering the penalty value on the ORDC is the simplest and most straightforward implementation.
  - Price formation becomes more transparent
  - Avoids potentially complicated price cutting/capping logic
- No explicit capping of the Energy Component of LMP or Total LMP



- Apply circuit breaker in Pricing run solution of ITSCED, LPC, and DA market clearing
  - Dispatch run solution (DA, ASO, SCED and LPC) would not apply circuit breaker logic
    - Applying CB in the dispatch run will limit the actions the engine can use to maintain reliability
    - Not applying the CB in the dispatch run allows MCEs to re-enforce dispatcher decisions to maintain reliability

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