Use of Penalty Factor for the ORDC

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Use of $2,000/MWh as the Penalty Factor

• PJM is proposing a penalty factor of $2,000/MWh for all reserve products
• PJM will commit and dispatch all economic generation to maintain 10- and 30-minute reserves products
• Energy offers from these resources can be up-to $2,000/MWh
• When LMPs are in the range of $2,000/MWh, the lost opportunity costs for resources with lower offers will be high.
• PJM’s dispatch systems must be able take these actions so that operators do not need to manually dispatch resources.
• Prices must reflect these actions.
Quick Example

- No congestion, no losses
- Marginal unit offer = $1,900/MWh
- LMP at Generator A = $1,900/MWh
- Energy Offer of Generator A = $50/MWh
- Lost Opportunity Cost = LMP – Offer = $1,900/MWh - $50/MWh = $1,850/MWh
• Pre-Emergency and Emergency Demand Response can also submit offers close to $2,000/MWh (~$1,850/MWh)

• These offers are submitted everyday and are an action that operators will take to maintain 10-minute reserves everyday
  – Section 2.3, PJM Manual 13
• Voltage Reduction Action and Manual Load Dump Action
  – Voltage Reduction Action will be done to maintain Synchronized Reserves but not Primary Reserves
  – Manual Load Dump Action will be done as a reserve deployment but not to maintain a minimum level of reserves

• These are the most extreme actions.
• Should the system operators ever take these actions, prices should be at or near their peak.
• When in either of these conditions today, PJM’s rules force a simultaneous shortage of all reserve products.
  – PJM believes this process should continue.
Flat Portion of the ORDC

Synchronized Reserve Demand Curve

Current Penalty Factor Curve
ORDC, $2000/MWh Penalty Factor
Probability of Not Meeting the Minimum Requirement

- Probabilities are determined using uncertainties
- This is a two-tailed distribution
  - Uncertainty can result in more reserves or less
  - This can happen under various conditions

- PJM will not rely on the benefit of forecast error to meet its minimum reserve requirements.
- This results in the removal of one tail of the distribution and the block shape to all the curves.
• Downward-sloping section of the curve
• Based on the PBMRR * Penalty Factor for various levels of reserves
  – Regulation requirement is subtracted from the MW levels

• At its core, the ORDC intended to reflect demand bids for reserves at various levels that do not exist in any markets today
  
  *What would a consumer be willing to pay to procure another MW of reserves given the incremental benefit to reliability?*

• The incremental benefit to reliability is the reduction in probability of not meeting the MRR.
• The maximum willingness to pay has already been established at $2,000/MWh
  – $850/MWh in today’s model
• If the cost of a reserve shortage is $2,000/MWh, and procuring another MW of reserves would result in a 40% chance of that shortage occurring, a rational demand bid for those reserves would be $800/MWh ($2,000/MWh * 40%).

• More generically, “willingness to pay” is:

  marginal cost of a reserve shortage * probability of that shortage occurring
  or
  Penalty Factor * PBMRR
Synchronized Reserve Demand Curve

Synchronized Reserves

- $2,000/MWh, Penalty Factor
- $850/MWh, Current Penalty Factor
- $300/MWh, Current Penalty Factor Curve

Synchronized Reserve (MW)