Day-ahead ORDC

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January 4, 2019
• PJM has proposed implementing 10- and 30-minute in both day-ahead and real-time
Theoretical Model: Similar Concepts

- DA and RT ORDCs are based on similar concepts but are not exact
  - Probabilities are the same
  - Maximum price on the curves different

- The maximum price on the curves are different because the highest point on the DA ORDC incorporates the marginal cost of energy at the expected value of real-time load.

- This load level, and therefore this price, will likely never be realized in real-time resulting in a different ORDC in DA and RT.
Theoretical Model: Value of Lost Load (VOLL)

• In the theoretical model, the maximum price for energy or reserves is the VOLL.

• This value is pre-determined.
  – It is used to calculate the height of the demand curve but it is not the only factor.
  – It also serves as a cap on energy offers.

• Because of the need to strictly adhere to a maximum price of the VOLL, the implementation of the ORDC is different than what PJM has proposed.
Theoretical Model: ORDC

Reserve Demand Curve

$/\text{kW/h}$

Reserve MW
Theoretical Model: Theoretical Model: $v \neq VOLL$

$v = VOLL - \text{marginal cost of energy}$

Several factors in the theoretical model require this relationship:

1. The strict adherence to the VOLL as the maximum price.
2. The additive nature of the cost of reserves and the cost of energy through co-optimization.
3. The ability to reflect scarcity value in generator offers under the theoretical model.
Theoretical Model: Why subtract the marginal cost of energy?

- As cleared offer prices reach the VOLL and the system is in shortage, the theoretical model could result in prices of 2 * VOLL absent any intervention.

- The mitigating measure taken is to decrement the ORDC by the expected value of the marginal cost of energy.

- For this type of implementation, this value must be estimated prior to solving the dispatch and pricing solution.

- Estimating this value accurately is not easy. Inaccurate estimates will bias the dispatch and market solutions.
Theoretical Model: $v = \text{VOLL} - \text{marginal cost of energy}$

- The net result of this is that in the theoretical model
  - The ORDC will change as the marginal cost of energy changes
  - The ORDC will be different in DA and RT because the marginal cost of energy will be different. The probabilities all remain the same.

- The theoretical model also permits virtual trading of reserves in the DA market.
- These bids are used to converge the reserve market solutions to better align with real-time given the different in ORDCs.
1. PJM’s proposal does not seek to cap the ultimate price of energy at a pre-determined VOLL.

2. Energy offers in PJM are not permitted to rise to the level of the VOLL.
   – They are capped at $1,000/MWh unless cost exceeds that level.
   – Ultimately capped at $2,000/MWh for price-setting.

3. PJM does not currently permit, and at this time is not proposing to permit, virtual trading of reserves in the DA market.
\[ v = VOLL - \text{marginal cost of energy} \]

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1. The strict adherence to the VOLL as the maximum price.
2. The additive nature of the cost of reserves and the cost of energy through co-optimization.
3. The ability to reflect scarcity value in generator offers under the theoretical model.
• FERC Order 831 implemented offers caps at the currently specified levels.
  – These offer caps permit far less (if any) ability to reflect scarcity value in energy offers.
  – Scarcity revenues are collected via high energy/reserve prices that are not related to energy offers that approach the VOLL.

• In this model, the marginal cost of energy, and the maximum price on the demand curve are complementary, not overlapping, as in the theoretical model.
• Given the differences between PJM’s market design and the rules assumed in the theoretical model, PJM believes that implementing identical curves in DA and RT is logical.

• In addition to the provided market design differences
  – Identical curves eliminates the potential need for virtual transactions for reserves. PJM does not support implementing these at this time.
  – Eliminates modeling discrepancies related to ORDC differences.