Fixed / Price Sensitive Demand Bids, Load Response, Virtual Bidding & Pump Storage Optimizer in the Day Ahead Market

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Demand Side Response (DSR)

Consumer’s ability to reduce electricity consumption at their location when wholesale prices are high or the reliability of the grid is threatened.

- End-use customers participate in DSR via Curtailment Service Providers (CSP)
- Meter data required to establish Baseline (CBL)
- Offer curves are required for Energy Market participation (offers submitted via Markets Gateway)
- Only one offer curve can be made available on a daily basis
  - Market Type participation can be Day Ahead, Balancing or Both and is associated with a schedule that can be changed daily by the CSP
  - **DA Market** – If hour clears in DA market then DR should respond with associated MWs. PJM will not dispatch in RT for hours that clear in DA market.
  - **Balancing Market** – DR should follow RT dispatch signal
  - **Both** – If hour does not clear then hour is eligible to be dispatched in RT
• Markets Gateway allows for the selection of either Slope of Block

• Offer curves consist of MW-Price pair segments. Up to ten (10) segments can be defined for each offer curve

• Resource will be cleared / dispatched economically in accordance with the offer curve
Fixed / Price-Sensitive Demand Bids

Hourly demand quantities for which a participant commits to purchase energy at Day-Ahead prices for consumption in the next Operating Day. Bid must specify MW quantity and location (aggregate or bus)

- Fixed Demand → Location, MW
- Price-Sensitive Demand → Location, MW & Price

- Price-Sensitive Demand bids are accepted in single bid-blocks only (up to 9 segments may be submitted per market participant at a specific location)

- If a Market Buyer submits no Day Ahead bid information, then a 0 MW quantity is assumed

- The total MW quantity of Fixed and Price-Sensitive demand bids submitted by an LSE for a given Operating Day must not exceed the LSE’s Daily Demand Bid Limit
Increment Offers & Decrement Bids (Virtual Bidding)

• Increment (Inc) offer
  – Looks like a spot market sale or dispatchable resource
  – “virtual generator” (injects MW)
  – If LMP goes above offer price, Inc will be cleared

• Decrement (Dec) bid
  – Looks like a spot market purchase or price-sensitive demand
  – “virtual load” (withdraws MW)
  – If LMP goes below bid price, Dec will be cleared
How are Virtual Bids Treated?

- INCs & DECs are part of the Day-Ahead Supply curve

- Inc offers/Dec bids can be placed at any eligible trading point where either generation, load, or interchange transactions are settled, or at trading hubs where forward positions can be taken

- Treated just like generation to clear the market

- Can displace more expensive generators and set clearing price in the Day-Ahead Market
INC Offer
- Sells MW into Day Ahead Market at High Price
- Buys replacement MW from Real-Time Market at Lower Price
- Profits when Day-Ahead Prices are Higher than Real-Time Prices

DEC Bid
- Buys MW from Day Ahead Market at Low Price
- Sells those MW in Real-Time Market at Higher Price
- Profits when Day-Ahead Prices are Lower than Real-Time Prices
**Example #1 – Increment Offer**

**Day-Ahead**

- Participant offers 100 MW at $30
- Assume Day-Ahead LMP = $35

\[ \text{Day-Ahead Settlement} = 100 \text{ MW} \times 35 = 3500 \text{ credit} \]

\[ \text{Day-Ahead Position} = 3500 \]

**Real-Time**

- Assume Real-Time LMP = $20
- Deviation from DA schedule = -100 MW

\[ \text{Balancing Settlement} = -100 \text{ MW} \times 20 = 2000 \text{ charge} \]

\[ \text{Balancing Position} = -2000 \]

**Net position**

\[ 3500 - 2000 = 1500 \text{ credit} \]
Example #2 – Decrement Bid

**Day-Ahead**
- Participant bids 100 MW at $20
- Assume Day-Ahead LMP = $15
- Day-Ahead Settlement = 100 MW * $15 = $1,500 charge
- Day-Ahead Position = -$1,500

**Real-Time**
- Assume Real-Time LMP = $25
- Deviation from DA schedule = 100 MW
- Balancing Settlement = 100 MW * $25 = $2,500 credit
- Balancing Position = $2,500

Net position = -$1,500 + $2,500 = $1,000 credit
Pump Storage Optimizer Input Parameters

- Initial Storage
- Final Storage
- Maximum Storage
- Minimum Storage
- Pump Efficiency

- Economic Minimum (Gen)
- Economic Maximum (Gen)
- Economic Minimum (Pump)
- Economic Maximum (Pump)
- Minimum Run Time
- Maximum Run Time
- Minimum Down Time
• No offers are modeled in objective function for optimized pump storage hydro units
• Optimized Pump Storage hydro units can’t set price
• Typically follow Day-Ahead Schedule in Real-Time
• Charged deviation if deviate from Day Ahead schedule