# Disaggregated Virtual Trading

# Concept Design

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# Agenda

- Key Points
- DVT Market Design
  - *Bidding Locations*
  - *Schedule Limits*
  - *Management of Bid Volume*
  - *Market Monitoring Tariff Changes*
  - *Summary of Design Proposal*
- Next Steps

# Key Points

- Several DVT discussions to-date on possible concept designs
- NYISO's end-state goal:  Allow virtual bidding at all generator nodes in NYCA
- What is best way to achieve goal with existing system limitations?
  - *Tariff obligation for 11 a.m. DAM post*
  - *Strong MP desire for DAM post prior to 10 a.m.*

# Key Points

- How can we maximize benefits while minimizing risks?
- MP feedback continues to be important as we finalize DVT concept design

# Bidding Locations

# Bidding Locations

- Virtual trading (VT) at generator nodes
  - *VT will still be allowed at the zonal level*
- To start: All nodes within NYC opened for VT
  - *Single trading node for each group of units modeled at a single point*
  - *Approximately 40 nodes in NYC*
- End-state: Virtual bidding at all generator nodes in NYCA

# Bidding Locations

- Expansion of virtual bidding locations dependent on system performance
  - *NYISO will evaluate performance as soon as practicable following implementation*
  - *If system performance is acceptable, open up remaining generator nodes in NYCA as part of a scheduled software implementation*
- Alternative option explored:
  - *VT at one node per transmission-limited area*
    - Determined to be undesirable due to modeling risks

# Bidding Locations

- Generator node option chosen
  - *Provides MPs with more bidding locations*
  - *Increased opportunities for arbitrage and liquidity*
  - *Reduced modeling risks*

# Schedule Limits

# Schedule Limits

- Limit sum of schedules at each node to plus/minus 2x the capabilities of generation resource(s) at that location
  - *Modeled through network model, rather than explicit limits placed on virtual bidding*
  - *Incorporate shadow price of constraint into LBMP*
    - Needed to ensure consistency between schedules and prices
    - Consistent with pricing of these constraints in TCC market
  - *For grouped units, scheduling limit on the group node will be plus/minus 2x the sum of the individual generator capabilities*

# Schedule Limits

- Example 1: Gen A node
  - *Gen A op cap = 100 MW*
  - *Gen A schedule +*
    *Virtual supply schedules at Gen A VT node -*
    *Virtual load schedules at Gen A VT node*
    *→ cannot exceed +/- 200 MW*

# Schedule Limits

- Example 2: Grouped units Z node

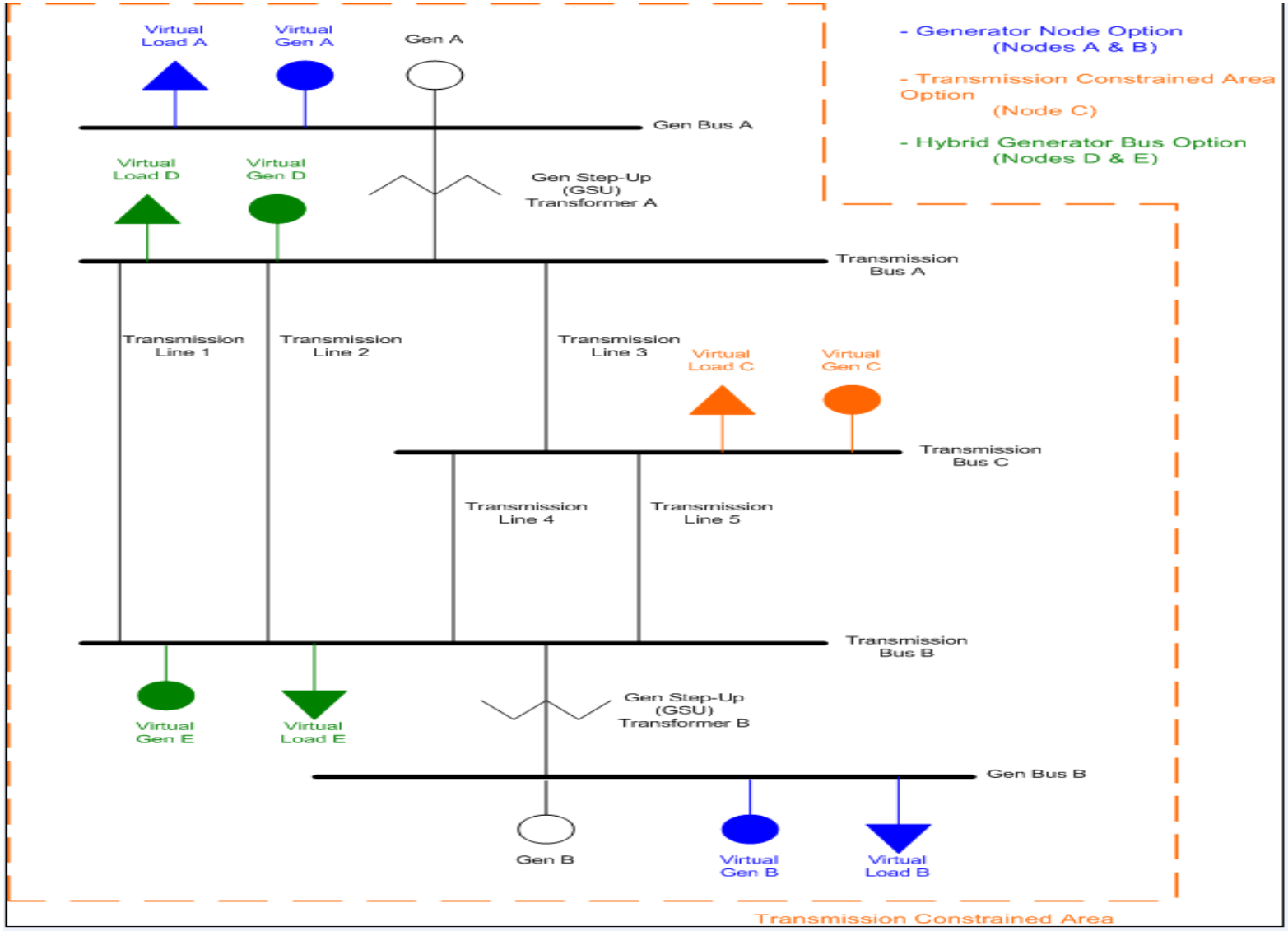
  - *Unit 1 op cap = 20 MW, Unit 2 op cap = 20 MW*
    *Unit 3 op cap = 40 MW, Unit 4 op cap = 40 MW*

  - *Unit 1 schedule + Unit 2 schedule +*
    *Unit 3 schedule + Unit 4 schedule +*
    *Virtual supply schedules at Group Z VT node -*
    *Virtual load schedules at Group Z VT node*
    *→ cannot exceed +/- 2 * (20+20+40+40) =*
    *+/- 240 MW*

# Schedule Limits

- Alternative option explored:
  - *Scheduling at each node based on existing transmission limits*
    - Infeasible with VT at generator node level. Excessive generation at a node may prevent the powerflow solution from converging, and thus, prevent the ability to run a security constrained dispatch.
- Limits based on generator capabilities necessary to ensure powerflow reaches a solution

# Schedule Limits



# Management of Bid Volume

# Management of Bid Volume

1. System Testing Results
2. Soft Bid Volume Cap
3. Virtual Bidding Fees
4. Minimum Bid Size
5. Bid Segments

# 1. System Testing Results

- Ran various test scenarios
  - *Bid volume appears to be the major concern*
  - *For other scenarios, SCUC processing time increased, but performance still acceptable*
- Bid Volume testing
  - *Bid-to-bill testing (Bid submission, MIS market close, SCUC evaluation, RTS evaluation, Billing)*
  - *Each process was monitored and measurements were taken for various bid volumes*
  - *Acceptable performance for each process with exception of SCUC evaluation*

# 1. System Testing Results

- With current hardware:
  - *SCUC could not solve with 4x today's bid volume*
  - *Exceeding 2x today's bid volume would likely put 11 am DAM post in jeopardy*
- With new hardware:
  - *NYISO projected that exceeding 3x today's bid volume would likely put 11 am DAM post in jeopardy*
  - *NYISO testing underway*
- NYISO will work with software vendor to optimize SCUC performance

# 2. Soft Bid Volume Cap

- Invoked at DAM close on an as-needed basis
- Determined by bid volume that NYISO can process and still meet timely DAM post
- When invoked, each MP who submitted virtual bids would be allowed an equal number of bids for that market day
- Similar to PJM model
- Any excess number of bids that NYISO could still process would be allocated to MPs equally, using an iterative process

# 2. Soft Bid Volume Cap

- MPs will have ability to prioritize bids upon submittal
- Aggregation of bids
  - *MPs will submit a start/end time for each bid*
  - *If a bid with identical MW and $ values is submitted across multiple hours, it will count as 1 bid. For example, a bid submitted for start time of 13:00:00 and end time of 15:59:59 will be considered as 1 bid, rather than 3.*
  - *System operates this way today*

# 2. Soft Bid Volume Cap

- Example:
  - 4 MPs submitted a total of 12,500 virtual bids for market day
  - Bid cap of 10,000* bids invoked
  - Each MP is allocated 2,500 bids

**10,000 bid cap is for example purposes only.*

*Actual bid cap TBD.*

# 2. Soft Bid Volume Cap

| | Bids Submitted | Bids Allowed | Difference | Excess Allocated |
|---|---|---|---|---|
| MP1: | 1,000 | 2,500 | -1,500 | |
| MP2: | 3,000 | 2,500 | 500 | +500 |
| MP3: | 6,500 | 2,500 | 4,000 | +1,500 |
| MP4: | 2,000 | 2,500 | -500 | |

- 2,000 total excess bids from MP1 and MP4 are allocated equally to MP2 and MP3 (1,000 each)
- MP2 only needs 500 of the 1,000 excess bids received
- 500 excess bids from MP2 allocated to MP3

# 2. Soft Bid Volume Cap

- Benefits:
  - *Allows NYISO to open up virtual bidding at more nodes*
  - *Ensures SCUC can reach solution*
  - *Ensures timely DAM posting*
  - *Maximizes benefits while minimizing risks*
  - *Eliminates need for hard bid volume cap, i.e. do not allow any additional virtual bids to be submitted after reaching X number.*

# 3. Virtual Bidding Fees

- While soft bid volume cap provides mechanism for ensuring NYISO's ability to post DAM in timely manner, it is preferable to manage bid volume with virtual bidding fees
  - *Bid fees reduce number of "fishing" bids*
  - *Increased efficiency with bid fees vs. invoking bid cap and limiting each MP to equal number of bids*
- NYISO proposes use of virtual bidding fees in conjunction with soft bid volume cap

# 3. Virtual Bidding Fees

- NYISO's previous proposal for bid fees:
  - *In DVT FERC filing, and on NYISO website, state that fee will initially be set at $0.10 per virtual bid submitted*
  - *In Tariff, state that fee for each virtual bid submitted will not exceed $1.00*
  - *If NYISO determines that it is necessary to modify fee, NYISO will post a notice and will report on the reasons at the next BIC meeting. NYISO will also notify FERC and the Market Advisor of the change. If time allows, NYISO will discuss the modification with BIC prior to implementation.*
  - *NYISO will perform periodic reviews of virtual bid fee*
  - *Similar to regulation demand curve provisions in the tariff*

# 3. Virtual Bidding Fees

NYISO's revised proposal:

- Bid fee initially set at $0.10 per virtual bid submitted
  - *$0.10 fee for each bid submitted for a VT node, regardless of number of bid segments*
- Bid fee discount (equal to 50% of bid fee) will be applied to cleared virtual bids
  - *Initial bid fee discount of $0.05 per virtual bid cleared*
- Initial fee stated in DVT FERC filing and on NYISO website

# 3. Virtual Bidding Fees

- Adjust bid fee 30 days after introduction of DVT
- Sliding scale for bid fee based on SCUC performance as represented by bid volumes
  - *As bid volumes increase or decrease relative to bid cap, fee adjusted up or down according to defined methodology (included in Tariff), with minimum fee of $0.03 and maximum fee of $1.00. (For cleared bids, fee less discount will range from $0.015 to $0.50).*

# 3. Virtual Bidding Fees

- Adjust bid fee on monthly basis
- Dynamic fee undesirable, as it leads to uncertainty

# 3. Virtual Bidding Fees

- Methodology for adjusting bid fee:
  - *On a monthly basis, NYISO will compare daily bid volumes for previous month relative to bid cap*
  - *If bid volumes for 10% or more of the days exceed bid cap:*
    - Using days with bid volumes > bid cap, calculate the average percentage by which bid volumes exceed bid cap
    - Increase bid fee by $0.01 for each percentage point of this average, rounded to the nearest penny (to maximum of $1.00 bid fee)

# 3. Virtual Bidding Fees

- Methodology for adjusting bid fee (cont'd):
  - *If bid volumes < bid cap for all days in month:*
    - Remove days with bid volumes which are below average bid volume by more than 2 standard deviations
    - For remaining days, calculate the average percentage by which bid volumes are below bid cap
    - Decrease bid fee by $0.01 for each percentage point of this average, rounded to the nearest penny (to minimum of $0.03 bid fee)

# 3. Virtual Bidding Fees

- Example 1:
  - *Bid cap=10,000**
  - *Bid volume exceeded bid cap for 4 days in month*
  - *Bid volumes for days exceeding cap: 10,250, 10,300, 10,500, 11,000*
  - *Percentage over cap:*
    - (10,250-10,000)/10,000 x 100 = 2.5%
    - (10,300-10,000)/10,000 x 100 = 3.0%
    - (10,500-10,000)/10,000 x 100 = 5.0%
    - (11,000-10,000)/10,000 x 100 = 10.0%
  - *Average percentage over cap = (2.5 + 3.0 + 5.0 + 10.0) / 4 = 5.125%*
  - *Increase bid fee by $0.05 for following month*

**10,000 bid cap is for example purposes only. Actual bid cap TBD.*

# 3. Virtual Bidding Fees

- Example 2:
  - *Bid cap=10,000**
  - *Bid volume did not exceed bid cap for any days in month*
  - *Bid volumes: 9,500 for 10 days, 9,600 for 10 days, 9,800 for 11 days (assume all are within 2 standard deviations of mean)*
  - *Percentage under cap:*
    - (9,500-10,000)/10,000 x 100 = -5.0% for 10 days
    - (9,600-10,000)/10,000 x 100 = -4.0% for 10 days
    - (9,800-10,000)/10,000 x 100 = -2.0% for 11 days
  - *Average percentage under cap = -3.613%*
  - *Decrease bid fee by $0.04 for following month (down to minimum of $0.03)*

**10,000 bid cap is for example purposes only. Actual bid cap TBD.*

# 3. Virtual Bidding Fees

- Comparison with other ISOs
  - *ISO-NE*
    - $0.005/bid submitted
    - $0.06/bid cleared
  - *PJM*
    - ~$0.06/bid submitted
    - ~$0.045/MWh for cleared bids
  - *MISO*
    - No bid fee
    - ~$0.085/MWh for cleared bids

# 3. Virtual Bidding Fees

- ISO-NE, PJM, and MISO also have additional allocations of charges to VT participants
- Charges to VT participants in recent months
  - *ISO-NE*
    - DA: Ranged from $0 to $4.25/MWh
    - RT: Ranged from $0 to $10.91/MWh
  - *PJM:*
    - Ranged from $0.80 to $1.37/MWh, plus adders ranging from trivial to $0.20/MWh

# 3. Virtual Bidding Fees

- Distribution of virtual bid fee revenue
  - *Refund the revenue collected from fee to all Rate Schedule 1 payers*
  - *Revenue collected for given year would be credited against costs collectable under Schedule 1 for following year*

# 4. Minimum Bid Size

- NYISO previously proposed 10 MW minimum bid size to help manage bid volumes
- New proposal:  1 MW minimum bid size
  - *First bid segment must be 1 MW or greater*
  - *Subsequent bid segments can be 0.1 MW or greater*
- Consistent with generator bids

# 5. Bid Segments

- Currently, 3 segments may be submitted for virtual bids and price-capped load bids
- NYISO proposing to increase number of segments to 11 for virtual bids
  - *Would apply to price-capped load bids as well*
  - *Consistent with bid segments allowed for generator bids*
- Benefits:
  - *Less restrictive for MPs*
  - *More price elasticity may allow for better price convergence*

# Market Monitoring Tariff Changes

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- Current Att. H tariff provisions not adequate for proper monitoring and mitigation of DVT

# Market Monitoring Tariff Changes

- Market manipulation concerns:
  - *TCC Market Interactions*
    - Increased potential for bidding strategies that result in a losing virtual trading position while creating an offsetting benefit on a TCC award (or other market positions), that do not result in improved convergence.
  - *Intermittent attempts to exercise market power*
    - Inappropriate virtual bids might be placed only intermittently, and might rotate among hours of day and targeted generator nodes

# Market Monitoring Tariff Changes

- Market manipulation concerns:
  - *Economic withholding of DAM Energy*
    - Application of bidding strategy by generation assets to offset capacity with virtual load positions in transmission-constrained areas, thereby avoiding automated mitigation procedures.
  - *Manipulation of solution differences*
    - Low risk nodal virtual trading positions at locations with potential spreads in prices caused by solution differences, leading to increased uplift costs while not necessarily improving price convergence

# Market Monitoring Tariff Changes

- Currently monitor for “persistent” LBMP deviations in any load zone
- With DVT, monitor DAM and RT LBMPs for recurring deviations at one or more virtual bidding locations that would not be expected in a workably competitive market.
  - *Requires change to Att. H, Section 4.6.2*

# Market Monitoring Tariff Changes

- Additional monitoring criterion required in 4.6.2
  - *Monitor for recurring virtual trading losses not expected in a workably competitive market*

# Market Monitoring Tariff Changes

- NYISO authority to impose penalties on MPs whose virtual bidding privileges have been limited
  - *Penalties based on estimated TCC and generation revenues gained by mitigated MP or its affiliates, as a result of the mitigated virtual bidding behavior*

# Market Monitoring Tariff Changes

- TCC virtual bidding penalty
  - *Penalty = Penalty multiplier * TCC MW * Maximum of*
    - 0
    - (Difference between DAM congestion at POW and POI) – (Difference between RT congestion at POW and POI)
    - (Difference between DAM congestion at POW and POI) – (Purchase cost per MW of TCC contract) / (24 * no. of days in contract)
  - *NYISO proposing to start penalty multiplier at 1.5*

# Market Monitoring Tariff Changes

- TCC virtual bidding penalty distribution:
  - *NYISO proposing to distribute the funds to Transmission Owners for crediting to their TSCs*
    - Mitigated virtual trading causes distortion in TCC market
    - Distribution based on location of virtual bid
      - Allocate clawed-back funds based on load ratio share to the T.O.(s) whose Transmission District(s) are located within the manipulated area.

# Market Monitoring Tariff Changes

- Generation virtual bidding penalty
  - *Penalty = Penalty multiplier * (DAM-scheduled output of the generating unit(s)) * (Excess of the generating unit's nodal Day-Ahead LBMP over its Real-Time LBMP)*
  - *NYISO proposing to start penalty multiplier at 1.5*

# Market Monitoring Tariff Changes

- Generation virtual bidding penalty distribution:
  - *NYISO proposing to distribute the funds to NYISO-wide withdrawals based on load ratio share for the current billing month*
    - Example: Penalties applied to mitigated virtual bidder's invoice for billing month May 2009. Credits applied to NYISO-wide withdrawals based on load ratio share for May 2009.

# Market Monitoring Tariff Changes

- Authority for NYISO to suspend generator nodes from virtual-trading eligible locations

# Summary of Design Proposal

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- Bidding Locations
  - *Virtual trading (VT) at generator nodes*
  - *Single trading node for each group of units modeled at a single point*
  - *Starting with NYC nodes*
  - *Evaluate performance as soon as practicable following implementation. If acceptable, open up remaining nodes in NYCA as part of scheduled deployment.*

# Summary of Design Proposal

- Schedule Limits
  - *Limit sum of schedules at each node to plus/minus 2x the capabilities of generation resource(s) at that location*
  - *Grouped units: scheduling limit on group node will be plus/minus 2x the sum of the individual generator capabilities*

# Summary of Design Proposal

- Soft bid volume cap
  - *Invoked on as-needed basis*
  - *Determined by bid volume that NYISO can process and still meet timely DAM post*
  - *When invoked, each MP who submitted virtual bids would be allowed an equal number of bids for that market day*
  - *Any excess number of bids that NYISO could still process would be allocated to MPs equally, using an iterative process*
  - *MPs will have ability to prioritize bids upon submittal and will include bid start/end times*

# Summary of Design Proposal

- Virtual bidding fees
  - *Initially set at $0.10 per bid submitted*
  - *Bid fee discount (equal to 50% of bid fee) will be applied to cleared virtual bids*
  - *Adjust fee after 30 days (and on monthly basis), using sliding scale for bid fee based on SCUC performance as represented by bid volumes*
  - *As bid volumes increase or decrease relative to bid cap, fee adjusted up or down according to defined methodology (included in Tariff), with minimum fee of $0.03 and maximum fee of $1.00*

# Summary of Design Proposal

- Minimum bid size
  - *First bid segment must be 1 MW or greater*
  - *Subsequent bid segments can be 0.1 MW or greater*
- Virtual bid segments
  - *11 segments for virtual bids (and price-capped loads)*

# Next Steps

- Continue tariff language development in Q3 2009
- Performance testing on new hardware in Q3 2009
- Present concept design at BIC
- Seek Q4 2009 MC approval
- Planned 2010 deployment subject to project prioritization and budget process

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