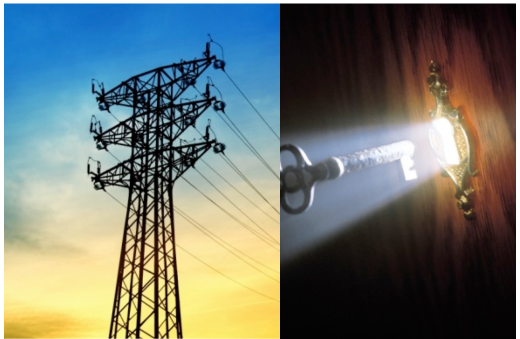


The Case for Convergence Bidding at All Pricing Points

Presented to Joint ISO/MSC Meeting

Offered by Western Power Trading Forum

August 10, 2007

Outline

- Overview: Why *Granular* Convergence Bidding is Superior to LAP Bidding
- Examples of How Granular Convergence Bidding Benefits Load
- Examples of How Granular Convergence Bidding Benefits Supply
- Assessment of Potential Concerns

Why Allow Convergence Bidding at *All* Pricing Points?

WPTF Western Power Trading Forum

- Effective hedges become available to all market participants
  - With LAP-level CB, only bundled customers can cleanly hedge their risk; with granular CB, generators, suppliers, and others can hedge “cleanly” (no issues with correlation between LAP price and component nodal prices)
  - In addition, load can tailor DA purchases more selectively (and thereby protect from paying too much)
  - Intra-LAP (Intra-zonal) congestion prices become tradable; enables a range of tailored products for all participants. Key enabler of full retail nodal access.
- Granular bidding drives comprehensive price convergence, which deters undesirable behavior at individual nodes
  - A robust market limits incentives to withhold supply DA
  - Also curbs incentives to under-schedule non-LAP load
  - More liquidity -> less volatility and more activity -> more efficient price discovery
- Concerns addressed by natural market structure
  - MPs who engage in Convergence Bidding either improve market efficiency or lose money (and exit)

How Is Convergence Bidding Used?

WPTF
Western Power Trading Forum

By Load:

- Financially “move” settlement of a CRR to RT (e.g., if spurious DA congestion would generate losses that would not be reflected in the RT market)
- Purchase less DA power at locations that are overpriced relative to RT (without impacting reliability)
- Directly hedge resources vs. relying on “dirty” LAP-level hedges (of particular benefit to Munis and Participating Load)

By Supply:

- Hedge risk of possible RT de-rating or unit trip
- Hedge DA market supply to receive RT price
- Compete “virtually” for supply at other locations

Outline

- Overview: Why Granular Convergence Bidding is Superior to LAP Bidding
- Examples of How Granular Convergence Bidding Benefits Load
- Examples of How Granular Convergence Bidding Benefits Supply
- Assessment of Potential Concerns

CB Example 1 - Load Tailors Purchases to Reduce Costs at a Sub-LAP

Case: LAP prices are $50 in DA and RT markets, but sub-LAP (or nearby Muni) prices differ and are $50 DA / $45 RT.

LAP-Level CB World	Granular CB World
Sub-LAP / Muni cash flow:	Sub-LAP / Muni cash flow:
Cost of DA Power: -$50	Cost of DA Power: -$50
(Note: Virtual Supply @ LAP	Virtual Supply @ Sub-LAP (DA $): +$50
provides no value)	Virtual Supply @ Sub-LAP (RT $): -$45
Total Cost = $50	**Total Cost = $45**

Implication: Load can reduce its costs in a way that is only possible with granular CB (via sub-LAP virtual supply)

Actual NYISO Example: Because CB is not allowed at the sub-zonal level, DA prices remained above RT at NYPA Astoria when it was testing (and only providing output in RT)

Comparison of NYPA Astoria vs. NYC DA Premium

– September 15 to December 31, 2005 –

	NYC Zone	NYPA Astoria (sub-zone)
DA	$110.81	$112.97
RT	$109.34	$106.96
Premium	$1.47	$6.01

If a sub-zonal virtual energy market had existed in NYISO this extremely large premium at Astoria would have converged right away

CB Example 2 - Load Moves CRR settlement to RT in the face of unanticipated adverse DA congestion, Pays Less at its Sub-LAP

WPTF
Western Power Trading Forum

Case: LAP prices are again $50 in DA and RT markets, but this time Muni / Sub-LAP prices are ***lower*** *DA ($40 DA / $45 RT). The Muni has a CRR sourcing from a nearby generator that it paid $5 for. Generator LMP is $45.*

LAP-Level CB World

Sub-LAP / Muni cash flow:

Cost of DA Power: -$40

"Sunk" CRR Cost: -$5

Value of CRR (SubLap - Gen): -$5

(Note: Virtual Demand @ LAP provides no value)

Total Cost = $50

Granular CB World

Sub-LAP / Muni cash flow:

Cost of DA Power: -$40

"Sunk" CRR Cost: -$5

Value of CRR (SubLap - Gen): -$5

Virtual Demand @ Sub-LAP (DA $): -$40

Virtual Demand @ Sub-LAP (RT $): +$45

Total Cost = $45

Implication: Load can eliminate CRR settlement loss in a way that Is only possible with granular CB (via Sub-LAP virtual demand)

Outline

- Overview: Why *Granular* Convergence Bidding is Superior to LAP Bidding
- Examples of How Granular Convergence Bidding Benefits Load
- Examples of How Granular Convergence Bidding Benefits Supply
- Assessment of Potential Concerns

CB Example 3 - Generator protects against potential de-rate and high RT prices through the use of virtual demand bids

Case: Generator has 200 mw of power to offer, but it fears a forced reduction (e.g. mechanical failure) may knock 100 mw offline in RT. Wants to protect against price increase in RT since he'll have to "buy power back" in RT if unit trips

Day-Ahead

Generator submits a price-taker (low price) schedule for 200 MW

Also submits virtual demand bid to buy for 100 MW at same bus at $20

Assume DA LMP = $15

DA Settlement (Gen) = 200MW * $15 = $3000 credit

DA Settlement (VB) = -100MW *$15 = $1500 charge

Net DA Position = $3000 - $1500 = $1500

Real Time

Assume Generator can only produce 100 MW

Assume RT LMP = $20

RT Gen Position = -100 MW

RT VB Position = 100 MW

RT Settlement (Gen) = - 100MW* $20 = $2000 Charge

RT Settlement (VB) = 100MW *$20 = $2000 Credit

Net RT Position = $0

Net Position = $1500 Credit

Without VB would have been net $1000 credit

Essentially hedged downside of derate

CB Example 4 – Generator hedges DAM “self schedule” to receive RT Price

Case: Generator submits a self schedule of 200 MW in DA but wants the RT Price, anticipated to be higher

Day-Ahead

Generator submits a self schedule for 200 MW

Also submits virtual demand bid to buy for 200 MW at same bus at high price

Assume DA LMP = $30

DA Settlement (Gen) = 200MW * $30 = $6000 credit

DA Settlement (VB) = -200MW *$30 = $6000 charge

Net DA Position = $6000 - $6000 = $0

Real Time

Assume Generator produces 200 MW

Assume RT LMP = $35

RT Gen Position = 0 MW

RT VB Position = 200 MW

RT Settlement (Gen) = 0MW* $35 = $0

RT Settlement (VB) = 200MW *$35 = $7000 credit

Net RT Position = $7000 Credit

Net Position = $0 + $7000 Credit

Settles the DA Generation at RT Prices but fully scheduled in DA

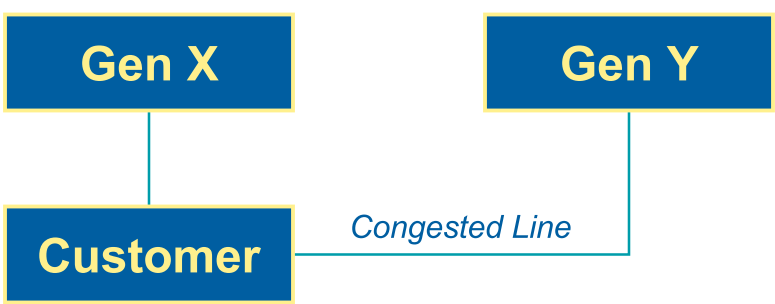
CB Example 5 – A supply entity (or any entity) competes to supply power at a competitor's generator location

WPTF Western Power Trading Forum

Case: Supplier realizes that "fair price" (and likely RT price) for power at location X is $50; submits a virtual offer at $52 in case prices rise above that in DA

Scenario I – Generator X Not Part of DA Market

- **Gen X does not get dispatched in DA**
  - Does not bid or bids above clearing price
- **Gen Y dispatched DA over congested line**
- **Day Ahead price = $60/MWh**
- **Gen X gets dispatched in Real Time**
  - Operator judgment (uplift) or self-schedule
- **Real time price = $50/MWh**
- **Customer Load = 100 MW (all DA)**
- **Customer Cost = $6,000**



Scenario II – Virtual Energy Replaces Generator X

- **Gen X does not get dispatched in DA**
  - Does not bid or bids above clearing price
- **Virtual Supply accepted in DA market @$52; more convergence**
- **Day Ahead price = $52/MWh**
- **Gen X gets dispatched in Real Time**
  - Operator judgment (uplift) or self-schedule
- **Real time price = $50/MWh**
- **Customer Load = 100 MW (all DA)**
- **Customer Cost = $5,200**
- **Customer hourly savings = $800 or 13%**

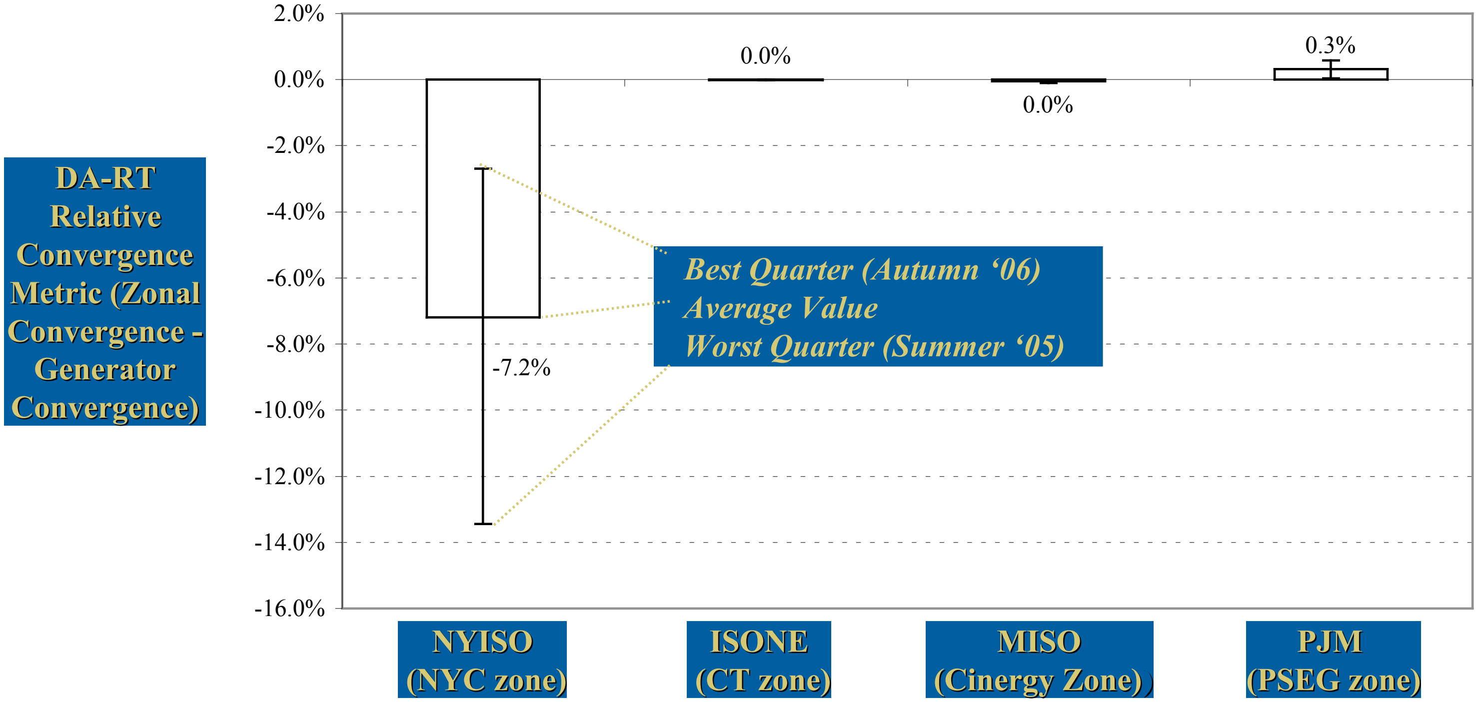
Implication: Convergence Bidding can expand profitable opportunities for supply while reducing cost for Participating Load

Actual NYISO Example: Allowing virtual bidding at a granular level has a major impact on price convergence -- as evidenced by comparing NYISO to other ISOs

WPTF
Western Power Trading Forum

Difference Between Zonal and Nodal Price Convergence Among ISOs[1]

– 7 Quarters, 6/1/05 to 2/28/07 –



Price convergence at nodal level has been much worse in NYISO than other ISOs in each of the last several quarters, likely because CB is only allowed at the zonal level in NYISO virtual energy market

[1] Convergence metric is the average absolute hourly DA-RT LMP difference, computed over 90-day intervals, normalized by DA prices. In each case, the convergence metric for a zone is compared with the average convergence metric for the generators in that zone.

Why is LAP-Only Convergence Bidding Inadequate?

WPTF
Western Power Trading Forum

- LAP-Only CB only considers DA and RT LAP prices -- whereas benefits in prior examples can only be realized if CB is available at many pricing points

- A wide range of physical participants will be denied these benefits if we implement LAP-level CB
  - LSEs – especially ESPs without other options for managing delivery and energy price DA/RT risks
  - Municipal entities with resources at different prices (outside MSS, away from LAP LMP price)
  - Participating loads settled at other than the LAP price
  - Generators, especially those with small portfolios

- The market will not be as healthy and robust as it could be
  - Reduced competition at generator nodes
  - Less DA/RT convergence; poorer dispatch and liquidity
  - Risks will be greater and consumers will likely pay more
  - Won't be laying the groundwork for strong nodal retail markets

Outline

- Overview: Why *Granular* Convergence Bidding is Superior to LAP Bidding
- Examples of How Granular Convergence Bidding Benefits Load
- Examples of How Granular Convergence Bidding Benefits Supply
- Assessment of Potential Concerns

Dispelling Some Myths About Convergence Bidding

WPTF
Western Power Trading Forum

- Participants Can Earn “Windfall” Profits (e.g., by manipulating the market)
  - Self-balancing nature precludes windfall profits from CB alone (any excess profits will be competed away)
  - Proven safeguards are available for CRR “game” (not just rules, but competition itself)
  - Experience in Eastern markets (4 markets; 19 collective years) indicates it’s not a problem
- Potentially Harms Buyers in Seller’s Choice Contracts
  - Not possible from CB alone unless contract is linked to DA price
  - Requires parallel CRR or other market position
- Causes Adverse Reliability Impacts by Creating “Infeasible” Schedules
  - Physical system attributes (Pmax, transmission flows) unaffected by CB
  - No adverse reliability impacts known or demonstrated elsewhere; Eastern markets claim CB sometimes necessary to help *solve* potentially infeasible solutions
  - Adverse *financial* impacts will fall on parties that use CB in ways that harm the market

Dispelling Some Myths About Convergence Bidding(cont)

WPTF Western Power Trading Forum

- Requires Undesirable ISO Software System Changes
  - If likely end state is granular CB, it will require less overall time / cost to design it once up front vs. a piecemeal approach
  - Besides the CRR rule (straightforward to implement), no other market design modifications are required
  - ISO systems unlikely to be overwhelmed. Collateral requirements and bid fees will act as natural limiters for bid volume (as they do in the Eastern markets)

- May Raise Costs for Buyers
  - Commitment still based on ISO load forecast rather than energy market bids
  - Price expectations will be based on physical (RT) delivery requirements
  - Those who attempt to “corner the market” will lose money doing so
  - Greater competition, more tools at load’s disposal should *lower* costs to consumers

If a financial participant tries to game the market by moving DA prices away from their natural equilibrium it will lose money

WPTF Western Power Trading Forum

Case: A financial participant wants to artificially raise prices at a node through a virtual bid

Day-Ahead

Assume DA LMP without bid is = $14

SC submits bid to buy for 100 MW at bus at $20

Assume DA LMP with bid = $15

DA Settlement (VB) = -100MW *$15 = $1500 charge

Net DA Position = - $1500

Real Time

Assume RT LMP without bid is = $14

Then, all else equal, RT LMP is still $14

RT Settlement (VB) = 100MW* $14 = $1400 Payment

Net RT Position = $1400

Net Position = $100 Charge

A participant cannot “win” in CB market by artificially moving prices

It's only possible to profit from moving prices away from RT if the participant has a larger position outside of the market.

WPTF
Western Power Trading Forum

Case: Assume same scenario but with a large CRR between some point and virtual point that benefits when virtual bid moves the DA market

Day-Ahead

Assume DA LMP without bid is = $14

SC submits bid to buy for 100 MW at bus at $20

Assume 500MW CRRs from a $10 node to this node

Assume DA LMP with bid = $15

DA Settlement (VB) = -100MW *$15 = $1500 charge

CRR settlement = 500MW * ($15-$10) = $2500 payment

Real Time

Assume RT LMP without bid is = $14

Then, all else equal, RT LMP is still $14

RT Settlement (VB) = 100MW* $14 = $1400 Payment

Net Energy Position = $100 Charge
Net CRR position = $2500 Payment
Overall net with virtual = $2400 Payment

Without VB CRR would have yielded $2000