California ISO Presentation
Convergence Bidding
- New England Experience

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Terminology

• This presentation/presenter may occasionally use the ISO New England (and PJM) terminology for Convergence Bidding:
  – Virtual Bid/Offers
    • INC – Virtual Offer or Virtual Supply
    • DEC – Virtual Bid or Virtual Demand
Integrated Forward Market

• What is IFM? Is it a:
  – Financial Market?
  – Physical Market?
  – Physical Market with Financial Impacts?
  – Financial Market with Physical Constraints modeled?

• What is the objective function of the IFM?
  – Maximize Social Welfare

• Do those buying from IFM care if they are buying from “virtual” or “real” resources? How about sellers?
  – In ISO New England Participants in DA have learned to not care
  – Virtual bidding important part of the DA market self-correcting process
Residual Unit Commitment

- Do you consider it part of the IFM?
- Do you consider it the start of the Real-Time Market?
- What is the Objective of the RUC? If I am a “physical” load/generator and cleared in IFM do I care about the RUC?
Convergence Bidding

• Supply Clearing - Impact IFM?
  – May displace a resource during commitment
    • Tends to lower Uplift
  – During scheduling, becomes very flexible “resource”
    • Can be scheduled anywhere between 0 and quantity offered
    • Will tend to lower the LMP since they displace higher priced resources
  – Goal of those offering supply is to “capture” the DA LMP – RT LMP price
Convergence Bidding

• Supply Clearing Impact - Real-Time Market?
  – Need to replace during RUC Convergence supply with Physical Supply (if necessary)
  – May need to pay those RUC committed resources uplift
  – Intermittent Resource not required to submit to DA in ISO New England
    • Many do not offer in the DA Market
    • These resources only clear in RT
    • Convergence/Virtual Bids make up for this supply
    • ISO New England typically have to commit very few resources during our process similar to RUC (1-2 at most)
Convergence Bidding

• Demand Clearing - Impact IFM?
  • May require adding a resource during IFM commitment
    – May raise overall IFM Uplift
  • During scheduling, becomes flexible “demand”
    – Can be scheduled anywhere between 0 and quantity bid
    – Will tend to raise the LMP since when cleared they move the system higher up the demand curve
  • Goal of those offering demand is to “capture” the RT LMP – DA LMP price
  • May create infeasible physical generator schedules during RT
    • Excess Generation – system-wide or locational
    • Causes the RT price to go low (or negative if negative bidding is allowed for generation)
    • Will not persist since high DA vs. low RT is losing bid
Convergence Bidding

- Demand Clearing Impact - Real-Time Market?
  - Unless additional “physical” demand occurs in RT market then DA Market demand will be greater than RT demand
  - RUC process will need to commit less (or no) additional generation if Convergence Demand bids clear in excess of Convergence Supply bids
  - The lack of this “virtual” demand in RT never creates RT uplift.
Experience in New England with Convergence Bidding (Virtual Bid/Offer)

• Initial Experience (2003)
  – Steep Learning Curve
    • Bilateral transaction delivers did not specify location, therefore most existing transactions delivered at “Seller’s Choice” of location, thousands of MW attempting to deliver to lowest price location
  – Other Mistakes
  – Physical Demand Bidding
Experience in New England with Convergence Bidding (Virtual Bid/Offer)

• On-Going Experience
  – Data shows many Virtual Supply Offers are submitted in each hour
    • Some weeks as much as 7000 per Hour (with a system load of 16,000-20,000) of Supply Offers submitted
    • Clearing average amount of 2500 per Hour
    • More on-peak than off-peak
  – Most days virtual bids/offers are marginal in many hours of DA
  – Most of these virtual’s that are marginal are clearing at a nodal location (about 60-70% of the submitted and cleared virtuals are at a nodal level)
  – The profit achieved by these transactions is generally under $100k a day (in a $25M per day market).
Experience in New England with Convergence Bidding (Virtual Bid/Offer)

Cleared Fixed and Price Sensitive Demand, Virtual Demand, and Virtual Supply Day-Ahead Market, April 7-13, 2008
Experience in New England with Convergence Bidding (Virtual Bid/Offer)

Average Hourly Bid In and Cleared Demand, Virtual Demand, and Virtual Supply
Day-Ahead Market, April 7-13, 2008
Experience in New England with Convergence Bidding (Virtual Bid/Offer)

Four years ago

Cleared Fixed and Price Sensitive Demand, Virtual Demand, and Virtual Supply
April 11 - April 17, 2004

Date

- FIXED
- PRICE SENSITIVE
- VIRTUAL DEMAND
- VIRTUAL SUPPLY
Experience in New England with Convergence Bidding (Virtual Bid/Offer)

Two years ago
Experience in New England with Convergence Bidding (Virtual Bid/Offer)

Average Hourly Bid In and Cleared Demand, Virtual Demand, and Virtual Supply
Day Ahead Market, April 11 - April 17, 2004
ISO Transaction Charges Assigned to Virtual Bids/Offer

• Initially in the market no charges were assigned to Virtual Bids/Offer to process them
  – Participants did attempt some minor “price discovery” that did start to impact performance (50,000 virtuals for a day)
  – No block limit in ISO New England

• ISO proposed and implemented per transaction charges in 2004 ($0.005 per submitted, $0.06 per cleared)
  – Comments were that virtual bids/offers would be limited due to these charges
  – Data shows opposite

• Tariff charge serves as a “natural” block limit, but does not prevent Virtuals from being submitted.
Why do Participants submit Convergence Bids in DA?

• Arbitrage DA/RT LMP
• Move financial positions from DA to RT (net out DA positions), or from RT to DA
• Arbitrage DA Congestion Price Differences versus RT Congestion Price Differences
• (In New England a some of the Virtual Supply is submitted by Generators as a substitute for the lack of hourly offer curves)
Impacts of Convergence/Virtual Transactions

• “What’s in it for me?” Why do I want these “purely financial” transactions if I am a…
  – Generator?
  – Load (Unhedged)?
  – Load (Hedged)?
  – Financial Trader?
  – FTR Holder?
Impacts of Virtual Transactions (Generators)

• What’s the impact on Generators?
  – Positive
    • DEC bids create an effectively higher price for the Generator to sell for in the IFM/DA Market.
    • DEC bids mitigate any “market power” that load has in the IFM/DA to not bid to purchase or to purchase at a low price only.
  – Negative
    • INC offers create an effectively lower price for the Generator to sell for in the IFM/DA Market.
    • INC offers mitigate any “market power” that the generator has in the IFM/DA and also any “lumpiness” of dispatch caused by high generator Economic Minimums (which create uplift).
Impacts of Virtual Transactions
(Unhedged Load)

• What’s the impact on Load that is unhedged by Bilaterals?
  – Positive
    • INC offers create an effectively lower price for the Load to purchase at in the DA Market.
    • INC offers mitigate any “market power” that the Generators have in the DA and also any “lumpiness” of dispatch caused by high generator Economic Minimums (which creates uplift).
  – Negative
    • DEC bids create an effectively higher price for the load to purchase at in the DA Market.
    • DEC bids mitigate any “market power” that load has in the DA to not bid to purchase or to bid to purchase at a very low price.
Impacts of Virtual Transactions (Hedged Load)

• What’s the impact on Load that is hedged by Bilaterals?
  – Positive
    • INC offers create an effectively lower price in the DA Market.
  – Negative
    • DEC bids create an effectively higher price in the DA Market.

• Bilateral Transaction prices have linkage to historical RT prices, but an efficient DA Market allows sellers of these transactions an alternative place to cover their positions.
Impacts of Virtual Transactions
(Financial Trader)

• What’s the impact on a Financial Trader?
  – Positive
    • INC/DEC create an opportunity to arbitrage price differences between the DA Market price and the RT Market price
  – Negative
    • Risks, such as uplift and emergency outages, can alter the ability to effectively arbitrage price differences.
Impacts of Virtual Transactions (FTR/CRR Holders)

• What’s the impact on CRR Holders?
  – Positive
    • INC/DEC moves the IFM/DA market towards an efficient price differential from the RT Market.
      – Should allow IFM/DA Market congestion to converge with expected RT congestion
  – Negative
    • May reduce or eliminate IFM/DA congestion by creating load/generation where none exists (when convergence goes badly)
Impacts of Virtual Transactions
(All Market Participants)

• INC/DECs have impacts on the Market that all Participants can appreciate.
  – Help stabilize prices in the IFM/DA Market to more efficiently align with RT Market prices.
  – Correct for price spikes from the previous day
Uplift and Convergence Bids

• DA Uplift
  – What is the difference between Virtual Demand and “Real Demand” in DA Financial Market?
    • DA New England both types of Demand pays DA “Economic” Uplift
    • DA uplift tends to be very small
      – 2007 Average $0.03 per MWh of Demand
        (high month $0.11/low month $0.01)
Uplift and Convergence Bids

• RT Uplift
  • RT New England RT deviations pay “Economic” Uplift
    – Demand deviations are netting across system, generator deviations are not netted but are not counted if resource is following dispatch orders from the ISO.
  • RT uplift tends to be higher and more volatile
    – 2007 Average $0.54 per MWh of Deviation
      (high month $1.98/low month $0.19)
Who should pay Uplift?

• DA Uplift
  – Demand of any kind, all Demand is met by generation (both “virtual and real”) in DA
  – Netting SS against Demand (as CAISO is doing) to create exemptions is a good choice in areas where generation and demand are “integrated” only IF it can be shown that if the SS and Demand were removed the remaining set of Committed resources would not change.
  – Convergence Supply tends to suppress DA uplift since offers without startup and no-load will creates a higher social welfare typically and Convergence never gets uplift.
Who should pay uplift?

- **RT Uplift**
  - Generally any Participant in the market that was part of the “cause” for needing to commit additional resources in the RUC process
  - Demand that did not clear DA
  - Generators that cleared DA but “failed” to deliver in RT
  - Convergence Supply that cleared DA but “failed” to deliver in RT (needs to be replaced by a generator)
  - What if you SS into RT from a resource not in the DA market?
    - You can you cause or worsen RT uplift depending on when SS is communicated (prior to RUC or after RUC)
Other Topics to Consider

- Relationship to CRRs and Rules to prevent CRR manipulation with Convergence Bids
  - “Sometimes bad things happen to good people”
    - Participants who submit Convergence Bids and have CRRs may inadvertently impact CRRs
  - There are some valid strategies for using Convergence Bids with CRRs to move CRR settlement to RT
    - Should these strategies be discouraged?
  - Determining if the Convergence Bid clearing create CRR revenue is not as simple as it sounds
    - Perfect analysis would require a “what if DA” without each Convergence Bid
Financial Assurance

- Convergence Bids positions are closed out quickly but must be assessed for exposure risk in many states:
  - Prior to DA clearing (largest unknown exposure)
  - Once Cleared in DA, prior to DA (known DA price)
  - After RT Cleared prior to Billing (known profit/loss)
ISO New England - Lessons Learned

• Training is very important!
• Learning curve is steep in the beginning, lack of data makes it difficult for market to predict RT prices during differing conditions
• Convergence Bidders will learn and improve, market will solve issues whenever and wherever price spikes in the IFM. Convergence Bidders will treat IFM as a Financial Market, everyone else should too!
Other information


• Weekly Data shown early in this presentation is publically available at:
  • http://www.iso-ne.com/markets/mkt_anlys_rpts/wkly_mktops_rpts/index.html