Local Market Power Mitigation Options Under Convergence Bidding

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I. Background

The introduction of convergence bidding – particularly at a nodal level – creates the potential to undermine the Local Market Power Mitigation (LMPM) provisions applied prior to the ISO's Integrated Forward Market (IFM). Specific examples of how convergence bidding may undermine these LMPM provisions were provided in a November 2007 whitepaper issued by the Department of Market Monitoring (DMM),[1] and have been discussed at two meetings with the Market Surveillance Committee (MSC) and stakeholders.[2]

The ISO's initial proposals for convergence bidding incorporated an approach in which the Competitive Constraint (CC) and All Constraint (AC) runs of the ISO's LMPM procedures would be run using all supply and demand bids – both physical and virtual. As illustrated in DMM's prior whitepaper and presentations, this approach would need to rely on a sufficient supply of competitively priced virtual supply bids within constrained areas to ensure local market power mitigation was not undermined by relatively high priced virtual demand or virtual supply bids within these constrained areas.[3] An additional concern that has been raised regarding this approach is that it may place significant or excessive reliance on the Residual Unit Commitment (RUC) process due to the displacement of physical supply with greater volumes of virtual supply in the IFM.[4]

After further consideration of this issue, several alternative options that may provide greater assurance of effective local market power mitigation and overall market efficiency in the IFM under nodal convergence bidding have been identified by the ISO, MSC and stakeholders. The following section describes these options and provides a discussion of the pros and cons of various approaches.

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[1] *Convergence Bidding: DMM Recommendations, Attachment A: Examples of Convergence Bidding and Local Market Power Mitigation*, November 2007.

[2] *DMM Comments and Recommendations on Convergence Bidding Design Options*, presentation to MSC/Stakeholders, August 10, 2007.

Local Market Power Mitigation Under Convergence Bidding, presentation to MSC/Stakeholders, September 18, 2009.

[3] See Example 1 and Example 2 in *Convergence Bidding: DMM Recommendations, Attachment A: Examples of Convergence Bidding and Local Market Power Mitigation*, November 2007.

[4] A concern about excessive reliance on RUC is that this may reduce market efficiency and raise overall cost (including uplifts and prices), since the RUC optimization commits units only on start-up and minimum load bids, and does not consider the units' energy bids. Thus, the units committed in RUC may represent a less efficient, higher cost mix of resources available to meet energy demand in the real-time market. Even if prices "converge" in the IFM and real-time market, prices may be at a higher overall level as a result of this less efficient unit commitment and dispatch in the real-time market.

II. Alternative LMPM Options

Table 1 provides a summary of the additional options discussed in this paper, in terms of the supply and demand bids (or load forecast) that would be used in the Competitive Constraint (CC) and All Constraint (AC) runs of the pre-IFM LMPM procedures under each approach.

Table 1. Alternative LMPM Options

	Current LMPM (Load Forecast and Physical supply)		**SCE Approach (Exclude Virtual Supply)**		**New Option A (Exclude Virtual Supply/CC Based on Forecast Demand)**		**New Option B (Perform AC Run with Mitigated Bids)**	
	Demand	**Supply**	**Demand**	**Supply**	**Demand**	**Supply**	**Demand**	**Supply**
CC Run	Forecast Demand	Physical Supply	Physical + Virtual Demand Bids	Physical Supply	Forecast Demand	Physical Supply	Physical + Virtual Demand Bids	Physical + Virtual Supply Bids
AC Run	Forecast Demand	Physical Supply	Physical + Virtual Demand Bids	Physical Supply	Physical + Virtual Demand Bids	Physical Supply	Physical + Virtual Demand Bids	Physical Supply (mitigated) + Virtual Supply Bids

Current LMPM:
Load Forecast and Physical Supply

Under this approach, pre-IFM LMPM runs would continue to be based on forecasted load and physical supply only. In the IFM, however, additional virtual supply and demand bids would be included in the actual market clearing process. The rationale for this approach is that virtual supply is not subject to bid mitigation, and can undermine LMPM by "crowding out" physical supply that has a lower actual cost but is bid at a higher price in the pre-IFM LMPM runs.[5]

Pros

- This approach clearly mitigates the key problem that could exist if virtual supply bids are included in the pre-IFM mitigation procedures. Specifically, since virtual supply is not included in the LMPM runs, relatively high priced virtual supply (which cannot be mitigated) cannot "crowd out" physical supply that has a higher market bid price, but a lower Default Energy Bid (DEB) in the AC run of the LMPM procedures.
- This approach would also ensure that the amount of physical supply subjected to mitigation is sufficient to at least meet forecasted load. Thus, if total bid-in demand clearing the IFM exceeds the forecast due to inclusion of virtual demand, a relatively limited amount of

[5] See Example 2 in *Convergence Bidding: DMM Recommendations, Attachment A: Examples of Convergence Bidding and Local Market Power Mitigation*, November 2007, pp.9-12.

competitively priced virtual supply may be needed to prevent uncompetitively high unmitigated physical or virtual supply bids from setting locational marginal prices (LMPs) in the IFM within constrained areas.

- By ensuring that the amount of physical supply subjected to mitigation is sufficient to meet forecasted load, this approach may also provide a certain level of predictability and certainty to the IFM that might facilitate the ability of load-serving entities (LSEs) and other participants to place virtual supply bids that efficiently and effectively mitigate potential price spikes due to additional virtual demand at nodes within constrained areas.
- Since this approach would also tend to reduce the extent to which physical supply is "crowded out" by virtual supply in the IFM, this approach would help avoid excessive reliance on commitment of resources through the RUC process (and the potential inefficiencies resulting from increased reliance on RUC).

Cons

- This approach would still rely to some extent on a sufficient supply of competitively priced virtual supply bids within constrained areas to ensure local market power mitigation was not undermined by relatively high priced virtual demand or virtual supply bids within these constrained areas.[6]
- Since this approach uses forecast demand (rather than bid-in load), this approach may be inconsistent with a prior directive from the Federal Energy Regulatory Commission (FERC) for the ISO to use bid-in demand in the pre-IFM LMPM process within three years of the Market Redesign and Technology Upgrade (MRTU) implementation.

Southern California Edison (SCE) Approach:
Exclude Virtual Supply

This approach, suggested by Southern California Edison (SCE), would include virtual demand in the pre-IFM LMPM procedures (along with bid-in demand), but would exclude virtual supply from these pre-IFM procedures. As with the previous option, the rationale for excluding virtual supply under this approach is to ensure that uncompetitively high virtual supply bids that are not subject to mitigation do not "crowd out" physical supply that has a lower actual cost (and DEB), but is bid at a higher price in the pre-IFM LMPM runs. However, this approach would include total bid-in demand (physical and virtual) in order to ensure that the amount of supply subject to mitigation was sufficient to meet the actual bid-in demand in the IFM (physical plus virtual).

[6] See Example 1 and Example 2 in *Convergence Bidding: DMM Recommendations, Attachment A: Examples of Convergence Bidding and Local Market Power Mitigation*, November 2007.

Pros

- Since this approach includes both physical and virtual demand in the pre-IFM process, this approach could avoid the way in which relatively high priced virtual demand and supply bids undermine LMPM under some conditions.[7]

Cons

- A major concern with this approach is that at relatively high load levels, most of the available physical supply may be dispatched in the CC run in order to meet total demand bids (physical plus virtual). For example, assuming virtual demand clearing the pre-IFM CC run equaled 20 percent of system load, total demand clearing the pre-IFM CC run could equal 120 percent of actual load. Thus, under high load conditions, the amount of total demand being cleared in the pre-IFM CC run could require that virtually all available physical supply be dispatched in this CC run. This could undermine LMPM in two ways.
    - First, units dispatched at full output in the CC run could not be dispatched up in the AC run, and would therefore not be subject to bid mitigation prior to the IFM.
    - Second, for units that were dispatched up in the AC run, the highest (unmitigated) bid from these units that was dispatched in the CC run may be relatively high. Under the ISO's bid mitigation procedures, the unit's highest (unmitigated) bid dispatched in the CC run is used as a "floor" below which the unit's final IFM bids are not mitigated.[8] Because the CC run would clear both physical and virtual demand against physical supply only, the highest unmitigated bids accepted in the CC run used as the "floor" in mitigation would tend to exceed the price of bids that that would clear in a competitive market.
- Suppliers have objected to this approach on the grounds that it is based on "asymmetrical" treatment of virtual demand and virtual supply, in that the pre-IFM LMPM runs would include virtual demand but not virtual supply.

New Approach A:
Exclude Virtual Supply/CC Based on Forecast Demand

This approach would address the first concern with the SCE approach described above by clearing only the load forecast against physical supply in the CC run (i.e., rather than clearing physical and virtual demand bids against physical supply). This would avoid situations where at relatively high load levels, most of the available physical supply would be dispatched in the CC run in order to meet total demand bid, thereby reducing or eliminating the degree of bid mitigation applied to physical resources that are dispatched up in the AC run. As shown in Table 1, the CC run under this approach would be performed in the same manner as under current LMPM procedures, with physical supply being cleared against the load forecast. However, with

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[7] Example 2 in *Convergence Bidding: DMM Recommendations, Attachment A: Examples of Convergence Bidding and Local Market Power Mitigation*, November 2007, pp.9-12.

[8] Specifically, under the pre-IFM LMPM process, final mitigated bids for units dispatched up in the AC run passed on to the IFM are calculated by taking the maximum of (a) the unit's highest accepted market bid in the CC run, or (b) the price of the unit's DEB for that segment of its output.

this approach, in the AC run physical supply would be cleared against total bid-in demand (physical plus virtual).

Pros

- By clearing only the load forecast against physical supply in the CC run, the CC run would establish a competitive baseline that accurately reflects physical supply and demand conditions on a system level. This would ensure that the level at which units are dispatched in the CC run and the highest bid accepted for each unit in the CC run reflect a competitive baseline given actual physical supply and demand conditions on a system level. Forecast demand is used (rather than bid-in physical demand), to ensure that LSEs may not seek to increase mitigation and depress prices by "under-bidding" their physical load.
- By clearing all bid-in demand (physical plus virtual) against physical supply only in the AC run, this approach would ensure that sufficient physical supply will be subject to mitigation to meet total bid-in demand in the IFM.

Cons

- A major drawback of this approach is that units may be dispatched at a higher level in the AC run and thereby be subject to bid mitigation due to a combination of non-competitive constraints and the additional virtual demand included in the AC run. This creates the situation where some lower cost units outside of non-competitive constrained areas could be dispatched up and subject to bid mitigation due to additional virtual demand included in the AC run, rather than the addition of uncompetitive constraints.[9]
- Since this approach excludes virtual supply from the AC run but includes virtual demand, suppliers would likely object to this approach as involving "asymmetrical" treatment of virtual demand and virtual supply.

New Approach B:
Perform AC Run with Mitigated Bids and Protect CC Run Schedules

Under this approach, all physical and virtual demand and supply bids would be included in both the CC and AC runs. However, in order to prevent higher priced virtual supply from "crowding out" physical supply that has a lower cost (but higher unmitigated market bid), this approach would consider mitigated bids from physical supply in clearing the AC run. Additional details of this approach are provided below:

1. The CC run would be performed with all physical and virtual bids (supply and demand).
2. Bids for physical resources would be replaced with the appropriate mitigated bid prior to the AC run. Specifically:
    a) Market bids for energy above the level at which units were scheduled in the CC run would be subjected to mitigation in the same manner currently used to mitigate bids

[9] However, it should be noted that such units are only mitigated to a bid that is above their marginal cost, and that their highest cleared bid in the CC run establishes a floor below which the rest of their bid curve is not mitigated (even if their default energy bid (DEB) is lower). Thus, this approach would not depress prices below competitive levels. In the IFM, virtual supply is free to compete with physical supply, so that if lower cost virtual supply is available it will be dispatched instead of any mitigated physical supply.

after the AC run. Specifically, the unit's highest accepted bid price in the CC run would be applied as a "floor" to the unit's DEB, so that the remaining segments of the unit's bid curve would be equal to the higher of (i) the unit's highest accepted bid in the CC run or (ii) it's DEB.

b) For units dispatched in the CC run, the unit's CC run schedule would be protected by negatively priced bid. This would prevent CC schedules of these resources from being reduced and replaced with lower cost energy from other units' mitigated bids in the AC run, unless these lower cost mitigated bids are actually needed to meet uncompetitive constraints added in the AC run. In other words, this ensures that units with mitigated bids are only dispatched up in the AC run if they are needed due to uncompetitive constraints.

3. The AC run would then be performed with all physical and virtual bids (supply and demand).
4. Physical units dispatched up in the AC run to meet uncompetitive constraints would be subject to mitigation in IFM (i.e., the mitigated bids described in Step 2b would be used in the IFM).
5. Physical units that were not dispatched up in the AC run to relieve congestion on uncompetitive constraints would not be subject to mitigation in the IFM (i.e., the unit's initial unmitigated market bid would be used, rather than mitigated bids described in Step 2b).
6. For consistency, an analogous approach would be employed in the LMPM procedures performed during the hour-ahead scheduling process (HASP) for the real-time market. However, in the real-time market, physical supply would be cleared against forecasted demand, since virtual bids are liquidated in real-time and physical demand does not submit bids in real-time.

Pros

- This approach would appear to effectively eliminate the concern that virtual supply and virtual demand bids may undermine LMPM.
- This approach allows mitigation to be targeted in local areas, without being triggered for broader system level demand.
- Compared to other proposals, this approach is more likely to increase overall market efficiency by resulting in the least cost units (in terms of DEBs) being dispatched in IFM for local supply purposes, and setting prices within non-competitive constrained areas.
- This approach is consistent with the FERC directive to use bid-in demand in LMPM.
- Symmetric treatment of supply and demand would be preserved.

Cons

- This approach represents a more significant modification of LMPM procedures than other approaches, particularly when compared to the option of continuing to clear the load forecast against physical supply only.

- This approach may be opposed by suppliers as increasing mitigation relative to current LMPM approaches. However, we believe that, in practice, it would not increase the amount of generation actually mitigated except to the extent that virtual demand caused overall demand within uncompetitive constrained areas to exceed forecasted demand. This is because in the AC run, only the minimal amount of additional generation necessary to relieve uncompetitive constraints would be dispatched. Once this minimum level of additional generation was dispatched in the AC run, the negative prices placed on each resource's schedule from the CC run would prevent any further additional dispatch beyond the minimum amount necessary to avoid a violation of the non-competitive constraints added in the AC run.

- A theoretical scenario under this approach is that if significant amounts of relatively high priced virtual demand caused total demand clearing in the CC run to exceed the supply of competitively priced physical and virtual supply bids, LMPM could be undermined by the relatively high dispatch levels and bid "floors" established in the CC run (see discussion under ***SCE Approach: Exclude Virtual Supply***). However, since virtual supply bids would be included in the CC run under this approach, we expect the market to remain sufficiently competitive on this broader level in the CC run to prevent this scenario. In addition, it would be much easier for LSEs to "defend" against this scenario through price sensitive LAP demand bids and virtual supply bids. For example, in the CC run, virtual supply at almost any point in the system (including LAPs and Gen Hubs) could be dispatched in the CC run to meet additional virtual demand even at nodes in local constrained areas.

III. Conclusions

Based on further consideration of a range of LMPM options under convergence bidding, we believe there are at least two effective options for addressing concerns about how virtual bidding may undermine LMPM procedures:

- We believe that continued use of the current LMPM procedures provides a reasonable level of protection against the ways in which convergence bidding could undermine LMPM, and that this approach involves fewer problems or risks that if both virtual demand and supply bids were included under current LMPM procedures. Under this approach, enough physical supply to meet forecasted load is subject to mitigation, so that a relatively limited amount of competitively priced virtual supply may be needed to prevent uncompetitively high unmitigated physical or virtual supply bids from setting LMPs in the IFM within constrained areas.

- We believe that Option B would also effectively eliminate concern that virtual supply and virtual demand bids may undermine LMPM, and would have the additional benefit of increasing overall market efficiency. We recognize that this approach may be perceived as a major change in current LMPM procedures that may result in "over mitigation", and therefore warrants further review and discussion. However, as explained in the preceding discussion, we do not believe this approach would significantly increase mitigation relative to the current market (with no virtual demand bidding), as this approach would only mitigate supply to the degree this was necessary to relieve congestion on uncompetitive constrained paths. This approach is consistent with the FERC directive to use bid-in demand in LMPM. Thus, we believe this option merits further consideration as a further modification of LMPM procedures, particularly as an option for complying with the Commission's directive for the ISO to base LMPM on bid-in demand within three years of the implementation of the ISO's nodal market design.

Finally, we note that there may be other options for basing LMPM on bid-in demand – while addressing concerns about how inclusion of virtual bids in the LMPM process may undermine LMPM procedures – that could be explored as part of a further market design process with the MSC and stakeholders. For example, other effective options might be developed that involve multiple passes of the pre-IFM procedures, and/or some type of "conduct" test that would trigger mitigation prior to the AC run of the LMPM process. However, since these options may involve more substantial modification to the LMPM process, substantial further time and resources would be needed to thoroughly explore these options.