Business Requirements Specification

<Local Market Power Mitigation Enhancements >

Version 1.0.9

November 4, 2011

January 31, 2012

Revision History

<table>
<thead>
<tr>
<th>Date</th>
<th>Version</th>
<th>Description</th>
<th>Author</th>
</tr>
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<tbody>
<tr>
<td>11/04/2011</td>
<td>0.9</td>
<td>Created the external business requirement document based on internal business requirement draft</td>
<td>CAISO</td>
</tr>
<tr>
<td>01/31/2012</td>
<td>1.0</td>
<td>Updated the document to provide the clarifications requested by several reviewers on the version 0.9</td>
<td>CAISO</td>
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Created By: [Insert Name]  
Effective Date: 11/04/2011 01/31/2011
1. Introduction

1.1 Purpose

The purpose of this document is to capture and record a description of what the Users and Business Stakeholders of the Local Market Power Mitigation Enhancements (LMPM) project wish to obtain by providing high-level business requirements. This document establishes the basis for the agreement between the initiators and implementers of the project. The information in this document serves as input to determining the scope of Information Systems projects and to all Business Process Modeling and System Requirements Specifications efforts.

These requirements are intended for submission to the Information Technology Services (ITS) department and will serve as the initial set of business unit requirements for the appropriate software application/systems development effort. It is understood that ITS will perform additional requirements and systems analysis and may produce “To Be” Business Process Models, System Requirements Specifications, and Use Cases to serve as the set of requirements documents used by the ITS development teams to buy, modify, or build the necessary software and hardware systems. The Business Unit(s) involved in the project will have an opportunity to review and approve all ITS requirements documentation produced.

1.2 References

All references represent external requirements documents or stakeholder requests developed and submitted by the Business Units.

1. LMPM Draft Final Proposal is located in http://www.caiso.com/2b76/2b76e05c46990.pdf

2. CPA Draft Final Proposal is located in http://www.caiso.com/2bb2/2bb2814740f40.pdf

3. Retrospective Analysis of Local Market Power Mitigation Enhancements is located in http://www.caiso.com/2b79/2b79-e5c95b260.pdf
2. Details of Business Need/Problem

2.1 Description

The ISO market includes a market power mitigation process designed “to provide strong and effective measures against the exercise of local market power.” On September 21, 2006 FERC approved the ISO’s market power mitigation process, which included the use of forecast demand in the pre-IFM runs. However, FERC directed the CAISO to implement the use of bid-in demand as the basis for market power mitigation in the day-ahead market no later than three years after the start of the new market.

Because the new market was implemented in April 2009, the ISO is planning to implement the LMPM redesign in April 2012. This redesign includes the use of bid-in demand in the day-ahead market power mitigation run, as well as other improvements to the LMPM process.

2.2 Business Needs

Bid-In Demand

In its current design, the ISO performs the market power mitigation-reliability requirements determination process (MPM-RRD) before the integrated forward market (pre-IFM) for the day-ahead market and as part of the hour ahead scheduling process (HASP) for the real-time market. The pre-IFM process uses a forecast of internal demand rather than submitted demand bids.

To comply the September 21, 2006 FERC order, the ISO must institute bid-in demand as the basis for applying market power mitigation in the pre-IFM runs.

Convergence Bidding

The ISO is taking the opportunity to use this redesign effort to consider how virtual bids should be considered in the LMPM process.

Convergence bidding was implemented in February, 2011. The introduction of virtual bidding requires additional modifications to the mitigation process to prevent virtual bids from undermining the effectiveness of the LMPM. Although the ISO is not proposing to mitigate virtual bids, the implementation of virtual bidding causes two concerns under current LMPM process. First, by including virtual demand bids in the IFM but not in MPM process, the unmitigated supply bids could determine the LMPs. On the other hand, including virtual supply bids in MPM can potentially “crowd out” a physical supply bid with higher bid prices but with lower default energy bids. The unmitigated bids of the physical supply resources would then be considered in the IFM with an increased likelihood that resources with unmitigated bids will be needed to meet generation needs in a non-competitive area. The ISO’s proposal addresses these concerns without mitigating virtual bids.

Demand Response
Similar to convergence bids, Proxy Demand Product (PDR) bids cannot be mitigated as the ISO has no means to develop a default energy bid for these types of resources. Therefore, these bids create the same issue described in the convergence bidding section outlined above. In February 2010 the ISO Board of Governors approved DMM’s request to exclude proxy demand resource bids from the MPM process as a short term resolution to the problem. In this market design effort we will address this issue along with the impacts of convergence bidding.

**RMR Concerns**

As part of the current pre-IFM market power mitigation process, the ISO commits RMR units needed to address reliability issues. In the LMPM redesign, the ISO will no longer automatically commit RMR units that have not submitted bids into the day-ahead market. Instead, the ISO will manually dispatch any RMR units that have not bid into the market and are necessary for local reliability purposes. The new LMPM redesign will determine the dispatch level of RMR resources that have submitted bids.

**Dynamic Competitive Path Assessment**

Another benefit of this LMPM proposal is that it reduces the overall processing time required for the MPM module since no explicit CC run, with its associated security constrained unit commitment (SCUC) and power flow iterations, is required. The time savings from removing the explicit CC run from MPM module is invaluable because it allows the ISO to:

- Include dynamic competitive/non-competitive designation calculation within the market application execution rather than using pre-defined designations based on seasonal studies performed by DMM.
- Run MPM more frequently than once an hour, as it is currently run in the HASP/real-time MPM process leading to more accurate market power mitigation.
- An in-line dynamic CPA (DCPA) will further improve market power mitigation by more accurately designating paths as competitive or non-competitive prior to application of the LMPM procedure.

### 2.3 Problem Understanding /Analysis

Today’s LMPM scheme needs to estimate the effect of non-competitive constraints on dispatch by running the market optimization twice to determine which bids will be mitigated based on the difference between the dispatch levels in the two passes. Since the LMP decomposition method is based on the impact of the non-competitive constraints the LMPM can be performed in one pre-market optimization run. Virtual supply and virtual demand require no special treatment in this process as shown in the following example. This approach eliminates the potential issue of physical resources bypassing market power mitigation by bidding virtual supply to undercut the physical supply.

#### 2.3.1 LMP Decomposition

The current LMPM process requires running the market optimization twice, i.e., the competitive constraints run (the “CC run”) and the all constraints run (the “AC run”). The redesigned LMPM process is based on an “LMP decomposition” approach rather than a dispatch approach which is used today. It reduces the process to one pre-market run, i.e., an AC run considering both physical and virtual bids, which shortens the market execution time and provides the opportunity for an inline dynamic competitive path designation. In the Day-ahead Market, the LMPM process will use bid in demand.
Under the LMP decomposition approach, the market power mitigation run produces dispatches and prices that are potentially impacted by market power. Each resulting LMP is then "decomposed" into four components as follows:

For location \( i \):

\[
LMP_i = LMP_{EC} + LMP_{LC} + LMP_{CC} + LMP_{NC}
\]

Where:
- \( EC \) = the energy component,
- \( LC \) = the loss component,
- \( CC \) = the competitive constraint congestion component, and;
- \( NC \) = the non-competitive constraint congestion component.

The LMP congestion cost is broken into two components: a competitive component \( LMP_{CC} \) and a non-competitive component \( LMP_{NC} \). Relative to a reference bus free of local market power, the non-zero positive non-competitive component \( LMP_{NC} \) is the price mark-up due to non-competitive constraints, and it is an indicator of local market power.

### 2.3.2 Reference Bus

The computation of the two LMP components at each pricing node in the system depends on the reference bus selection. Ideally, the reference bus should be at a location free of local market power impact. The LMP at such a reference bus will be used to gauge local market power elsewhere.

In practice, the reference bus can be either of two choices:

**Distributed Load Slack Bus:**

One approach is to use the distributed load slack bus as the reference bus. However, the load distributed slack bus LMP could be affected by local market power.

**A High Voltage Bus Free of Local Market Power:**

The other approach is to use a major high voltage bus located close to the center of the California transmission grid. The high voltage busses that are least influenced by market power are the Midway 500KV bus if path 26 flow is from north to south or the Vincent 500KV bus if path 26 flow is from south to north. These busses are least affected by market power because they are located close to the center of the California transmission grid with sufficient generation and roughly half of the system load on either side of the path.

### 2.3.3 Local Market Power Mitigation

**No Local Market Power**

If there are no binding non-competitive constraints then \( LMP_{NC} = 0 \). This means there is no local market power and the bids of resources at that location will not be mitigated.
Local Market Power Mitigation

If there are binding non-competitive constraints, the physical resources with $LMP_{RC} > Mitigation\ Threshold\ Price$ potentially have local market power and the bids or resources at that location will be subject to mitigation.

If the non-competitive constraint congestion component of a physical supply bid is greater than Mitigation Threshold Price (default value 0) ($LMP_{RC} > Mitigation\ Threshold\ Price$) its bid will be mitigated to the higher of the default energy bid (DEB) and its competitive LMP if it is lower than the unmitigated bid.

Competitive LMP

The competitive LMP, mentioned above is analogous to the LMP produced in the current CC run. It is the resource specific LMP without the non-competitive constraint congestion component:

$$LMP_{CMP} = LMP_{RC} + LMP_{LC} + LMP_{CC}$$

2.3.4 Treatment of RMR Units

For purposes of the redesigned MPM process, Condition 1 RMR Units will be treated like non-RMR Units with respect to any capacity in excess of the Maximum Net Dependable Capacity specified in the RMR Contract. For up to the Maximum Net Dependable Capacity specified in the RMR Contract for Condition 1 RMR Units, the portion of the market Bid at and below the Competitive LMP at the RMR Unit’s Location will be retained in the IFM/RTPD. To the extent that the non-competitive Congestion component of an LMP calculated in the MPM process is greater than zero the Mitigation Threshold Price, and that MPM process dispatches a Condition 1 RMR Unit at a level such that some portion of its market Bid exceeds the Competitive LMP at the RMR Unit’s Location, those Bid prices above the Competitive LMP will be set to the higher of the RMR Proxy Bid or the Competitive LMP. If any Bid prices are set to the level of the RMR Proxy Bid through this process, any incremental dispatch of the resource based on the RMR Proxy Bid will be flagged as an RMR Dispatch and the resource shall be considered to have received a Dispatch Notice pursuant to the RMR Contract. Condition 1 RMR Units that have not submitted Bids and Condition 2 RMR Units will not be considered in the MPM unless the CAISO issues a manual RMR Dispatch, in which case the dispatch level specified in the manual RMR Dispatch will be protected in the MPM. If a Condition 2 RMR Unit is issued a Manual RMR Dispatch by the CAISO, then RMR Proxy Bids for all of the unit’s Maximum Net Dependable Capacity under the RMR Contract will be considered in the MPM. Any incremental dispatch based on RMR Proxy Bids will be flagged as an RMR Dispatch and the resource shall be considered to have received a Dispatch Notice pursuant to the RMR Contract.

All RMR resource outputs from MPM runs will need to be retained in order to settle energy as market or RMR as appropriate. This includes the competitive MW level, RMR pre-dispatch and RMR requirement. Since we are using one single AC run in the new MPM methodology, the competitive MW level (equivalent to today’s CC run MW level) will be derived by comparing the competitive LMP to the bid curve. When it is lined up with a marginal segment, the maximum MW shall be used.

2.3.5 Dynamic Competitive Path Assessment

The California Independent System Operator Corporation (ISO) has committed to implementing the dynamic competitive path assessment in the day-ahead market and the new local market power mitigation in both the
day-ahead and real time (Hour-ahead and 15 minutes) markets. This implementation will be done in phases, with the dynamic CPA for the day-ahead LMPM process implemented in April 2012, and dynamic CPA for the real-time markets targeted for implementation in the fourth quarter of 2012.

2.3.5.1 Timing of execution and constraints tested

- Day-ahead: After the all constraints run prior to the day-ahead market.
- Hour-ahead: After the all constraints run prior to the hour-ahead scheduling process.
- Real-time pre-dispatch: After the real-time pre-dispatch run that procures ancillary services from internal resources prior to the real-time dispatch runs for the same trade intervals.

2.3.5.2 Accounting for changes in control – tolling agreements

The purpose of a pivotal supplier test is to determine whether one or more suppliers can influence market price through withholding. Each supplier in the ISO control area may have more than one SC_ID. Combining physical and net virtual supply that are controlled by the SC's that correspond to a single supplier is necessary to accurately account for the extent of withholding and resulting market impact. In addition to supply that can be directly linked to a single supplier, there may exist several legal entities (or companies) with separate SC_IDs that may participate in the ISO market in a coordinated fashion via organizational, contractual, or other relationships. For this reason, supply controlled by affiliated legal entities must also be aggregated in order to accurately account for the extent of withholding and resulting market impact. We refer to the aggregation of these related resources as a portfolio for purposes of conducting the pivotal supplier test - the potential that one or more suppliers' portfolios may be withheld and have an impact on the market.

Resources will be assigned to a supplier's portfolio based on the Schedule Coordinator ID associated with that resource unless a different market participant has control of the resource through a tolling agreement. Then the resource will be excluded from the supplier's portfolio and added to the control entity's portfolio.

Following is the proposed process for obtaining and incorporating information about tolling agreements:

- Parties to a tolling agreement will provide tolling agreement information to the ISO on a monthly basis using a form and/or interface provided by the ISO.
- Data provided will be subject to both the ISO confidential data policy as well as Tariff provisions governing provision of accurate information.
- Submitted data will be validated by matching information submitted by stated counterparties.
- This data will be stored in the ISO Master File and used when calculating the residual supply index (RSI) through the market software.

2.3.5.3 Resources and suppliers considered

1. All Resources for Day-ahead DCPA

All resources that are available to the day-ahead market will be considered, whether committed in the all constraints run or not.

2. On-line Resources and short-start resources for Real-time DCPA

1 In the power industry, in a tolling agreement, the buyer supplies the fuel and receives the resulting power output of the facility—in effect, buying the service of converting fuel into electric energy.
For the hour-ahead and real-time pre-dispatch applications, available capacity from all online resources can be considered as well as all available short-start resources that are not online at the time of the mitigation run but have sufficiently short start time that they can be online during the binding market / trade interval considered by the competitive path assessment and local market power mitigation.

3. Net Sellers as Potentially Pivotal Suppliers:

For determination of the top three potentially pivotal suppliers:

- Net sellers of electricity at the affiliate level will be considered.
- Net buyers of electricity do not have an incentive to exercise local market power and increase spot wholesale prices.
- Identification of net buyers to exclude from the set of potentially pivotal suppliers will be determined by the Department of Market Monitoring and will be based on historical market participation.

4. Cleared Convergence Bids included

Cleared virtual supply bids are included in the demand for counterflow and effective supply calculations for potentially pivotal and fringe competitive suppliers.

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2 A Generating Unit that has a cycle time less than five hours (Start-Up Time plus Minimum Run Time is less than five hours), has a Start-Up Time less than two hours, and can be fully optimized with respect to this cycle time.

3 Demand for counterflow is the sum of all dispatched energy that will flow on in the counterflow direction. Please refer to section 4 for more details.
3. Business Process Impacts

3.1 High Level Business Process

3.1.1 Description

The ISO has developed a new Local Market Power Mitigation (LMPM) methodology that:

- Meets the requirements to use bid in demand rather than forecast demand outlined in the September 21, 2006 FERC order and
- Incorporates design elements to reflect the implementation of convergence (virtual) bidding and new demand response products.
- Improves the accuracy of mitigation in the real-time market
- Provides the ability to incorporate dynamic competitive/non-competitive path designation into the LMPM process.

3.1.2 System Impacts

- **Master File (MF):**
  a. Store information about who is the SC that has control on the resource as supplied by the SC via the *Resource control agreement information* form to the Customer Service team.
  b. Store corporate affiliation of SCs as supplied by the SCs via the *corporate affiliation information* form.
  c. Store whether a corporate portfolio (created using item (b) above) is a net buyer or net seller of electricity. Allow the SCs to request this information either manually (via email) or automatically (via a UI report).
- **Market DAM/RTM:** Use Bid-in demand in LMPM process in DAM and incorporate convergence (virtual) bidding and new demand response products. Use real time bids in LMPM process in HASP. Calculate residual supply index RSI(3); Incorporate the dynamic competitive path designations in the IFM, HASP and RTPD.
- **MQS:** Calculate expected energy using applicable mitigated bids from RTPD process.
- **CMRI:** Display mitigated bids from RTPD process.
- **SAMC:** Use applicable mitigated bids of each DAM and RTM (both HASP and RTPD) interval for the resource BCR calculation.
- **OASIS:** Display LMPM and DCPA results.

3.1.3 Market Timeline Impacts

The redesigned LMPM process will change the current LMPM process with one AC run, DCPA, LMP decomposition and bid mitigation. But the LMPM design will not change the current bid-to-bill market timeline.

Phased-in functionality:
Phase 1:
April 2012
- New local market power mitigation in day-ahead and hour-ahead, no local market power mitigation in real-time pre-dispatch.
- Static competitive path assessment used for local market power mitigation in day-ahead and hour-ahead scheduling process.
- Dynamic competitive path assessment in day-ahead (DAM).

Phase 2
Q4 2012
- Dynamic competitive path assessment in the hour-ahead scheduling process (HASP).
- Add new local market power mitigation and dynamic competitive path assessment in real-time 15 minute pre-dispatch (RTPD).

3.2 Justification

The LMPM enhancements will ensure ISO compliance with FERC’s mandate to use bid-in demand in the day-ahead LMPM process, as set forth in its order of September 21, 2006 and increase the effectiveness and accuracy of local market power mitigation, therefore, make the ISO energy market more efficient.
4. Business Requirements

The sections below describe the Business Processes and the associated Business Requirements involved in the project. These may represent high level functional, non-functional, and reporting and/or infrastructure requirements. These business requirements directly relate to the high level scope items determined for the project.

4.1 Local Market Power Mitigation (LMPM) Model Overview

The LMPM enhancements will be implemented in two phases.

**Phase 1: April 2012**

Comply with FERC order to use bid in demand and incorporate convergence (virtual) bidding and new demand response products

1. For pre-IFM and pre-HASP, reduce LMPM to one pre-market run, i.e., an AC run, considering both physical and virtual bids, PDR, RDRP, LSRP, DDR and bid in demand in pre-IFM in the power balance; using forecast load and physical bids including PDR, RDRP, LSRP, DDR and pseudo generators for dispatch-able pumps in pre-HASP in the power balance;
2. Designate the non-competitive paths (NC), using the existing Static CPA method;
3. Recalculate the node i to non-competitive binding constraint i Shift Factors $SR_i^{NC}$ from distributed load bus e to the new reference bus n that free of local market power;
4. Calculate node $i$ on $LMP$ congestion cost using new reference bus:

$$LMP_{i}^{NC} = \sum_{NC} (SR_i^{NC}) \times TSC_i$$

$TSC_i$: Shadow price of constraint i at interval i
$SR_i^{NC}$: Shift Factor of i on i using new reference bus

5. LMP decomposition: the LMP congestion cost is broken into two components: a competitive component $LMP^{NC}$ and a non-competitive component $LMP^{NC}$:

$$LMP_i = LMP_i^{EC} + LMP_i^{LC} + LMP_i^{CC} + LMP_i^{NC}$$

6. Bid mitigation: If $LMP_i^{NC} > Mitigation\ Threshold\ Price_i$, the resource bid would be mitigated to the higher of the default energy bid (DEB) and its competitive LMP. The bid mitigation apply to all the resources subject to LMPM, regardless whether the resource is on-line or not at LMPM AC run.

$$Bid_i^{Mitigated} = \max (DEB_i; LMP_i^{NC})$$

if submitted $Bid_i > \max (DEB_i; LMP_i^{NC})$
7. For RMR units with bids regardless condition 1 or 2, the RMR Proxy bid will serve the purpose of default bid. The portion cleared within RMR Proxy bid will be deemed RMR requirement.
8. RMR units without market bid will not be considered in the MPM unless the CAISO issues a manual RMR Dispatch.
9. If a Condition 2 RMR Unit is issued a Manual RMR Dispatch by the CAISO, then RMR Proxy Bids for all of the unit’s Maximum Net Dependable Capacity under the RMR Contract will be considered in the MPM.

Incorporate the dynamic competitive path designations in the IFM
1. Dynamic CPA will be inline performed.
2. For dynamic CPA option, CPA will be assessed after the all-constraints run (LMPM) prior to IFM market.
3. For each congested constraint k, calculate demand for counterflow (DCF) (the default constraint direction being the market AC run flow):
   \[ DCF_k = \sum_{i} -SF_{k,i} \times \text{Cleared Schedule MW}_i \]
   for physical resources and virtual supply resources i with SF_{k,i} < threshold (<0, default -0.02) for the direction of market AC run flow; where Cleared Schedule MW_i is the energy schedule for physical or virtual supply resource i, for all the portfolios, net suppliers and new-net buyers.
   The energy supply from pump storage and NGR LESR resources shall be included in the counterflow calculation. The demand side of pump storage and NGR LESR resources shall be excluded from the flow calculation. The NGR DDR, pseudo generators associated with PDR/RDRP/Dispatched Pump resources and NGR DDR shall be excluded from the flow calculation.

4. For each congested constraint k, calculate withheld capacity (WC):
   \[ WC_{k,i} = \sum_{j} (-SF_{k,j} \times \text{ENGYMAX}_i) + \sum_{j} \text{SVCF}_{k,j,i} \]
   for resources i of net seller j with SF_{k,j} < DCPA Threshold
   Where ENGYMAX_i = \min((MAXCAP_i - OR_i - RU_i),(MAXECON_i - OR_i))
   MAXCAP_i = \min((PMAX_i - DERATE_i), Maximum exceptional dispatch)
   MAXECON_i = \min((PMAX_i - DERATE_i), Maximum exceptional dispatch, Max economic bid MW)
   PMAX_i is regulation pmax if on regulation otherwise operational Pmax
   OR_i is self scheduled spinning and non-spinning reserves
   RU_i is set scheduled regulation up
   Note that for MSG Plants the SF is given per plant aggregate connectivity node, and the above calculations involve plant level maximums and derates. The withheld capacity calculation shall not consider pump storage resources, pseudo generators associated with PDR/RDRP/Dispatched Pump resources, NGR LESR and NGR DDR.
   \[ SVCF_{k,j,i} = -SF_{k,j} \times \text{DOP}_i \]
   for cleared individual virtual bid supply counterflow.
   \[ Note: for IFM, that WC calculation is applicable for all the available physical resources of net seller j, regardless the resource commitment status. \]
5. For each binding constraint k, suppliers are ranked on WC from highest to lowest and the top three net sellers portfolios are identified as the set of potentially pivotal suppliers (PPS) for that constraint.
6. The fringe competitive suppliers (FCS) for the constraint k are the portfolios of net buyers and net sellers’ resources that do not belong to PPS for constraint k.
7. Calculate the effective supply of physical counterflow (SPCF) for fringe competitive supplier:
   \[ SPCF_{k,j,i}^{\text{FCS}} = -SF_{k,j} \times \text{ENGYMAX}_i \]
   The energy supply from pump storage and NGR LESR resources shall be included in the counterflow calculation. The demand side of pump storage and NGR LESR resources shall be excluded from the flow calculation. The NGR DDR, pseudo generators associated with PDR/RDRP/Dispatched Pump resources and NGR DDR shall be excluded from the flow calculation.
8. Set the three potentially pivot suppliers’ counterflow from physical units SPCF_{k,j,i}^{\text{PPS}} = 0
9. Calculate cleared Virtual supply counterflow \( SVCF^{FCS}_{k,j,i} = -SF_{k,j,i} \cdot DOP_{i} \) and \( SVCF^{PPS}_{k,j,i} = -SF_{k,j} \cdot DOP_{i} \) for FCS and PPS.

10. Combine for physical and virtual for PPS and FCS:
\[
\begin{align*}
SCF^{PPS}_{k,j,i} &= SPCF^{PPS}_{k,j,i} + SVCF^{PPS}_{k,j,i} \\
SCF^{FCS}_{k,j,i} &= SPCF^{FCS}_{k,j,i} + SVCF^{FCS}_{k,j,i} \\
SCF_{k,j} &= \sum_{i} SCF^{PPS}_{k,j,i} \\
SCF_{k} &= \sum_{j} SCF_{k,j}
\end{align*}
\]

11. Calculate RSI:
\[
RSI_{k} = \frac{SCF^{PPS}_{k} + SCF^{FCS}_{k}}{DCF_{k}}
\]

12. \( K \) is deemed uncompetitive (NC) if residual supply index \( RSI_{k} < 1 \)

13. Apply each binding constraint \( k \). The DCPA will be performed only to those paths binding in the AC run.

14. The three pivotal supplier test (RSI(3)) will not account for current operation conditions in AC run. The calculation is applicable to all the available resources, regardless ramp rate and the commitment status in IFM.

15. Only paths that are tested and fail the pivotal supplier test will be designated as noncompetitive (NC) on an hourly basis.

16. LMP decomposition and bids Mitigation on an hour basis.

**Phase 2**

**Q4 2012**

Incorporate the dynamic competitive path designations in the HASP and 15 minute RTPD

1. **Pre-HASP AC run** will use the SIBR clean bids for the HASP trading hour while it will use the previously RTPD mitigated bids for the current hour:

2. **After MPM - Pre-HASP AC run**, perform DCPA and Pre-HASP bid mitigations.

3. **For a resource that is mitigated by the Pre-HASP mitigation in HASP trading hour**, it will be re-evaluated by the 5-interval RTPD run that has the first 15-minute of the HASP hour in the horizon as the second interval. This re-evaluation will be based on the SIBR clean bid for the HASP hour;

4. **After every RTPD**, perform DCPA and bid mitigation for the second interval.

5. **The RTPD shall use the original bids for the DCPA and bid mitigations for the HASP hour.**

6. Use consistent mitigated bids for the bidding interval of RTPD and RTD. Note that the consistent mitigated bids used at current RTPD binding interval are obtained from the prior RTPD second interval bid mitigation.

7. Once a resource is mitigated for the HASP trading hour, the RTPD mitigated bids will be applied towards the end of the hour and will not be subject to evaluation again in latter RTPD run carried over the rest of the hour for latter RTPD and RTD.

8. **Such evaluation will carry on a rolling forward base**

**Dynamic CPA for HASP after AC run**:

1. Calculate Withheld Capacity \( WC_{k,j} \) for the units \( i \) that are net suppliers \( j \) and Shift Factor \( SF_{k,j,i} < \) threshold (default -0.02) for the congested constraint \( k \):
\[
WC_{k,j} = \frac{SF_{k,j}}{DOP_{i}} \cdot \min \left( \left( \text{Popt}_{i} + \text{RR}_{i} \cdot 15 \right), \text{ENGYMAX}_{i} \right) - \max \left( \left( \text{Popt}_{i} - \text{RR}_{i} \cdot 15 \right), \text{ENGYMIN}_{i} \right)
\]
\( \text{Popt}_{i} \) is resource \( i \)'s dispatch operating point from the previous interval
\( \text{RR}_{i} \) is resource \( i \)'s ramp rate in MW/minute

Where
\[
\begin{align*}
\text{ENGYMAX}_{i} &= \min \left( \text{MAXCAP}_{i} - \text{OR}_{i} - \text{RU}_{i}, (\text{MAXECON}_{i} - \text{OR}_{i}) \right) \\
\text{MAXCAP}_{i} &= \min \left( \text{PMAX}, \text{DERATE}_{i}, \text{Maximum exceptional dispatch} \right) \\
\text{MAXECON}_{i} &= \min \left( \text{PMAX}, \text{DERATE}_{i}, \text{Max economic bid MW}, \text{Maximum exceptional dispatch} \right)
\end{align*}
\]
\( \text{PMAX} \) is regulation \( P_{\max} \) if on regulation otherwise operational \( P_{\max} \)

\( \text{OR}_{i} \) is HASP qualified self scheduled spinning including transferred DA spin capacity + HASP qualified self scheduled non-spinning including transferred DA non-spinning capacity

\( \text{RU}_{i} \) is HASP qualified self scheduled regulation up including transferred DA regulation up capacity
RR is the effective ramp rate at Popt (in case of dynamic ramp rate)
Where ENGYMIN = max{MINCAP + RD}, Self scheduled energy
MINCAP = max[(Pmin + Pmin RERATE), minimum exceptional dispatch]
PMIN is regulation pmin if on regulation otherwise operational pmin
RD is HASP qualified self scheduled regulation down including transferred DA regulation down capacity
For a unit that is offline in the previous interval and has a startup time of 60 minutes or less, then WC = Pmin. For RTPD other than HASP, the startup time to be used will be reduced to 15 minutes or less.
The withheld capacity calculation shall not consider pump storage resources, pseudo generators associated with PDR/ RDRP/Dispatched Pump resources, NGR LESR and NGR DDR.
For MSGs only the MSG configuration that is committed is taken into account.
In short, the Withheld Capacity is the Upper Limit a unit could reach from the initial MW to the corresponding interval considering ramping constraint, de-rate.
2. Rank (WC_{ij}) from highest to lowest, the top three suppliers js are identified as the set for the potentially pivot suppliers (PPS) for the constraint k

3. Calculate supply of counterflow from FCS, for each binding constraint k in any four of 15 minute intervals
   \[ SPCF_{FCS, k, i} = -SF_{k, i} \ast \min (LDOP_{i} + RR_{i} \ast 15), ENGYMAX_{i} \]
   \[ SPCF_{FCS, k, j} = \sum_{i} SPCF_{FCS, k, i} \]
   \[ SCF_{FCS, k} = \sum_{j} SPCF_{FCS, k, j} \]

4. Calculate PPS:
   \[ SPCF_{PPS, k, i} = -SF_{k, i} \ast \max (LDOP_{i} - RR_{i} \ast 15), ENGYMIN_{i} \]
   \[ SPCF_{PPS, k, j} = \sum_{i} SPCF_{PPS, k, i} \]
   \[ SCF_{PPS, k} = \sum_{j} SPCF_{PPS, k, j} \]

5. Calculate Demand for counterflow: \( DCF_{k} = \sum_{i} -SF_{k, i} \ast DOP_{i} \)
6. Calculate RSI for k:
   \[ RSI_{k} = (SCF_{PPS, k} + SCF_{FCS, k}) / DCF_{k} \]
7. K is deemed uncompetitive if RSI_{k} < 1 for the trading hour
8. Apply same process to each k

DCPA for RTPD after RTPD run:
Using the same process as Pre-HASP, DCPA will be applied to RTPD, except that RTPD has 1-15 minute interval.
Regulation up, regulation down, spinning, and non-spinning quantities will be the awarded quantity from the RTPD market run. For quick start unit, start up time will be 15 minute or less.

To utilize the LMP model and dynamic CPA will require the modification in various systems:

- Master File (MF):
  1. Store information about who is the SC that has control on the resource as supplied by the SC via the Resource control agreement information form to the Customer Service team. Phase 1
  2. Store corporate affiliation of SCs as supplied by the SCs via the corporate affiliation information form. DMM may provide the initial list. Phase 1
  3. Master File shall store whether a portfolio (created by grouping all the SCs with common corporate affiliation) is a net seller/ net buyer of electricity. Phase 1
4. Master File shall make the information about who is the controlling SC of a resource and the status of each SC (as either net Buyer or net Seller) to the downstream systems. **Phase 1**

- **Market DAM/RTM:**

1. DAM/RTM shall remove CC run from MPM process for IFM and HASP. **Phase 1**
2. DAM/MPM shall run AC run in MPM process. AC run shall include bid-in demand, physical supply and demand bids, virtual supply and demand bids, PDR bids. **Phase 1**
3. RTM/MPM shall run AC run in MPM process. AC run shall include forecast demand, physical supply and demand bids, and PDR bids. **Phase 1**
4. After AC run, for each interval (hour), DAM/RTM MPM process shall convert LMP distributed reference bus to the applicable new reference bus under condition and rules. Midway or Vincent 500 Kv bus for each interval, subject to selected path (path 26) flow directions at the interval. **Phase 1**
5. MPM shall designate No-competitive (NC) path: Static CPA will use pre-specified NC. **Phase 1**
6. MPM using dynamic CPA shall designate the NC paths after DCPA. **Phase 1 and 2**
7. For each interval, DAM/RTM MPM shall calculate new Shift Factors on the non-competitive paths, using new reference bus. **Phase 1**
8. DAM/RTM MPM process shall calculate LMP congestion cost component for binding NC paths \( LMP_{k,j,i}^{NC} \) for each node and each interval by using sum of new Shift Factors \( * \) NC constraint shadow prices from AC run. **Phase 1**
9. For \( LMP_{k,j,i}^{NC} > \text{threshold} \), MPM shall calculate Competitive LMP for node \( i \): \( LMP_{k,i}^{C} \) for each node and each interval. **Phase 1**
10. Bid mitigation: If \( LMP_{k}^{NC} > \text{threshold} \), the resource bid would be mitigated to the higher of the default energy bid (DEB) and its competitive LMP. The bid mitigation apply to all the resources subject to LMPM, regardless whether the resource is on-line or not at LMPM AC run. **Phase 1**
11. IFM/HASP shall use mitigated bids. **Phase 1**
12. Mitigated bids shall send to SC through CMRI. **Phase 1**
13. If Dynamic CPA is chosen for IFM, Pre-specified NC paths will be invalid for DAM/MPM. However, HASP shall continue use pre-specified NC if static CPA is chosen for HASP. **Phase 1**
14. After AC run, DAM/MPM with Dynamic CPA option shall perform CPA and then designate the NC paths before the LMP congestion cost recalculation. **Phase 1**
15. For each congested constraint \( k \) and each interval \( t \), DAM/MPM shall calculate demand for counterflow \( DCF_{k,j}^{F} \). The constraint direction is defined by the AC run. **Phase 1**
16. For each congested constraint \( k \) and each interval \( t \), DAM/MPM shall calculate Withheld Capacity \( WC_{k,j} \) for the units \( \langle i \rangle \) that are net suppliers \( \langle j \rangle \) and Shift Factor \( SF_{k,j} < \text{threshold} \) (default -0.02)) for the congested constraint \( k \). **Phase 1**
17. For each congested constraint \( k \) and each interval \( t \), DAM/MPM shall Rank \( WC_{k,j} \) from highest to lowest, the top three suppliers \( j \) are identified as the set for the potentially pivot suppliers (PPS) for the constraint \( k \). **Phase 1**
18. For each congested constraint \( k \) and each interval \( t \), DAM/MPM shall designate the fringe competitive suppliers (FCS) that are not net buyers and net suppliers and not be part of three PPS. **Phase 1**
19. For each congested constraint \( k \) and each interval \( t \), DAM/MPM shall calculate the effective supply of physical counterflow \( SPCF_{k,j}^{FCS} \) for fringe competitive suppliers. **Phase 1**
20. For each congested constraint \( k \) and each interval \( t \), DAM/MPM shall set three PPS counterflow \( SPCF_{k,j,i}^{PPS} = 0 \). **Phase 1**
21. For each congested constraint \( k \) and each interval \( t \), DAM/MPM shall calculate cleared virtual supply for FCS and PPS by \( SVCF_{k,j,i} = -SF_{k,j} * DOP \). The DOP is the cleared virtual supply from AC run. **Phase 1**
22. For each congested constraint \( k \) and each interval \( t \), DAM/MPM shall combine effective physical and virtual supply of counterflow. \( SCF_{k,j,i} = SPCF_{k,j,i} + SVCF_{k,j,i} \). **Phase 1**
23. For each congested constraint \( k \) and each interval \( t \), DAM/MPM shall calculate RSI \( k = \frac{SCF_{k}^{PPS} + SCF_{k}^{FCS}}{DCF_{k}} \). **Phase 1**
24. For each congested constraint k and each interval t, if $RSl_k < 1$, DAM/MPM shall designate k as NC path for the interval t for LMP decomposition and bids mitigation. Phase 1
25. If Dynamic CPA is chosen for HASP, Pre-specified NC paths will be invalid for HASP. MPM will conduct dynamic CPA after all AC run and designate the NC paths. Phase 2
26. If Dynamic CPA is chosen for RTPD, after each RTPD, RTPD shall conduct dynamic CPA and designate NC. RTPD shall conduct LMP decomposition and bids mitigation. Phase 2
27. RTM/MPM shall calculate for each four of 15 minute intervals' Withheld Capacity $(WC_{kj})$ for the units (i) that are net suppliers (j) and Shift Factor $(SF_{kj} < threshold)$ for the congested constraint k from pre-HASP AC run in each four of 15 minute intervals; The operation range shall be calculated base on ramp rate and operation capacity. For the quick start unit, the capacity will be included in the calculation if start up time 60 minute or less. The WC = $Pmin$ for quick start unit. $WC_{kj} = \Sigma_j -SF_{kj} * \min(Poptj + RRIj * 15) , ENGYMAXi) – \max(PoPi -RRij * 15, ENGYMINj). Phase 2
28. For each k and interval t, RTM/MPM shall rank $(WC_{kj})$ from highest to lowest, the top three suppliers j are identified as the set for the potentially pivot suppliers (PPS) for the constraint k. designate the fringe competitive suppliers (FCS) that are net suppliers and net buyers and not be part of three PPS. Phase 2
29. For each k and interval t, RTM/MPM shall calculate physical supply of counterflow for fringe competitive suppliers $SCF^{FCS}_k$, and potential pivotal suppliers $SCF^{PPS}_k$. Phase 2
30. No virtual supply of counterflow in RTM. Phase 2
31. For each k and interval t, RTM/MPM shall calculate demand for counterflow $DCF_k$. Phase 2
32. For each congested constraint k and each interval t, RTM/MPM shall calculate $RSl_k = (SCF^{PPS}_k + SCF^{FCS}_k) / DCF_k$. Phase 2
33. k is deemed uncompetitive for each 15 minute interval within the HASP hour if $RSl_k < 1$ in each four of 15 minute interval of the trading hour. Phase 2
34. RTM/MPM Pre-HASP AC run shall perform bid mitigation for each four of 15 minute interval of HASP trading hour., The hourly mitigated bid curve is the lower envelope of the mitigated bids of each interval. Hourly mitigated bid curve will be applied to HASP and following RTPD runs for the HASP trading hour intervals if the RTPD applicable mitigation interval is before the HASP trading hour. Phase 2
35. Dynamic CPA shall be applied after each RTPD run's applicable mitigation interval. Bid mitigation for the applicable interval is performed. Phase 2
36. The mitigated bids will be applied to the next RDPT for the 15 minute binding interval and the three 5 minute binding intervals of the three RTD runs. Phase 2
37. For the resources that are mitigated for the HASP hour and have a binding commitment from the HASP decision in the horizon, their HASP mitigated bids shall not be subject to mitigation evaluation again. These mitigated bids will continue to be used for later RTPD and RTD runs;
38. If the applicable mitigation interval of RTPD run is the first 15 minute interval in the HASP binding trade hour, for the resources that do not have a binding commitment from the HASP, the original SIBR clean bid for the HASP trading hour will be used in the RTPD mitigation instead of the HASP mitigated bids. The DCPA and bid mitigation will be performed for the applicable mitigation interval. These mitigated bids will continue to be used for later RTPD and RTD runs for the trading hour. The latter RTPD will mitigate bids in addition to the previous RTPD for the same trading hour. RTPD mitigated bids for the trading hour will be carried to the rest of hour and will not be subject to the mitigation for latter RTPD runs.
39. RTPD shall send mitigated bids to SC through CMRI. Phase 2
40. System shall store and publish for LMP component for the reference bus and shift factor; for pre-IFM AC run, for pre-HASP AC run, as well as for RTPD second interval run. Phases 1 and 2.
41. System shall store and publish the CPA calculation results, for pre-IFM AC run, for pre-HASP AC run, as well as for RTPD interval run. Phase 1 and 2
- **OASIS:**
  1. Display interval LMP components from the LMPM: \( LMP_{FE} \), \( LMP_{LC} \), \( LMP_{EC} \) and \( LMP_{NC} \). *Phase 1*
  2. Display mitigation AC run interval binding constraints and shadow prices. *Phase 1*
  3. Display mitigation interval binding constraints, non-competitive path designation. *Phase 1*
  4. *Reference bus being used in the LMPM. Phase 1*

- **CMRI:**
  1. CMRI shall display mitigated bids after 15 minute RTPD. *Phase 2*

- **MQS:**
  1. MQS shall continue to receive mitigated bids from every 15 minute RTPD run and use them to calculate expected energy. *Phase 2*

- **SaMC:**
  1. SaMC shall continue to use the mitigated bids of each applicable interval for the resource BCR calculation. *Phase 2*

### 4.2 Business Process: Manage Entity and Resources and manage Scheduling Coordinator Registration

#### 4.2.1 Business Requirements

<table>
<thead>
<tr>
<th>ID#</th>
<th>Business Feature</th>
<th>Phase</th>
<th>Requirement Type</th>
<th>Potential Application(s) Impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMPM-BRQ001</td>
<td>One or more SCs may have a common corporate affiliation to a common entity. The SCs shall be required to disclose their corporate affiliation to the ISO if they share corporate affiliation with any other SC in the ISO Market. This information would be communicated to the ISO via a new form titled “Corporate Affiliation Information” form.</td>
<td>1</td>
<td>Core</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>LMPM-BRQ002</td>
<td>The SCs shall be required to send new or updated “Corporate Affiliation Information” form to the Customer Services team. The customer service team shall forward the copy of the form to the Contracts team (for record keeping in eRecords) and also forward the form to the MCI team by attaching it to an SMC ticket.</td>
<td>1</td>
<td>Core</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>ID#</td>
<td>Business Feature</td>
<td>Phase</td>
<td>Requirement Type</td>
<td>Potential Application(s) Impacted</td>
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<tr>
<td>LMPM-BRQ003</td>
<td>The system shall allow users to store (via bulk-loading or otherwise) the corporate affiliation of one or more SCs as supplied by the SCs to the Customer Services team via the Corporate Affiliation information form.</td>
<td>1</td>
<td>Core</td>
<td>Master File</td>
</tr>
<tr>
<td>LMPM-BRQ004</td>
<td>The system shall allow users to store (via bulk-loading or otherwise) whether a corporate entity (having one or more affiliates) is a Net Buyer or Net Seller of electricity. If a corporate entity is a net Buyer then it cannot be net Seller. The default value would be Net Seller.</td>
<td>1</td>
<td>Core</td>
<td>Master File</td>
</tr>
<tr>
<td>LMPM-BRQ005</td>
<td>If a corporate entity is a net Buyer then all its affiliated SCs are net buyers. Similarly, if a corporate entity is a net seller, then all its affiliated SCs are net seller.</td>
<td>1</td>
<td>Core</td>
<td>Master File</td>
</tr>
<tr>
<td>LMPM-BRQ006</td>
<td>The system shall make the information on Net Seller and Net Buyer available to any system (DAM, RTM, etc.) or user (DMM representative) that needs it or may benefit from it.</td>
<td>1</td>
<td>Core</td>
<td>Master File</td>
</tr>
<tr>
<td>LMPM-BRQ007</td>
<td>If an SC has transferred control of a resource to another SC, then that SC shall be responsible to inform the ISO of such transfer by using the &quot;Resource Control Information&quot; form. This form would have the following fields among others:</td>
<td>1</td>
<td>Core</td>
<td>Not Applicable</td>
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<tr>
<td></td>
<td>• From_SC</td>
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<td></td>
<td>• To_SC</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>• Effective Start Date of Transfer</td>
<td></td>
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<td></td>
<td>• Effective End Date of Transfer</td>
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<tr>
<td></td>
<td>• List of Resources IDs</td>
<td></td>
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<tr>
<td>LMPM-BRQ008</td>
<td>Similarly, if an SC has taken control of a resource from another SC, then that SC shall be obligated to inform the ISO of such transfer by using the ‘Resource Control Information’ form. This form would have the following fields among others:</td>
<td>1</td>
<td>Core</td>
<td>Not Applicable</td>
</tr>
<tr>
<td></td>
<td>• From_SC</td>
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<td></td>
<td>• To_SC</td>
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<td></td>
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<tr>
<td></td>
<td>• Effective Start Date of Transfer</td>
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<td></td>
<td>• Effective End Date of Transfer</td>
<td></td>
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<td></td>
<td>• List of Resources IDs</td>
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</tr>
<tr>
<td>LMPM-BRQ009</td>
<td>The SCs shall be required to send new or updated “Resource Control Information” form to the Customer Services team.</td>
<td>1</td>
<td>Core</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>LMPM-BRQ010</td>
<td>The system shall allow users to store (via bulk-loading or otherwise) which SC has control of the resource and for what duration (effective start date and Effective end date). Please note that the controlling SC doesn’t get the rights to • Submit resource parameters updates via MF (UI or API). • Submit bids in SIBR</td>
<td>1</td>
<td>Core</td>
<td>Master File</td>
</tr>
<tr>
<td>LMPM-BRQ011</td>
<td>Only one SC shall be allowed to be the controlling SC of a resource for any trade day. However an SC can subsequently transfer the control of the resource to another SC. The System shall store all resource control agreements of a resource for a given trade date.</td>
<td>1</td>
<td>Core</td>
<td>Master File</td>
</tr>
<tr>
<td>LMPM-BRQ012</td>
<td>Only internal physical generation resources shall be allowed to have the so called “Controlling” SC who is different than the resource’s actual SC.</td>
<td>1</td>
<td>Core</td>
<td>Master File</td>
</tr>
<tr>
<td>LMPM-BRQ013</td>
<td>The ISO staff may take as much as 5-11 business days to update / storing of both the corporate affiliation and resource control agreements in to their system.</td>
<td>1</td>
<td>Core</td>
<td>Master File</td>
</tr>
<tr>
<td>LMPM-BRQ014</td>
<td>When storing resource control agreement, the system shall store • The actual contract effective start and end date; and • The effective start and end date of a resource control agreement as the resource control agreement was available to the Market system.</td>
<td>1</td>
<td>Optional</td>
<td>Master File</td>
</tr>
<tr>
<td>LMPM-BRQ015</td>
<td>An SC shall be allowed to inquire about his status (Net Buyer or Net Seller) as it is set in MF and read by the Market System for LMPM purposes.</td>
<td>1</td>
<td>Core</td>
<td>Master File</td>
</tr>
</tbody>
</table>
4.3 Business Process: < Manage Day Ahead and Real Time Market >

### 4.3.1 Business Requirements

<table>
<thead>
<tr>
<th>ID#</th>
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<tbody>
<tr>
<td>LMPM-BRQ0090</td>
<td>DAM/RTM shall allow operator to input threshold of Shift Factor (default -0.02) used in CPA calculation. The same SF threshold applies to DCPA for IFM/HASP/RTPD. DAM/RTM shall allow operator to choose Static CPA or Dynamic CPA for IFM, HASP, and RTPD independently:</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM</td>
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<tr>
<td>LMPM-BRQ0100</td>
<td>If Static CPA is chosen for RTPD, the RTPD will use the same non-competitive path designation as HASP for the same 15 minute interval.</td>
<td>1</td>
<td>Core</td>
<td>RTM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0110</td>
<td>DAM/RTM shall remove CC run from MPM process for IFM and HASP.</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM, MPM, IFM, HASP</td>
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<tr>
<td>LMPM-BRQ0120</td>
<td>DAM/MPM shall run all constraints (AC) run in MPM process. AC run shall include bid-in demand, physical supply and demand bids, virtual supply and demand bids, PDR bids.</td>
<td>1</td>
<td>Core</td>
<td>DAM, MPM, IFM</td>
</tr>
<tr>
<td>LMPM-BRQ0130</td>
<td>RTM/MPM shall run AC run in MPM process. AC run shall include forecast demand, physical supply and demand bids, and PDR bids. Convergence virtual bids liquidate in the real time market, shall not be included in the RTM MPM process.</td>
<td>1</td>
<td>Core</td>
<td>RTM, MPM, HASP</td>
</tr>
<tr>
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</tr>
<tr>
<td>LMPM-BRQ0140</td>
<td>After AC run, for each interval (hour in DAM, 15 minute in RTM), DAM/RTM MPM process shall convert LMP distributed reference bus to the applicable new reference bus. The new reference buses are subject to selected path flow direction: 1. Midway 500KV bus If path26 flow is from north to south for the interval in DAM/RTM MPM AC run, 2. Vincent 500KV bus If path26 flow is from south to north for the each interval in DAM/RTM MPM AC run, For the DAM/MPM, the interval is an hour, 24 hours for the trading day. For the RTM/MPM, the interval is 15 minutes, 4 intervals for the trading hour. Different intervals can have different reference bus, depend on the flow direction on path 26.</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM, MPM, IFM, HASP</td>
</tr>
<tr>
<td>LMPM-BRQ0141</td>
<td>The Market system shall send (via web services) to OASIS, the information about which reference bus was used for LMPM for each hour (in DAM and HASP) and each 15 minute interval (in RTPD)</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM, MPM, IFM, HASP, OASIS</td>
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<tr>
<td>LMPM-BRQ0150</td>
<td>DAM/RTM MPM shall designate Non-competitive (NC) path: Static CPA will use pre-specified NC paths.</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM, MPM, IFM, HASP, SMDM</td>
</tr>
<tr>
<td>LMPM-BRQ0152</td>
<td>Non-competitive constraints shall include nomogram constraints, and flow gate group constraints. Dynamic CPA shall be applicable for these constraints.</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM, MPM, IFM, HASP, SMDM</td>
</tr>
<tr>
<td>LMPM-BRQ0170</td>
<td>For each interval, DAM/RTM MPM shall calculate new Shift Factors on the non-competitive paths, using new reference bus.</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM, MPM, IFM, HASP</td>
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## Local Market Power Mitigation Enhancements (LMPM)

### Business Requirements Specification - Draft

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<tbody>
<tr>
<td>LMPM-BRQ0180</td>
<td>DAM/RTM MPM process shall calculate LMP congestion cost component $LMP_{NC}^{i,n}$ for binding NC paths for each node and each interval by sum of (new Shift Factors $\times$ NC constraint shadow prices) from AC run, corresponding the new reference bus. Following formula is used to describe the concept. Further detail shall be refined in design. $LMP_{NC}^{i,n} = \sum SF_{i,n} \times TSC_{i}$</td>
<td>1</td>
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<td>DAM, RTM, MPM, IFM, HASP</td>
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<tr>
<td>LMPM-BRQ0190</td>
<td>For $LMP_{NC}^{i,n} &gt;$ mitigation threshold price, MPM shall calculate Competitive LMP for node $i$: $LMP_{i}^{C} = LMP_{i}^{EC}$. The different reference bus will not change the LMP at location $i$. The different reference bus will change the LMP components, EC, LC, CC and NC. EC = the energy component, LC = the loss component, CC = the competitive constraint congestion component, and; NC = the non-competitive constraint congestion component. LMP decomposition: the LMP congestion cost is broken into two components: a competitive component $LMP_{i}^{EC}$ and a non-competitive component $LMP_{i}^{NC}$. $LMP_{i}^{C} = LMP_{i}^{EC} + LMP_{i}^{LC} + LMP_{i}^{CC} + LMP_{i}^{NC}$</td>
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| LMPM-BRQ0191 | MPM shall calculate each component of the LMP for the **new** reference bus at both market resource and Pnode/Apnode:  
  \[ LMP_{EC,i}^{t} \] : node i LMP energy component for the new reference bus for t  
  \[ LMP_{LC,i}^{t} \] : node i LMP loss component for the new reference bus for t  
  \[ LMP_{CC,i}^{t} \] : node i LMP competitive congestion component for the new reference bus for t  
  \[ LMP_{NC,i}^{t} \] : node i LMP non-competitive congestion component for the new reference bus for t  
  \[ LMP_{C,i}^{t} = LMP_{EC,i}^{t} + LMP_{LC,i}^{t} + LMP_{CC,i}^{t} \] : node i competitive LMP for new reference bus for t | 1     | Core             | DAM, RTM, MPM, IFM, HASP |
<p>| LMPM-BRQ0200 | DAM/RTM MPM shall perform the bid mitigation for each interval: If market resource’s ( LMP_{NC}^{mitigation\ threshold\ price} ), the resource bid would be mitigated to the higher of the default energy bid (DEB) and its competitive LMP. The bid mitigation apply to all the physical resources subject to LMPM, regardless whether the resource is on-line or not in AC run for the trading intervals. ( Bid_{i}^{Mitigated,t} = \max (DEB_{i}^{t}, LMP_{C,i}^{t}) ); if submitted ( Bid_{i}^{t} &gt; \max (DEB_{i}^{t}, LMP_{C,i}^{t}) ) ( Bus\ submitted Bid_{i}^{t} ) : is per segment of bid-in monotonic cost curve | 1     | Core             | DAM, RTM, MPM, IFM, HASP |
| LMPM-BRQ0201 | Same as current DAM/MPM, DAM/MPM shall produce mitigated bids for each hour. Each hour can have different mitigated bids. | 1     | Core             | DAM, MPM, IFM, HASP |</p>
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<tr>
<td>LMPM-BRQ0202</td>
<td>For RTM/MPM shall perform bid mitigation for 4 15-minute intervals of the trading hour. Each interval can have different non-competitive path designation based on CPA. Each interval can have different reference bus based on AC run path 26 flow. Each interval can have different mitigated bids.</td>
<td>2</td>
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<td>RTM, MPM, HASP</td>
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<tr>
<td>LMPM-BRQ0203</td>
<td>RTM/MPM shall produce one mitigated bid curve for each trading hour. The mitigated bids for each hour are produced by combining the four 15-minute interval mitigated bid curves, using lower envelope of interval bids and used in HASP.</td>
<td>2</td>
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<td>RTM, MPM, HASP</td>
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<tr>
<td>LMPM-BRQ0210</td>
<td>Convergence (virtual) bids shall not be mitigated. PDR bids shall not be mitigated. Dispatchable Demand Resource (DDR) bids shall not be mitigated.</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM, MPM, IFM, HASP</td>
</tr>
<tr>
<td>LMPM-BRQ0211</td>
<td>Limited Energy Storage Resource (LESR) shall be subject to mitigation same as pump storage unit: positive bids shall be mitigated if the LESR is designated to LMPM, and has a DEB; negative bids shall not be mitigated.</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM, MPM, IFM, HASP</td>
</tr>
<tr>
<td>LMPM-BRQ0220</td>
<td>IFM shall use hourly mitigated bids from IFM/MPM.</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM, MPM, IFM, HASP, RTPD, RTD</td>
</tr>
<tr>
<td>LMPM-BRQ0230</td>
<td>The system shall continue to send the mitigated bids to CMRI.</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM, MPM, IFM, HASP, CMRI</td>
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<td>LMPM-BRQ0231</td>
<td>DAM/RTM shall allow operator to issue a manual RMR dispatch. The Manual dispatch MW is RMR amount.</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM, MPM</td>
</tr>
<tr>
<td>LMPM-BRQ0232</td>
<td>RMR condition 2 units, unless the ISO issues a manual RMR dispatch, the resource will not be considered at all in the MPM-RRD. If it is issued manual RMR dispatch, then it will be considered on the basis of its RMR proxy bids. The dispatch MW is RMR.</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM, MPM</td>
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<tr>
<td>LMPM-BRQ0233</td>
<td>For RMR condition 1 units, its market bids will be utilized in the AC run and its RMR proxy bids will be used instead of default energy bids to construct the mitigated bids. The competitive MW level (equivalent to today's CC run MW level) will be derived by comparing the competitive LMP to the bid curve. When it is lined up with a marginal segment, the maximum MW shall be used.</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM, MPM</td>
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<tr>
<td>LMPM-BRQ0236</td>
<td>DAM/RTM shall provide through web services the LMP components from the LMPM pass (whenever the LMPM is executed) for the new reference bus at Pnode/Apnode that are associated for physical bids only (not virtual) for each trading intervals: [ \text{Ref Bus}, \text{LMP}<em>{\text{EC}}^n, \text{LMP}</em>{\text{LC}}^n, \text{LMP}<em>{\text{CC}}^n, \text{LMP}</em>{\text{NC}}^n ]</td>
<td>1</td>
<td>Core</td>
<td>DAM, RTM, MPM, OASIS</td>
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| LMPM-BRQ0237 | Whenever the LMPM is executed, the DAM/RTM shall send the following to OASIS (through web service)  
  - List of binding constraints from the LMPM AC pass and  
  - shadow prices for each trading intervals. | 1     | Core             | DAM, RTM, MPM, OASIS           |
| LMPM-BRQ0239 | MPM using dynamic CPA update the designation of the NC paths after dynamic CPA. | 1     | Core             | DAM, RTM, MPM, IFM, HASP, RTPD  |
| LMPM-BRQ0240 | If Dynamic CPA is chosen for IFM then the system shall ignore the pre-specified designation of the paths in DAM/MPM pass. As mentioned in LMPM-BRQ0239, the MPM using dynamic CPA shall update the designation of the paths after CPA.  
  HASP shall continue use pre-specified NC if static CPA is chosen for HASP. | 1     | Core             | DAM, MPM, IFM, RTM, HASP       |
<p>| LMPM-BRQ0241 | For each path that is tested for competitiveness using the Dynamic CPA in DAM, the system shall send the results to OASIS via web services. One record per hour per path tested. | 1     | Optional         | DAM, MPM, IFM, OASIS           |</p>
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<td>LMPM-BRQ0242</td>
<td>For each path that is tested for competitiveness using the Dynamic CPA in RTM, the system shall send the results to OASIS via web services. For HASP, it would be one record per interval (15 minute) per path tested. For RTPD, the results would include the designation for each RTPD intervals.</td>
<td>2</td>
<td>Optional</td>
<td>DAM, RTM, HASP, OASIS</td>
</tr>
<tr>
<td>LMPM-BRQ0250</td>
<td>After AC run, DAM/MPM with Dynamic CPA option shall perform CPA and then designate the NC paths before the LMP congestion cost recalculation.</td>
<td>1</td>
<td>Core</td>
<td>DAM, MPM, IFM,</td>
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| LMPM-BRQ0260 | For each congested constraint k and each interval t (hour), DAM/MPM shall calculate demand for counterflow DCFₖ as the sum of all dispatched energy that will flow on k in the counterflow direction:  

\[ \text{DCF}_k = \sum_i -SF_{k,i} \times \text{DOP}_i \]  

for physical resources and virtual supply resources i with SFₖ,i < threshold where DOPᵢ is the dispatch operating point for physical or virtual supply resource i. All the resources are included for net seller and net buyer portfolios.  

Note: The flow direction is defined by the MPM AC run flow direction on binding constraint. The sign convention used in this document reflects the resource injection contribution on the binding constraint, SF>0 means the contribution is in the same direction as flow binding in AC run. SF<0 means counterflow for the binding direction. | 1     | Core             | DAM, MPM, IFM,                                                                                                                                         |
<p>| LMPM-BRQ0270 | DAM/MPM shall identify all resources that controlled by the each net seller or net buyer portfolio j. If the resource has tolling contract, the resource shall be allocated to the SC that controls the resource. | 1     | Core             | MF, DAM, MPM, IFM,                                                                                                                                      |</p>
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<td>LMPM-BRQ0280</td>
<td>For each congested constraint k and each interval t, DAM/MPM shall calculate Withheld Capacity ($WC_{k,j}$) for the units (i) that are net suppliers (j) and Shift Factor ($SF_{k,i} &lt; \text{threshold} (-0.02)$) for the congested constraint k. The resource capacity shall include maximum available physical capacity and virtual cleared bid in the AC run. Physical capacity shall include the units that are available but not committed by the AC run. The resources must be controlled by the net seller js. All the resources that controlled by the net sellers shall be included. $WC_{k,j} = \sum_i (-SF_{k,i} \times ENGYMAX_i) + \sum_i SVCF_{k,j,i}$ for resources i of net seller j with $SF_{k,j} &lt; \text{DCPA Threshold}$ Where $ENGYMAX_i = \min([\text{MAXCAP}_i - \text{OR}_i - \text{RU}_i], [\text{MAXECON}_i - \text{OR}_i])$ $\text{MAXCAP}_i = \min([\text{PMAX}_i - \text{DERATE}_i])$, Maximum exceptional dispatch $\text{MAXECON}_i = \min([\text{PMAX}_i - \text{DERATE}_i])$, Maximum exceptional dispatch, Max economic bid MW $\text{PMAX}_i$ is regulation pmax if on regulation otherwise operational Pmax $\text{OR}<em>i$ is self scheduled spinning and non-spinning reserves $\text{RU}<em>i$ is self scheduled regulation up Note that for MSG Plants the SF is given per plant aggregate connectivity node, and the above calculations involve plant level maximums and derates. The withheld capacity calculation shall not consider pump storage resources, pseudo generators associated with PDR/ RDRP/Dispatched Pump resources, NGR LESR and NGR DDR. $SVCF</em>{k,j,i} = -SF</em>{k,j} \times \text{Popt}_i$ for cleared individual virtual bid supply counterflow.</td>
<td>1</td>
<td>Core</td>
<td>DAM, MPM, IFM,</td>
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**Note:** For MSG Plants the SF is given per plant aggregate connectivity node, and the above calculations involve plant level maximums and derates. The withheld capacity calculation shall not consider pump storage resources, pseudo generators associated with PDR/ RDRP/Dispatched Pump resources, NGR LESR and NGR DDR.
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<td>LMPM-BRQ0290</td>
<td>For each congested constraint k and each interval t, DAM/MPM shall Rank (WC_k,j) from highest to lowest, the top three net supplier portfolio js are identified as the set for the potentially pivot suppliers (PPS) for the constraint k.</td>
<td>1</td>
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<td>DAM, MPM, IFM,</td>
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<tr>
<td>LMPM-BRQ0300</td>
<td>For each congested constraint k and each interval t, DAM/MPM shall designate the fringe competitive suppliers (FCS) that are net suppliers and net buyers and not be part of three PPS.</td>
<td>1</td>
<td>Core</td>
<td>DAM, MPM, IFM,</td>
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</table>
| LMPM-BRQ0310 | For each congested constraint k and each interval t, DAM/MPM shall calculate the effective supply of physical counterflow (SPCF_FCS) for fringe competitive suppliers.  
SPCF_FCS_{k,j} = -SF_{k,i} \times ENGYMAX_i  
for resources i in fringe competitive supplier portfolio j with SF_{k,i} < threshold  
The energy supply from pump storage and NGR LESR resources shall be included in the counter flow calculation. The demand side of pump storage and NGR LESR resources shall be excluded from the flow calculation. The NGR DDR, pseudo generators associated with PDR/RDR/Dispatched Pump resources and NGR DDR shall be excluded from the flow calculation. | 1     | Core             | DAM, MPM, IFM,                  |
| LMPM-BRQ0320 | For each congested constraint k and each interval t, DAM/MPM shall set three PPS counterflow SPCF^PPS_{k,j,i} = 0                                                                                                                                                                           | 1     | Core             | DAM, MPM, IFM,                  |
| LMPM-BRQ0330 | For each congested constraint k and each interval t, DAM/MPM shall calculate cleared virtual supply for FCS and PPS by  

SVCF_{FCS}^{PPS}_{k,j,i} = -SF_{k,i} \times DOP_{FCS,i}  
SVCF_{PPS}^{PPS}_{k,j,i} = -SF_{k,i} \times DOP_{PPS,i}.  
The DOP is the cleared virtual supply from AC run. | 1     | Core             | DAM, MPM, IFM,                  |
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<td>LMPM-BRQ0340</td>
<td>For each congested constraint $k$ and each interval $t$, DAM/MPM shall combine effective physical and virtual supply of counterflow. $\text{SPCF}^{\text{FCS}}<em>{k,j} = \sum_i \text{SPCF}^{FCS}</em>{k,i} + \sum_i \text{SVC}<em>{k,i}^{FCS}$ $\text{SCF}^{\text{FCS}}</em>{k,j} = \sum_i \text{SPCF}^{FCS}<em>{k,i} + \sum_i \text{SVC}</em>{k,i}^{FCS}$ $\text{SPCF}^{\text{PPS}}<em>{k,j} = \sum_i \text{SPCF}^{PPS}</em>{k,i} + \sum_i \text{SVC}<em>{k,i}^{PPS}$ $\text{SCF}^{\text{PPS}}</em>{k,j} = \sum_i \text{SPCF}^{PPS}<em>{k,i} + \sum_i \text{SVC}</em>{k,i}^{PPS}$</td>
<td>1</td>
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<td>DAM, MPM, IFM,</td>
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<tr>
<td>LMPM-BRQ0350</td>
<td>For each congested constraint $k$ and each interval $t$, DAM/MPM shall calculate $\text{RSI}_k = (\text{SCF}^{\text{PPS}}_k + \text{SCF}^{\text{FCS}}_k) / \text{DCF}_k$</td>
<td>1</td>
<td>Core</td>
<td>DAM, MPM, IFM,</td>
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<tr>
<td>LMPM-BRQ0360</td>
<td>For each congested constraint $k$ and each interval $t$, if $\text{RSI}_k &lt; 1$, DAM/MPM shall designate $k$ as NC path for the interval $t$ for LMP decomposition and bids mitigation. After dynamic CPA designate the NC for each interval, DAM/MPM shall perform the LMP decomposition and bid mitigation same way as specified in LMPM-BRQ0110 to LMPM-BQR0220.</td>
<td>1</td>
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<td>LMPM-BRQ0361</td>
<td>With LMPM enhancement and dynamic CPA, DAM must meet the market timeline: Each day at 10 am, the DAM closes and the DAM processes begin. The DAM results must be published at 1:00 pm.</td>
<td>1</td>
<td>Core</td>
<td>DAM, MPM, IFM,</td>
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<tr>
<td>LMPM-BRQ0370</td>
<td>If Dynamic CPA is chosen for HASP, the system shall ignore the previously-specified competitiveness (NC) of the paths. MPM will conduct dynamic CPA after the AC run and update the designation of the paths.</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, HASP</td>
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<tr>
<td>LMPM-BRQ0380</td>
<td>After dynamic CPA designated the NC for each interval for HASP, RTM/MPM shall perform the LMP decomposition and bid mitigation for each 4 15-minute intervals same way as specified in LMPM-BRQ0110 to LMPM-BQR0220.</td>
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<td>RTM, MPM, HASP</td>
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<tr>
<td>LMPM-BRQ0390</td>
<td>If Static CPA is chosen for RTPD, mitigated bids used in HASP shall be used through the trading hour.</td>
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<td>RTM, MPM, HASP, RTPD</td>
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<tr>
<td>LMPM-BRQ0400</td>
<td>If Dynamic CPA is chosen for RTPD, after each RTPD run for the trading hour 15-minute interval, RTPD shall conduct dynamic CPA and designate NC. RTPD shall conduct LMP decomposition and bids mitigation.</td>
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<td>Core</td>
<td>RTM, MPM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0410</td>
<td>After dynamic CPA designate the NC for RTPD, the RTPD shall perform the LMP decomposition and bid mitigation same way as specified in LMPM-BRQ0110 to LMPM-BQR0220.</td>
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<td>Core</td>
<td>RTM, MPM, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0420</td>
<td>With RTM Dynamic CPA, HASP hourly mitigated bid curve shall apply to the subsequent RTPD HASP trading hour intervals until the RTPD applicable mitigation interval is the HASP trading hour first 15 minute interval.</td>
<td>2</td>
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<td>RTM, MPM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0430</td>
<td>The RTPD shall use the original non-mitigated bids for the DCPA and bid mitigations for the HASP trading hour intervals.</td>
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<td>Core</td>
<td>RTM, MPM, RTPD</td>
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<tr>
<td>LMPM-BRQ0431</td>
<td>. The RTPD mitigated bids will be carried over the rest of the hour for latter RTPD and RTD.</td>
<td>2</td>
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<td>RTM, MPM, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0440</td>
<td>For the HASP trading hour, the resources that not be mitigated by the prior RTPD process will use the original non-mitigated bids in RTD and latter RTPD.</td>
<td>2</td>
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<td>RTM, MPM, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0450</td>
<td>Run subsequent RTPD with most recent mitigated bids set. Perform CPA and LMP decomposition for bid mitigation for the applicable interval.</td>
<td>2</td>
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<td>RTM, MPM, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0460</td>
<td>The mitigated bids from subsequent RTPD shall add to the prior bid mitigation sets to apply the applicable interval RTD and latter RTPD of the trading hour. Once the unit is mitigated through RTPD process, the mitigated bids shall be applied to the end of the hour, not subject to mitigation again at latter RTPD.</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0470</td>
<td>RTM dynamic CPA follow the similar process specified for DAM dynamic CPA. But the resource ramp rate, operation range. Include quick start resources are considered in the Withheld capacity calculation and the counterflow supply calculation. The AS self schedule amount are used in HASP dynamic CPA, AS awards are used in RTPD dynamic CPA.</td>
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<td>Core</td>
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<tr>
<td>LMPM-BRQ0480</td>
<td>RTM dynamic CPA shall not include virtual supply of counterflow.</td>
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<td>LMPM-BRQ0490</td>
<td>RTM/PM shall calculate Withheld Capacity ($WC_{k,i}$) for the units (i) that are net suppliers (j) and Shift Factor ($SF_{k,i} &lt; \text{threshold}$) for the congested constraint k from pre-HASP AC run in each four of 15 minute intervals; The operation range shall be calculated base on ramp rate and operation capacity.</td>
<td>2</td>
<td>Core</td>
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$$WC_{k,i} = \sum_i -SF_{k,i} \times \left[ \min \left( P_{opt_i} + RR_i * 15 \right), \text{ENGYMAX}_i \right] - \max \left( P_{opt_i} - RR_i * 15 \right), \text{ENGYMIN}_i.$$  

Popt is resource i’s dispatch operating point from the previous interval  
RR is resource i’s ramp rate in MW/minute  
Where $\text{ENGYMAX}_i = \min\left( \text{MAXCAP}_i - \text{OR}_i - \text{RU}_i \right), \text{(MAXECON}_i \text{) - OR}_i \right)$  
MAXCAP is price sensitive dispatch including transferred DA spin capacity + HASP qualified self scheduled non-spinning capacity  
MAXECON, is economic bid MW, Maximum exceptional dispatch  
PMAX is regulation Pmax if on regulation otherwise operational Pmax  
OR is HASP qualified self scheduled spinning including transferred DA spin capacity + HASP qualified self scheduled non-spinning including transferred DA non-spinning capacity.

RU is HASP qualified self scheduled regulation up including transferred DA regulation up capacity.  
RR is the effective ramp rate at Popt (in case of dynamic ramp rate)  
Where $\text{ENGYMIN}_i = \max\left( \text{MINCAP}_i + \text{RD}_i \right)$, Self scheduled energy  
MINCAP = $\max\left( \left[ \text{Pmin}_i + \text{Pmin RERATE}_i \right], \text{minimum exceptional dispatch} \right)$  
PMIN is regulation pmin if on regulation otherwise operational pmin  
RD is HASP qualified self scheduled regulation down including transferred DA regulation down capacity. For a unit that is offline in the previous interval and has a startup time of 60 minutes or less, then $WC = P_{min}$. For RTPD other than HASP, the startup time to be used will be reduced to 15 minutes or less.

The withheld capacity calculation shall not consider pump storage resources, pseudo generators associated with PDR/RDRP/Dispatched Pump resources, NGR LESR and NGR DDR. For MSGs only the MSG configuration that is committed is taken into account.
<table>
<thead>
<tr>
<th>ID#</th>
<th>Business Feature</th>
<th>Phase</th>
<th>Requirement Type</th>
<th>Potential Application(s) Impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMPM-BRQ0491</td>
<td>For pre-HASP DCPA, include short-start unit that is off-line, if it has a start up time 60 minute or less, then WC=Pmin. For 15 minute RTPD DCPA, include quick start unit that is off-line, if it has a start up time 15 minute or less, then WC=Pmin.</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0492</td>
<td>Capacity pump storage resources, pseudo generators associated with PDR/ RDRP /Dispatched Pump resources, NGR LESR and NGR DDR will NOT be included in the calculation for withholding capacity in DA, HASP, and RTPD but WILL BE included in the calculation for effective supply of counter-flow and demand for counter-flow. Capacities from the resources when consuming are always excluded in all calculations.</td>
<td>2</td>
<td>Core</td>
<td>DAM, MPM, RTM, MPM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0493</td>
<td>Units that are offline with a startup time 60 minutes or less for HASP (15 minutes or less for RTPD) will have a withholding capacity and available supply equal to Pmin. The supply will be multiplied by the SF to calculate effective supply of counter-flow.</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0494</td>
<td>Units that are ramping up, i.e. cleared value less than Pmin, will have a withholding capacity and available supply equal to the current intervals cleared value. Supply will be multiplied by the SF to calculate effective supply of counter-flow.</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0495</td>
<td>In HASP/RTPD only the configuration which is committed will be considered for MSG</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0499</td>
<td>Same process as Pre-HASP DCPA will be applied to RTPD 15 minute interval DCPA. The formula of LMPM-BRQ0490 is used except Regulation up, regulation down, spinning, and non-spinning quantities will be the awarded quantity from the RTPD market run, not self scheduled AS. Startup time is 15 minute or less for offline unit to be included.</td>
<td>2</td>
<td>Core</td>
<td>RTM, RTPD</td>
</tr>
<tr>
<td>ID#</td>
<td>Business Feature</td>
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</tr>
<tr>
<td>LMPM-BRQ0500</td>
<td>For each k and interval t, RTM/MPM shall rank (WC\textsubscript{k,j}) from highest to lowest, the top three suppliers j are identified as the set for the potentially pivot suppliers (PPS) for the constraint k. designate the fringe competitive suppliers (FCS) that are net suppliers and net buyers and not be part of three PPS.</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0510</td>
<td>For each k and interval t, RTM/MPM shall calculate supply of counterflow from FCS, for each binding constraint k in any four of 15 minute intervals ( \text{SPCF}<em>{FCS}^{k,j,i} = -SF</em>{k,i} \times \min ([P_{opt,i} + RR_{i} \times 15) , ENGYMAX_{i}] ) With ( SF_{k,i} &lt; \text{threshold} )</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0520</td>
<td>For each k and interval t, RTM/MPM shall calculate PPS: ( \text{SPCF}<em>{PPS}^{k,j,i} = -SF</em>{k,i} \times \max (P_{opt,i} - RR_{i} \times 15) , ENGYMIN_{i} ) With ( SF_{k,i} &lt; \text{threshold} )</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0530</td>
<td>For each k and interval t, RTM/MPM shall calculate demand for counterflow ( DCF_{k} = \sum_{i} -SF_{k,i} \times DOP_{i} ) With ( SF_{k,i} &lt; \text{threshold} )</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0540</td>
<td>For each k and interval t, RTM/MPM shall calculate physical supply of counterflow for fringe competitive suppliers ( SCF_{FCS}^{k} ) and potential pivotal suppliers ( SCF_{PPS}^{k} ) ( SF_{k,i} = \sum_{k} \text{SPCF}<em>{FCS}^{k,i} ) ( SCF</em>{FCS}^{k} = \sum_{i} \text{SPCF}<em>{FCS}^{k,i} ) ( SF</em>{k,i} = \sum_{k} \text{SPCF}<em>{PPS}^{k,i} ) ( SCF</em>{PPS}^{k} = \sum_{i} \text{SPCF}_{PPS}^{k,i} )</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0550</td>
<td>For each congested constraint k and each interval t, RTM/MPM shall calculate ( RSI_{k} = (SCF_{PPS}^{k} + SCF_{FCS}^{k}) / DCF_{k} )</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, HASP, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0560</td>
<td>RTM/MPM ensure k is deemed uncompetitive for each interval if ( RSI_{k} &lt; 1 ) in each four of 15 minute interval of the trading hour.</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, HASP</td>
</tr>
<tr>
<td>ID#</td>
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<td>---------------------------------------------------</td>
</tr>
<tr>
<td>LMPM-BRQ0570</td>
<td>RTM/MPM shall perform bid mitigation apply the same steps LMPM-BRQ0110-LMPM-BRQ0220 in this section. DCPA for HASP and bid mitigation are applied for each interval. The mitigated bids for each hour are produced by combining the four 15-minute interval mitigated bid curves, using lower envelope of interval bids. Hourly mitigated bids will be applied to HASP and following RTPDs' HASP trading hour 4 intervals until the applicable mitigation interval of RTPD is the first interval of HASP trading hour.</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, HASP</td>
</tr>
<tr>
<td>LMPM-BRQ0580</td>
<td>Dynamic CPA shall be applied to the applicable interval after each RTPD run for the interval of trading hour using same step as HASP.</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, RTPD</td>
</tr>
<tr>
<td>LMPM-BRQ0590</td>
<td>RTPD shall perform bid mitigation apply the same steps of LMPM-BRQ0110-LMPM-BRQ0220 in this section. Mitigated bids will be applied to corresponding interval three 5-minute RTD and latter RTPD.</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, RTPD, RTD</td>
</tr>
<tr>
<td>LMPM-BRQ0600</td>
<td>RTPD shall send mitigated bids to MQS every 15 minutes.</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, RTPD, MQS</td>
</tr>
<tr>
<td>LMPM-BRQ0610</td>
<td>RTPD shall send mitigated bids to CMRI every 15 minutes. CMRI shall display mitigated bids for every 15 minute (RTPD) interval upon receiving the payload containing mitigated bids from RTPD.</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, RTPD, CMRI</td>
</tr>
<tr>
<td>LMPM-BRQ0620</td>
<td>If RTM/MPM pre-HASP run failed, no bid mitigation shall apply. If RTPD run fails, the post-processing -price-correction rerun shall be applied. Rerun shall follow the same process in the market.</td>
<td>2</td>
<td>Core</td>
<td>RTM, MPM, RTPD, Post-process Price correction</td>
</tr>
<tr>
<td>LMPM-BRQ0623</td>
<td>DAM/RTM shall provide through web services the Dynamic CPA Binding constraints Non-competitive path designation for each intervals. Interval for DAM is hour, for RTM is the 15 minutes. Each interval can have different binding constraints, each interval can have different non-competitive path designation.</td>
<td>1, 2</td>
<td>Core</td>
<td>DAM, MPM, RTM, MPM, RTPD, OASIS</td>
</tr>
</tbody>
</table>
4.4 Business Process: <Manage CMRI>

4.4.1 Business Requirements

<table>
<thead>
<tr>
<th>ID#</th>
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</thead>
<tbody>
<tr>
<td>LMPM-BRQ0630</td>
<td>CMRI shall display mitigated bids after 15 minute RTPD, receive RTPD payload with mitigated bids.</td>
<td>2</td>
<td>Core</td>
<td>RTPD, CMRI</td>
</tr>
</tbody>
</table>

4.5 Business Process: <Manage Market Quality System (MQS)>

4.5.1 Business Requirements

The requirements listed in this section are not new and are not changing with this project. These are listed here remind Siemens (MQS Vendor) of the existing functionality that shall remain unchanged with this project.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>LMPM-BRQ0640</td>
<td>MQS shall receive mitigated bids for every 15 minute RTPD interval.</td>
<td>2</td>
<td>Core</td>
<td>RTPD, MQS</td>
</tr>
</tbody>
</table>

4.6 Business Process: <Manage Market Billing and Settlements (SAMC)>

4.6.1 Business Requirements

<table>
<thead>
<tr>
<th>ID#</th>
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<th>Potential Application(s) Impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMPM-BRQ0650</td>
<td>The calculation / algorithm of Bid Cost Recovery shall use the mitigate bids.</td>
<td>2</td>
<td>Core</td>
<td>MOS, MAPP, SaMC</td>
</tr>
</tbody>
</table>

4.7 Business Process: <Manage OASIS>

4.7.1 Business Requirements
### 4.8 Business Process: Metrics and Performance Criteria

#### 4.8.1 Business Requirements

<table>
<thead>
<tr>
<th>ID#</th>
<th>Business Feature</th>
<th>Requirement Type</th>
<th>Manual Or Auto</th>
<th>Potential Application(s) Impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMPM-BRQ0561</td>
<td>The implementation of the requirements mentioned in this BRS shall not negatively impact the execution time of any of the runs.</td>
<td>Core</td>
<td>Auto</td>
<td>IFM, RTM, HASP, RTPD, OASIS, CMRI, MQS, MAPP</td>
</tr>
</tbody>
</table>

### 4.9 Business Process: Information Security Adherence

<table>
<thead>
<tr>
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<th>Requirement Type</th>
<th>Manual Or Auto</th>
<th>Potential Application(s) Impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMPM-BRQ591</td>
<td>Adherence to all existing ISO security standards is required</td>
<td>Core</td>
<td>Auto</td>
<td>IFM, RTN, SMDM</td>
</tr>
</tbody>
</table>