Post-Release-1 MRTU Scoping Study (Study Initiation White Paper)

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1. Introduction

The MRTU Release 1 to be implemented in Fall 2007 includes all functionality indispensable for successful performance of the MRTU markets upon start-up. Nevertheless, some additional functionality is highly desirable to enhance the performance of the MRTU markets or provide capabilities desired by market participants. Specifically:

- In their February 23, 2005 review report of CAISO's initial MRTU design, LECG identified a dozen areas of concern that needed to be reviewed by the CAISO for potential inclusion in the MRTU implementation. Three of these (Load Aggregation Point (LAP) clearing, Hour-Ahead Scheduling Process (HASP) pricing, and Local Market Power Mitigation (LMPM) were considered critical to address before starting the MRTU market, and have already been incorporated in MRTU Release 1. Others were judged to be significant but not critical enough to warrant delaying the MRTU Release 1 to accommodate them.
- In 2005, in the course of the MRTU policy and page-turn discussions with stakeholders, a number of additional highly desirable features and functions were also identified that could not be accommodated in Release 1, but were judged not to be essential to delay MRTU implementation.
- Finally, during CAISO's internal Tariff/Policy/Software reconciliation effort prior to MRTU filing, CAISO staff identified a number of highly desirable software functionality that could not be accommodated in Release 1, but were judged not to be essential to delay MRTU implementation.

An initial list of 23 features and functions so compiled was presented to CAISO Board at their March 8, 2006 meeting. This list is provided below in Section 3 followed by a brief explanation of each in Section 4.

A stakeholder process is scheduled on July 18-19, 2006 to start discussion and prioritization of the features and functions on this list, along with any other candidate features and functions that may be identified at that meeting as significant improvements for comparable consideration. Collectively, these items are referred to as Post Release 1 MRTU Features and Functions (PR1).

For the afternoon session of July 18th, stakeholder discussion will be focused on the development of "Ranking Criteria" that upon completion will be applied for prioritizing the PR1 issues. CAISO management intends to incorporate the outcome of the July 18th stakeholder discussion in its presentation of a formal "Ranking Criteria" to the CAISO Board for information at the August 3rd Board meeting.

This White Paper outlines the initial PR1 list and initiates a "PR1 Scoping Study" to continue throughout the third quarter of 2006. During the morning session of the July 19th stakeholder meeting, these issues will be reviewed along with other suggested features of prime interest to stakeholders. The objectives of this "Scoping Study" (as outlined in Section 2) will be reviewed.

The CAISO envisions that subsequent monthly PR1 Scoping Study stakeholder meetings would be conducted about the middle of each month. To expedite the process during these monthly meetings, stakeholder Breakout Work Groups will be formed at the July 19th meeting on topics of highest interest to the stakeholders. The idea is for these groups to hold discussions (via email, CAISO setup mailboxes, or conference calls) in between the monthly meetings, and

develop proposals, carry out evaluation of alternatives, and identify recommendations for discussion at the monthly PR1 stakeholder meetings.

2. Scoping Study Objectives

One objective of the PR1 scoping study will be to discuss and classify the candidate features and functions (PR1 list) into three categories, namely:

- Release 1A: This category will include features and functions that lead to significant enhancement of the MRTU market with high cost effectiveness. This category will be slated for implementation as soon as possible after MRTU Release 1 has operated in a stable manner for a reasonable length of time from both the system and market point of view. At this time CAISO estimates that Release 1A could be implemented no sooner than 12 months after the start of the MRTU Release 1 market, but it may take longer depending on the number and nature of the features and functions that will eventually be included in this category.
- Release 2: This category will include features and functions that lead to substantial enhancement of the MRTU market, but may require either longer implementation time or higher implementation cost, and generally rank somewhat lower than those in the Release 1A category. Software implementation will be scheduled consistent with CAISO periodic release cycles.
- Deferred: This category may include items in which the cost to implement exceeds the estimated value to the marketplace, or items that have otherwise been characterized as "non-essential".

Additional objectives of the PR1 scoping study will be:

- By the end of Fall 2006, to formulate alternatives and identify the recommended solution for Release 1A functions and estimate the costs, benefits, and risks of the preferred solution in each case for information to the Board of Governors.
- By the end of 2006, formulate alternatives and identify the recommended solution for Release 2 functions and estimate the costs, benefits, and risks of the preferred solution in each case.

3. Initial List of Candidate Features and Functions

The following is a list of the candidate post Release 1 features and functions presented to CAISO Board on march 8, 2006, with no particular order as to their relative priority or originating source, except for Convergence Bidding. To avoid confusion, the same numbering of features and functions used for the March 8 Board memo is used here, although the explanation of the issues in the next section has been updated as relevant.

1. Convergence Bidding
2. Day-Ahead Market Power Mitigation and Unit Commitment issues, including the following elements:
   (a) Use of bid-in Demand rather than Demand forecast in Pre-Integrated Forward Market (IFM) passes in the Day-Ahead Market
   (b) Eliminating use of extreme DEC bids on the Pass 1 pre-IFM schedules in Pass 2 pre-IFM

(c) Unrestricting the pool of resources in the IFM pass for the Day-Ahead Market

(d) Developing an alternative means to determine RMR pre-dispatch

3. Simultaneous Residual Unit Commitment (RUC) and IFM
4. Participating Load demand response in Day-Ahead Market
5. The California Energy Commission's proposal on rebate of loss over-collection for renewable resources
6. System-level scarcity pricing
7. Consideration of a full Hour-Ahead settlement market
8. Dynamic pivotal supplier test for market power mitigation
9. Multi-settlement system for Ancillary Services
10. Consideration of import energy in the RUC process
11. Multi-day unit commitment in the IFM
12. DEC Bidding Activity Rule on Final Day-Ahead Resource Schedules
13. Ramping Limits for the Real-Time Pricing Run with Constrained Output Generation (COG)
14. LMPM for COG units; provision for daily bidding of minimum load
15. Ramp Rates
    a. Operational ramp rate function
    b. Operating Reserve ramp rate
16. Ancillary Service Self-Provision at the Interties
17. Reservation of transmission capacity for Ancillary Service exports
18. Hourly designation of Ancillary Service Contingency Only Flag
19. Combined-cycle modeling
20. Treatment of use-limited resources with limited number of hours or start ups
21. Start Up Energy
22. Automatic treatment of conditional A/S self provision
23. Automation of sub-LAP adjustments in step 3 of LAP clearing validation

A brief explanation of each of the above features and functions is presented below.

4. Brief Explanation of Candidate Features and Functions

4.1 Convergence Bidding

Convergence Bidding (also known as Explicit Virtual Bidding) is a mechanism whereby market participants can make financial sales (or purchases) of energy in the Day Ahead market, with the explicit requirement to buy back (or sell back) that energy in the Real Time market, thereby arbitraging their expected differences between Day Ahead and Real Time prices. The CAISO is under FERC order to implement Convergence Bidding as soon as possible after Release 1. At present this function has a high priority for resolution, although eventually it will be ranked along

with other features and functions on the PR1 list during the scoping study. A tutorial and panel session was held on June 13, 2006, and related documents are posted at: http://www.caiso.com/1807/1807996f7020.html. A separate White Paper has been developed to initiate discussion during the July 19th stakeholder meeting of the design alternatives for convergence bidding (http://www.caiso.com/1831/1831d8652cac0.pdf).

4.2 Day-Ahead Market Power Mitigation and Unit Commitment Issues

In their review of CAISO's proposal for the day-ahead market processes (Pre-IFM, IFM, and RUC), LECG expressed concerns with three aspects of CAISO's proposal, namely, the use of forecast load rather than bid-in demand in Pre-IFM, the use of extreme DEC bids in Pre-IFM Pass 2 for schedules selected in Pre-IFM Pass 1, and restricting the pool of resources in IFM and RUC based on unit commitment in Pre-IFM. CAISO could address only one of these issues partially (unrestricting the pool of resources in RUC) in release 1, and after analysis of the underlying issues concluded (and LECG agreed) that these elements were not critical enough to delay implementation of Release 1. Subsequently, FERC ordered CAISO to revise its pre-IFM procedure to base it on bid-in demand. The CAISO filed a rehearing request explaining that such a change could not be accommodated in Release 1 without substantial delay of the Release 1 implementation schedule. A related issue not addressed by LECG (or FERC) that will have to be worked out if pre-IFM is to be based on bid-in demand is RMR pre-dispatch. RMR pre-dispatch relies on the use of forecast rather than bid-in demand. Therefore, the features slated in this category consist of four elements:

a) Use of bid-in Demand rather than Demand forecast in Pre-IFM passes in the Day-Ahead Market

b) Eliminating use of extreme DEC bids on the Pass 1 pre-IFM schedules in Pass 2 pre-IFM

c) Unrestricting the pool of resources in the IFM pass for the Day-Ahead Market

d) Developing an alternative means to determine RMR pre-dispatch

4.3 Simultaneous RUC and IFM

In the current MRTU design Residual Unit Commitment (RUC) is performed after completion of the IFM and does not impact Day-ahead Market Energy, A/S, and Congestion/CRR pricing and settlement. The question here is whether to perform IFM and RUC simultaneously, and if so, how. Strictly speaking, there is no precedence for true simultaneous RUC and IFM market clearing at other ISOs. Currently, PJM conducts Residual Unit Commitment after the Day-ahead Market (sequential RUC). New York ISO includes RUC in the day-ahead market pricing process, but the commitment decisions to meet the bid-in and forecast demand are sequential.

4.4 Participating Load demand response in Day-Ahead Market (DAM)

The CAISO's initial design proposed that Participating Loads would be able to purchase energy in the DAM at the LAP price and sell back demand response – also in the DAM – at the nodal price. LECG's February 2005 comments identified this treatment of Demand Response as a major implementation issue that would create poor market incentives. As a result, in Release 1 MRTU will support Demand Response only from Participating Loads that can respond to real-time dispatch instructions by reducing their demand, and will settle these entities at the nodal price for both their energy consumption and their real-time demand response. As part of the

PR1 scoping study, the CAISO will consider potential alternative designs to allow Participating Loads to offer demand response in the DAM.

Note: Due to software implementation issues in Release 1, aggregate Participating Loads (such as pumps located at different locations within a LAP but bid as aggregate) can be bid only as an ON-OFF aggregate. Manual workarounds are under consideration to facilitate more flexible bidding for such resources. Detailed representation (as negative generator) for scheduling, dispatch, and locational pricing and settlement purposes may be included as a separate PR1 issue for evaluation and ranking separately from the broader DAM Participating Load issue stated above.

4.5 The California Energy Commission's (CEC) proposal on rebate of loss over-collection for renewable resources

In spring 2005 in the context of the MRTU stakeholder process the CEC proposed a method for reducing the impact of LMP-based marginal transmission loss charges on intermittent resources. At the time the ISO and the stakeholders agreed to defer discussion of this proposal for consideration after MRTU Release 1. Subsequently, in the 2005 MRTU stakeholder and policy resolution process the ISO agreed to modify the crediting back of marginal loss surplus revenues and accelerate that process, so the question for discussion in the scoping study is whether special treatment for intermittent resources is still needed, and if so, how.

4.6 System-level scarcity pricing

The current MRTU design provides for scarcity pricing for Energy; however, no explicit measures are included for scarcity pricing of Reserves. In the MRTU Release 1, Reserve prices may exceed the bid cap to the extent of the opportunity cost of Energy. In other words, Reserve prices will generally be limited to the sum of the prevailing bid cap for Reserves plus the prevailing bid cap for Energy. The question is whether (a) this implicit scarcity pricing (double cap) is adequate for scarcity pricing of Reserves, or (b) explicit scarcity pricing for Reserves should be provided.

4.7 Consideration of a full Hour-Ahead settlement market

The question is whether to augment the two-settlement market design of MRTU Release 1 with a third Hour Ahead settlement market, which could be either a substitute for or in addition to the Hour Ahead Scheduling Process (HASP) element of the Release 1 design.

4.8 Dynamic pivotal supplier test for market power mitigation

Local Market Power Mitigation in Release 1 is accomplished through prior classification of transmission constraints as "Competitive" or "Non-competitive". The question here is whether this process should (or could) be replaced by "on-the-fly" determination of pivotal suppliers in the market-clearing process.

4.9 Multi-settlement system for Ancillary Services

LECG's February 2005 report stated that the lack of a full multi-settlement system for Ancillary Services that optimizes real-time reserves and settles deviations from day-ahead schedules at real-time prices could raise consumer costs when reserves scheduled in the Day Ahead market must generate energy in Real Time as a result of minimum run times, minimum down times or transmission constraints. The Release 1 design procures A/S in the Day Ahead market to meet

100% of forecasted real-time needs, and then procures additional A/S incrementally in Real Time only to the extent that they are needed due to changes in system conditions or demand exceeding the Day Ahead forecast. Moreover, unless the Operating Reserves are designated as “Contingency Only”, their energy will be dispatched economically, and if as a result the Operating Reserves fall below the NERC/WECC’s Minimum Operating Reserves Criteria (MORC), CAISO will procure additional Operating Reserves in real-time. The question to be considered is whether to modify the Release 1 design to create a multi-settlement A/S market as suggested by LECG.

4.10 Consideration of import energy in the RUC process

Early in the 2005 MRTU stakeholder process it was suggested that import energy bids that were not cleared in the IFM could be considered in the RUC optimization by treating such bids in the same manner as the minimum load bids of internal generators that were not committed in the IFM. The question to consider is whether, in light of the treatment of imports in RUC as filed in the Release 1 MRTU tariff, any additional provisions for considering imports in RUC are needed or appropriate.

4.11 Multi-day unit commitment in the IFM

In MRTU Release 1, the forward looking time horizon in IFM is one day, taking into account the impact of prior commitment of units with very long start up times. During the MRTU Stakeholder meetings there were requests that the CAISO make commitment decisions in the IFM that look out beyond a single day in order to create a commitment decision that is more efficient and better reflects the impact of startup-up cost for a resources that have long start-up times. There are several design issues, including the need for bidding and bid replication rules as well as software performance and solution time requirements, that must be discussed and resolved via a stakeholder process before considering modification of the software to accommodate Multi-Day unit commitment in IFM.

4.12 DEC Bidding Activity Rule on Final Day-Ahead Resource Schedules

The bidding activity rules in MRTU Release 1 disallow post Day-Ahead Market reduction of the Energy Bid prices that have been accepted in the IFM. This activity rule was designed to prevent the “DEC” game in situations where transmission derates require re-dispatch of generation in the real-time market. LECG pointed out problems with this activity rule. The issue under consideration is to relax this activity rule without the risk of creating “DEC” game incentives. One proposed solution is to allow a limited re-bid period shortly after the publication of the Day-Ahead market results (e.g., between 1:00 p.m. and 3:00 p.m.) without enforcing this activity rule. Accordingly, during the re-bid period, accepted Day-Ahead bids can be changed above or below the corresponding Day-Ahead bid prices for use in the Real-Time market.

4.13 Ramping Limits for the Real-Time Pricing Run with Constrained Output Generation (COG)

The February 2005 LECG report stated that the mechanism proposed for implementation of real-time constrained output generator (COG) pricing could result in the calculation of inappropriately high prices during circumstances in which uneconomic gas turbines are operating as a result of either minimum run time or minimum-down time constraints. The proposed solution to be considered, which is used in the NYISO markets, is to use the dispatch level of non-COG resources from the previous interval’s pricing run as the initial operating point

of the non-COG resources in the pricing run for the current interval, rather than using telemetry as basis for the initial operating point of non-COG resources as the Release 1 software will do.

4.14 LMPM for COG units; provision for daily bidding of minimum load

In the course of the stakeholder discussions and during the Tariff page turn in 2005, the ability for the COG resources to bid their Minimum load on a daily basis, subject to local market power mitigation, was stated as a highly desirable feature. During the Tariff/Policy/Software reconciliation process, it was noted that local market power mitigation of COG resources could not be implemented in Release 1. This feature is thus slated as a potential post Release 1 feature for discussion and prioritization.

4.15 Ramp Rates

The issues in this category consist of Operational ramp rates and Operating Reserve ramp rates. These are explained briefly below:

a. Operational ramp rate function

   Operational ramp rates are used for scheduling and dispatch in real time. In order to maintain performance of the software within the required solution timing parameters, the number of operational ramp-rate segments supported in Release 1 is limited to 4 (versus 10 segments initially contemplated). Only 5% of the resources with ramp-rates operational ramp-rates defined in the Master-File would have ramp rates with more than 4 segments defined. Some participants have concerns about the reduction in the number of ramp-rate segments. After actual performance is determined, the CAISO can work with its vendor to determine if additional operational ramp-rate segments can be supported.

b. Operating Reserve ramp rate

   While a separate Operating Reserve ramp-rate is used for procuring the spinning and non-spinning reserves, the Operational ramp rate is used for all dispatching of a resource. To the extent the operational ramp rate at a given operating level is less than the Operating Reserve ramp-rate, the resource may be subject to A/S “No-Pay” charge for reserves that are not actually available based on the lower Operational ramp rate. Modifications to the software would be necessary to more closely align procurement of A/S with energy dispatch from A/S capacity in real-time.

4.16 Ancillary Service Self-Provision at the Interties

Under MRTU Release 1 the self-provision of Ancillary Services from interties is not supported. Import A/S can only be bid and must compete with import energy bids for the use of New Firm Use (NFU) transmission capacity. A candidate feature to be studied for a subsequent MRTU release is to accommodate A/S self provision from the inter-ties.

4.17 Reservation of transmission capacity for Ancillary Service exports

Under MRTU Release 1 there is no formal mechanism or specific process for on-demand export of A/S. The optimization does not reserve transmission capacity for this functionality. In MRTU Release 1, a manual workaround will be provided for entities with on-demand obligation, to the extent transmission capacity is available (or must be reserved according to ETC/TOR rights). A

candidate feature for a subsequent MRTU release is to build the reservation of transmission capacity into the optimization so that market participants who might have an obligation to supply Ancillary Service energy in real-time to neighboring control areas can serve this obligation.

4.18 Hourly designation of Ancillary Service Contingency Only Flag

In MRTU Release 1 the designation of "Contingency Only" Ancillary Services is accommodated on a daily basis. Provisions for hourly designation of "Contingency Only" A/S is slated as a potential post Release 1 feature.

4.19 Combined-cycle modeling

In MRTU Release 1 different configurations of a combined cycle unit are modeled collectively as a single resource. The idea here is to model each configuration as a separate resource, and incorporate software capability to ensure changes in configuration during different scheduling and commitment cycles in the course of the optimization process respect all relevant technical and inter-temporal constraints. This approach is of interest to different ISOs, but has not yet been implemented successfully.

4.20 Treatment of use-limited resources with limited number of hours or start ups

Use-limited resources accommodated in MRTU Release 1 are those with Energy (MWh) limitations. The idea here is to incorporate software capability to accommodate other types of use limitation, including limitation on the number of hours of usage, or the number of start-ups a resource may be used for, during the scheduling horizon.

4.21 Start Up Energy

The current MRTU design (Release 1) will not explicitly recognize the time lapse from unit synchronization to operations at its minimum stable operating unit. Any Start Up Energy, i.e., energy produced during the time interval from synchronization to minimum load, is assumed to be uninstructed deviation. Various stakeholders have requested that Start-up energy be considered as instructed energy during the dispatch process. Some resources may take time to ramp to minimum load. Better recognition of this start-up ramp will better reflect the imbalance energy needs and reduce uninstructed deviations during resource start-up.

4.22 Automatic treatment of conditional A/S self provision (Now Accommodated in Release 1)

Under MRTU Release 1 resources can indicate their intention to self provide A/S. In the MRTU design filed on February 9, 2006, resources self-providing A/S were not subject to optimization in the IFM engine, but were protected. Since qualification of Self Provided A/S occurs before co-optimization of Energy, A/S, and Congestion, this meant that if a resource under contractual obligation to offer (e.g., an RMR or RA unit) self-provided A/S then that capacity was no longer available to resolve local constraints in pre-IFM runs. Effectively, self-provided A/S that was not disqualified prior to IFM optimization had higher priority than load. The CAISO had detailed a manual workaround to qualify/disqualify Self Provided A/S from resource under contractual obligation to offer (e.g., an RMR or RA unit). In subsequent discussions with the vendor, it turned out that the manual process CAISO was contemplating could in fact be automated in

Release 1 for A/S self provision from internal resources. This is thus no longer a candidate feature for post Release 1 MRTU. since it is already accommodated in Release 1.

Note: ***To keep consistent numbering of PR1 Issues compared to the March 8 Board presentation, we have kept placeholder for Issue 22, which we may use for either the Aggregated Participating Load issue (see note under Issue 5), or another functionality that may be of significant interest to the stakeholders.***

4.23 Automation of sub-LAP adjustments in step 3 of LAP clearing validation

As explained in the MRTU Tariff and testimonies, the LAP clearing procedure recommended by LECG and incorporated in MTU Release 1, may under some rare conditions result in unintended inefficiencies. A three-step process was suggested to deal with such rare situations. The third step in this process involves "softening" the constraints imposed by fixed LAP Load Distribution Factors (LDFs) and allowing independent adjustment of nodal loads. A manual process in MRTU Release 1 will accomplish this step. The issue here is to automate this step in the post Release 1 MRTU software.

5. Stakeholder Inputs

Will be completed after the July 19th meeting.

6. Next Steps

Will be completed after the July 19th meeting.