Final Proposal

Reserve Scarcity Pricing Design

July 15, 2008
# Final Proposal
## Reserve Scarcity Pricing Design

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Revision Summary

This Final Proposal for Reserve Scarcity Pricing Design has modifications from the Revised Draft Proposal dated May 20, 2008. The modifications respond to issues raised by stakeholders and reflect the CAISO’s final recommendations. They are summarized as follows:

1) The CAISO proposes to wait until nine months after the startup of MRTU to decide with stakeholders when to enable the Scarcity Pricing mechanism in the A/S Sub-Regions. The CAISO will initiate a discussion with stakeholders concerning the Scarcity Reserve Demand Curve to be utilized in the A/S Sub-Regions, which may include a new A/S product designed to meet 30 minute contingencies if the CAISO and stakeholders finds that such an A/S product is necessary.

2) Due to restrictions on operating conditions, the CAISO proposes that RA hydro units should submit A/S bids, together with their energy bids, in the day-ahead market for all their available A/S capacity based on the expected available energy. Hydro RA units submitting energy self-schedules will not be required to offer A/S in the day-ahead market.

3) Based on FERC June 20, 2008 MRTU Order, the CAISO proposes not to consider sub-regional A/S cost allocation at this time.
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Executive Summary

Scarcity Pricing is a mechanism that lets the market prices rise automatically, potentially beyond any applicable bid cap, when there is a shortage of supply in the market. Following general practice in other ISO markets, shortage is defined as the inability by the California ISO (CAISO) to procure sufficient regulation or operating reserves through market mechanisms. Properly designed scarcity prices should enhance short-term and long-term market efficiency and reliability because they stimulate Demand Response, draw supply from outside of the CAISO control area, create incentives for availability of generation during peak load periods, promote long-term contracting, and attract investment in new generation resources.

The Federal Energy Regulatory Commission (FERC) directed the CAISO to file tariff language and to implement a reserve shortage Scarcity Pricing mechanism within 12 months after MRTU startup as part of its September 21 Order. The September 21 Order provided guidance that “prices should rise to reflect the increased need for reserves and energy, whether or not the shortage arises in conjunction with a generation or transmission outage, in both the day-ahead and real-time markets.” In addition, the September 21 Order directed the CAISO to develop a “mechanism that applies administratively-determined graduated prices to various levels of reserve shortage.”

In order to implement the Scarcity Pricing mechanism successfully and efficiently, the CAISO believes the design should be guided by the following considerations: 1) consistency with the Ancillary Service (A/S) reserve requirements and the A/S Region and Sub-Region definitions under the MRTU Tariff; 2) lessons learned from the design and operational experiences of other ISOs; and 3) the effective interaction between Scarcity Pricing and other MRTU components.

Since the Issue Identification Paper for Reserve Scarcity Pricing Design was posted on May 31, 2007, the CAISO has: (1) posted a Straw Proposal, a Revised Straw Proposal, a Draft Proposal, and a Revised Draft Proposal for Reserve Scarcity Pricing Design; (2) hosted four stakeholder meetings discussing the CAISO Scarcity Pricing design and a panel discussion stakeholder conference call on the Scarcity Pricing designs of NYISO and ISO-NE; and (3) requested and responded to stakeholder comments on all papers. The purpose of this Proposal is to lay out the CAISO recommendations for the following issues of Scarcity Pricing design, building on the previous versions of proposals and stakeholder inputs.

1) Scope of Scarcity Pricing: After the startup of MRTU, the CAISO will investigate the A/S requirements and the possible need for a new A/S product to meet 30 minute contingencies in A/S Sub-Regions. Sub-regional Scarcity Pricing should be designed

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2 September 21 Order at P 1077, 1079.

3 Id. at P 1079.

4 All versions of proposal and stakeholder written comments are posted on the CAISO web site at [http://www.caiso.com/1bef/1bef12b9b420b0.html](http://www.caiso.com/1bef/1bef12b9b420b0.html).
based on the outcomes of the investigation. Therefore, the CAISO proposes to proceed to develop Scarcity Pricing mechanism in the CAISO Region and wait until nine months after the startup of MRTU to decide when to enable Scarcity Pricing in the A/S Sub-Regions. That will give the CAISO time for the investigation and development of a new A/S product. The CAISO, however, will develop the software with the Scarcity Pricing capability in both the CAISO Region and Sub-Regions. The sub-regional Scarcity Pricing function can be simply turned on once it is approved.

2) Triggers of Scarcity Pricing: The CAISO proposes to use the minimum A/S requirements of the A/S Region (the CAISO system) and Sub-Regions as the triggers of Scarcity Pricing. That is, if any of the minimum requirements in the A/S Region or Sub-Regions is violated, Scarcity Pricing will be triggered in that A/S Region or Sub-Region.

3) A/S Reserves in Scarcity Pricing: The CAISO proposes a joint Scarcity Reserve Demand Curve for the three upward A/S reserves including Regulation Up, Spinning, and Non-Spinning Reserves. Regulation Down Reserve will have a separate Scarcity Reserve Demand Curve, as suggested by stakeholders.

4) Scarcity Reserve Demand Curve: Based on the analysis of CAISO historical A/S bids and market clearing prices and the experience of NYISO and ISO-NE, the CAISO proposes a tiered Scarcity Reserve Demand Curve and sets the Scarcity Reserve Demand Curve Values of three tiers of Non-Spinning, Spinning, and Regulation Up Reserves as 50%, 60%, 70%, 10%, and 20% of energy bid cap respectively in the A/S Region. The lowest scarcity price in the A/S Region is higher than the A/S bid cap and the second tier Non-Spinning scarcity price can trigger Interruptible Load Demand Response resources. The highest A/S market clearing price in the A/S Region, when supply of all upward A/S reserves is short, can get as high as the energy bid cap. Regulation Down has a Scarcity Reserve Demand Curve Value of 60% of energy bid cap in the A/S Region.

5) Energy price in case of reserve scarcity: Under MRTU, the prices of energy and A/S are co-optimized in both Day-Ahead and Real-Time Markets. The opportunity cost of capacity is reflected in both prices. When Scarcity Pricing is triggered, the prices of A/S will rise automatically to the values determined by the Scarcity Reserve Demand Curves. The price of energy could be impacted through the opportunity cost of capacity, as ordered by FERC, if the marginal capacity is capable and needed for providing both energy and A/S.

6) Resource Adequacy (RA) resources A/S must-offer requirement: The existing MRTU Tariff requires that RA resources offer capacity into the Day-Ahead Market (DAM) as energy or A/S or a combination thereof, but does not expressly require that RA resources make 100% of their A/S certified capacity available in the DAM through A/S bids. To minimize the possibility of artificial scarcity caused by A/S capacity withholding in the DAM, the CAISO proposes that RA resources be required to offer 100% of their A/S certified RA capacity in the form of A/S bids into the DAM, including RA capacity self-scheduled for energy. The CAISO will honor the energy self-schedules unless it is unable to procure 100% of its A/S requirements in the DAM. In such case, the CAISO would curtail the energy self-schedules, or portion thereof, to allow A/S certified capacity to be used for A/S. Due to various restrictions on operating conditions, hydro RA resources should submit A/S bids, together with their energy bids, in the day-ahead market for all their available A/S capacity based
on the expected available energy. Hydro RA units submitting energy self-schedules will not be required to offer A/S in the DAM.

7) Interaction of Scarcity Pricing and Demand Response: In the scope of the Markets and Performance (MAP) Demand Response initiative, the CAISO proposes enhanced functionalities for demand resources. The enhanced Demand Response programs, Participating Loads, Non-Participating Load, as well as Emergency Triggered Interruptible Load will provide much needed resources when market supply is insufficient. The available price responsive demand resources would reduce the chances of triggering Scarcity Pricing mechanism. On the other hand, Scarcity Pricing mechanism will set proper prices to incent participation of the Demand Response programs.

8) Scarcity Pricing and capacity payment adjustment: Some stakeholders suggested that RA resources, which have received a capacity payment towards coverage of annual fixed costs through an RA contract, should be disqualified from receiving scarcity prices. The CAISO believes that it is inappropriate to disqualify RA contract holders from receiving scarcity prices or to adjust any particular resource’s capacity payments. Both RA and non-RA resources will be needed at times of scarcity and should face the same incentive to provide their resource into the market. Therefore RA resources should be compensated for providing services (energy or A/S) no differently than non-RA resources during times of scarcity. Consistent with general market design principles, the appropriate response in bilateral RA contract negotiations should be to estimate the price of capacity on the basis of expected total market revenues, including those due to scarcity pricing. It is through bilateral contracts that parties can decide the appropriate revenue to accrue to buyer or seller.

The CAISO requests stakeholder written comments on this Final Proposal. The proposal and stakeholder comments will be presented to the CAISO Board of Governors for decision in September 2008.

1 Introduction

Scarcity pricing can redress one of the recognized market inefficiencies of bid caps. Although bid caps are necessary due to the inelasticity of demand in real-time, bid caps can prevent prices from rising sufficiently for certain resources, such as peaking units, to be profitable. This problem can be addressed by eliminating bid caps, which the CAISO does not propose, or by other mechanisms, such as capacity payments and scarcity pricing, both of which are on the drawing board for post Release 1 MRTU.

As an enhancement to MRTU, Scarcity Pricing is a mechanism that will let the prices of reserves and energy rise automatically, even beyond the price cap, when there is inadequate supply in the market to maintain the target level of reserves and regulation on the CAISO coordinated transmission grid. Scarcity Pricing is designed to set prices that reflect the level of shortage in supply. More accurate price signals will stimulate participation in Demand Response programs, attract supply from outside of the CAISO control area, and provide incentives for existing generation owners to make more generation capacity available during peak demand periods and for investments in new generation resources, particularly in flexible generation

5 Future designs for the RA markets may include a centralized market element that incorporates a mechanism for deducting peak energy rents from the capacity market clearing prices.
units. The automatic trigger of Scarcity Pricing ensures that suppliers do not need to raise their bid prices above competitive levels to achieve the higher prices.

Under MRTU, the CAISO has included a limited scarcity pricing mechanism that raises energy bids to the bid cap when there are insufficient energy bids in Real-Time Market and when no contingency events have occurred. In its September 21, 2006 Order, the Federal Energy Regulatory Commission (FERC) accepted the CAISO’s initial scarcity proposal, but directed the CAISO to develop a more extensive reserve shortage scarcity pricing approach be filed and implemented within 12 months of the implementation of MRTU. In its April 20, 2007 Order, FERC further emphasized these requirements and stated that “the concept of scarcity pricing involves a systematic procedure to ensure that prices can rise during periods of genuine scarcity.” 6 The FERC Orders specified that:

1) Prices should rise when energy and reserves are short in both the day-ahead and real-time markets whether or not there is a transmission or generation outage. 7

2) The scarcity pricing mechanism should apply administratively-determined graduated prices to various levels of reserve shortage. This requirement calls for a Scarcity Reserve Demand Curve with different pre-determined prices at different levels of scarcity. The Order also stated that “In the event that a shortage occurs, prices should reflect the economic value of the reserves necessary to resolve the shortage. Thus, the prices for both reserves and energy in California should increase automatically as the severity of the shortage increases.” 8

Since the new Scarcity Pricing will be implemented within 12-months after the start of MRTU, it must be consistent with the pre-existing MRTU design and systems. In addition, because both NYISO and ISO-NE have implemented Scarcity Pricing mechanisms with a Reserve Demand Curve, the CAISO intends to study these mechanisms as appropriate, for potential use in the CAISO’s Scarcity Pricing design. 9 Accordingly, to ensure successful and efficient implementation of Scarcity Pricing, the mechanism should be designed with the following guidelines in mind:

1) While meeting all the requirements specified by FERC Orders, the design should be consistent with the MRTU Tariff as much as possible to minimize changes to the existing system.

2) The CAISO’s design should consider the designs of NYISO and ISO-NE as those have been tested in the market operation.

3) The design should take into account the impacts of Scarcity Pricing on other existing and future components of MRTU, such as Congestion Revenue Rights (CRR), Demand Response (DR) programs, and a capacity market (centralized or bilateral). Market monitoring and mitigation functions should not be weakened.

Scarcity Pricing is an enhancement to energy and A/S market that is intended to reflect underlying market conditions. As such, and consistent with the “locational” nature of the MRTU

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7 September 21 Order, at P1077.
8 September 21 Order at P1079.
energy markets, any increased price volatility in the wholesale spot market arising from Scarcity Pricing can be avoided by load serving entities (LSEs) entering into long-term bilateral contracts to hedge the price of power, by providing DR, and through holdings of CRRs.

2 Reserve Scarcity Pricing Design Issues & Proposed Solutions

This section discusses major design issues and proposes specific solutions for stakeholders to review and discuss.

2.1 Scope of A/S Procurement

The MRTU Tariff defines A/S Regions and Sub-Regions for A/S procurement purposes. There are two A/S Regions and eight A/S Sub-Regions. The A/S Regions are the System Region and the Expanded Region (i.e., the System Region and the intertie Scheduling Points with adjacent Control Areas). The eight A/S Sub-Regions are the following:

1. the South of Path 15 Sub-Region
2. the Expanded South of Path 15 Sub-Region
3. the South of Path 26 Sub-Region
4. the Expanded South of Path 26 Sub-Region
5. the North of Path 15 Sub-Region
6. the Expanded North of Path 15 Sub-Region
7. the North of Path 26 Sub-Region
8. the Expanded North of Path 26 Sub-Region

2.2 Triggers of Reserve Scarcity Pricing

Each ISO with a Scarcity Pricing mechanism defines Scarcity Pricing triggers according to its own reliability criteria and operating procedures. The CAISO reliability requirements are based on the WECC Minimum Operating Reliability Criteria (MORC) and NERC control performance criteria. When the reliability requirements are violated, the CAISO may issue an alert, warning, or declare an emergency based on the available reserve margin. In the MRTU Tariff, the reliability requirements criteria and procedures are defined as the following:

“The CAISO shall maintain sufficient Generating Units immediately responsive to Automatic Generation Control (AGC) in order to provide sufficient Regulation service to allow the CAISO Control Area to meet WECC and NERC control performance criteria by continuously balancing Generation to meet deviations between actual and scheduled Demand and to maintain interchange schedules.”

“The CAISO shall maintain minimum contingency Operating Reserve made up of Spinning Reserve and Non-Spinning Reserve in accordance with WECC MORC criteria equal to (a) 5% of the Demand to be met by Generation from hydroelectric resources (excluding the Demand covered by firm purchases from outside the CAISO Control Area) plus 7% of the Demand to be met by Generation from other resources (excluding the Demand covered by firm purchases from outside the CAISO Control Area), or (b) the

10 MRTU Tariff Section 8.3.3
11 MRTU Tariff Section 8.2.3.1
single largest Contingency, if this is greater.” “The Spinning Reserve component of Operating Reserve shall be no less than one-half the Operating Reserve required for each Settlement Period of the Day-Ahead Market, each hour in the HASP, and in each 15 minute period in Real-Time.”

“Within the Expanded System Region, the System Region, and any the Sub-Regions, the CAISO may establish limits on the amount of Ancillary Services that can be provided from each region or can be provided within each region. When used, these limits identify either a maximum or a minimum (or both a maximum and a minimum) amount of Ancillary Services to be obtained within the region.”

The CAISO proposes to use the minimum requirements for A/S reserves in the A/S Regions and Sub-Regions as the triggers of Scarcity Pricing. Each time any of these requirements is violated, whether in the Day-Ahead Market (DAM) or Real-Time Market (RTM), the Scarcity Pricing mechanism would be activated in the A/S Region or Sub-Region in which the reserve requirement violation occurred.

Use of these requirements as triggers for reserve Scarcity Pricing preserves consistency between Scarcity Pricing and the A/S procurement requirements, and requires minimal changes to the MRTU market design for implementation.

Currently the CAISO has only 10-minute A/S reserves (Regulation, Spinning, and Non-Spinning), but some contingencies in A/S Sub-Regions have a 30-minute recovery time. Having a reserve product to meet the 30-minute contingency requirements may be appropriate an alternative to relying on 10-minute reserve, as some market participants urge, or utilizing Exceptional Dispatch to commit additional resources. The CAISO will evaluate the need for such a new A/S reserve product and develop it, if justified, before the implementation of Scarcity Pricing. In addition, the CAISO will have nine months of MRTU operations to analyze A/S sub-regional procurement. The design of Sub-regional Scarcity Pricing will benefit from these experiences.

The CAISO, therefore, proposes to seek Board approval for a Scarcity Pricing mechanism only in the CAISO Region and defer the decision on when to enable Scarcity Pricing in the A/S Sub-Regions until nine months after the startup of MRTU.

The CAISO will, however, develop the software with the Scarcity Pricing capability in both the CAISO Region and Sub-Regions. Nine months after the startup of MRTU, if the decision is to implement sub-regional Scarcity Pricing, the functions can be simply enabled once the proposal is approved by the CAISO Board of Governors and accepted by FERC.

### 2.3 A/S Reserves in Scarcity Pricing Mechanism

There are four types of A/S reserves under MRTU: Regulation Up, Regulation Down, Spinning Reserves, and Non-Spinning Reserves. The substitution capability among the different types of A/S reserves is an important factor in determining which types of A/S reserves are to be included in Scarcity Pricing mechanism. Reserves that can substitute for other reserves are often called “higher quality” than reserves that cannot substitute. Hence, Regulation Up is higher quality than Spinning Reserves, which is higher quality than Non-Spinning Reserves.

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12 MRTU Tariff Section 8.2.3.2. The WECC/NERC new paradigm that will be enforced does not require the exporting control area to back firm energy interchanged with Operating Reserves.

13 MRTU Tariff Section 8.3.3.1
The MRTU Tariff Section 8.2.3.5 defines the relationship among the A/S reserves as follows:

(a) The Regulation requirement must be satisfied only by Regulation Bids for Resources qualified to provide Regulation;

(b) Additional Regulation Up capacity can be used to satisfy requirements for Spinning Reserve, or Non-Spinning Reserve;

(c) Regulation Up and Spinning Reserve requirements must be collectively satisfied by the combination of Regulation Up and Spinning Reserve Bids. Spinning Reserve and Regulation may be provided as separate services from the same Generating Unit, provided that the sum of Spinning Reserve and Regulation Up provided is not greater than the maximum ramp rate of the Generating Unit (MW/minute) times ten;

(d) Additional Regulation Up and Spinning Reserve capacity can be used to satisfy requirements for Non-Spinning Reserve.

(e) Regulation Up, Spinning Reserve, and Non-Spinning Reserve requirements must be collectively satisfied by the combination of Regulation Up, Spinning Reserve and Non-Spinning Reserve Bids; and

(f) Total MW purchased from the Regulation Up, Spinning Reserve, and Non-Spinning Reserve markets will not be changed by this [MRTU Tariff] Section 8.2.3.5.

The substitution capability among the three upward A/S reserves and the minimum A/S requirements can be described using the following constraints:

**Regulation Up Requirements:**

\[ \text{RegUp} \geq \text{RegUp}_{\text{MinReq}} \]

**Spinning Reserve Requirements:**

\[ \text{RegUp} + \text{Spin} \geq \text{RegUp}_{\text{MinReq}} + \text{Spin}_{\text{MinReq}} \]

**Non-Spinning Reserve Requirements:**

\[ \text{RegUp} + \text{Spin} + \text{Non-Spin} \geq \text{RegUp}_{\text{MinReq}} + \text{Spin}_{\text{MinReq}} + \text{Non-Spin}_{\text{MinReq}} \]

where, \( \text{RegUp}_{\text{MinReq}} \), \( \text{Spin}_{\text{MinReq}} \), and \( \text{Non-Spin}_{\text{MinReq}} \) represent the minimum procurement requirements for the A/S reserves.

Because of the substitution capability among Regulation Up, Spinning, and Non-Spinning, the CAISO proposes that these three types of reserves be considered jointly for Scarcity Pricing.

Regulation Down Reserve is provided by resources that can decrease their actual operating level in response to direct electronic signals from the CAISO to maintain standard frequency in accordance with established reliability criteria. In some situations the CAISO could face a shortage of supply for Regulation-Down Reserve. Such shortages could become more prevalent in the near future since California is moving forward to meet Renewable Portfolio Standards. Connecting more renewable resources (primarily wind generation) to the CAISO grid will increase the demand for Regulation Reserves. The CAISO therefore proposes to include Regulation-Down Reserve in the Scarcity Pricing mechanism in order to provide proper price signal and incentives to potential AGC resources. Due to its lack of compatibility, Regulation-
Down Reserve will be measured separately in Scarcity Pricing from the other three types of upward A/S reserves.

### 2.4 Scarcity Reserve Demand Curve

As noted above, the September 21, 2006 FERC Order specified that the Scarcity Pricing mechanism should apply administratively-determined graduated prices to various levels of reserve shortage. This requirement implies that it is necessary to define a Scarcity Reserve Demand Curve with pre-determined prices at different levels of shortages, similar to that which NYISO and ISO-NE have implemented. A Scarcity Reserve Demand Curve sets a Scarcity Reserve Demand Curve Value (SRDCV) for each of the A/S reserves and allows the market to clear in shortage conditions. Based on the experiences of these ISOs, the design of the Reserve Scarcity Demand Curve needs to decide rules for (1) setting the SRDCVs for each type of A/S reserves; (2) calculating cumulative reserve market clearing prices (MCPs) based on SRDCVs across different types of A/S reserves; and (3) determining energy prices (i.e., LMPs) when reserve supply is short.

The following sections discuss the Scarcity Reserve Demand Curve for the CAISO. In order to compare with that of NYISO and ISO-NE, Table 1 lists the equivalent terminologies describing the reserve demand curves used by the three ISOs.

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<td>Reserve Constraint Penalty Factor (RCPF)</td>
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<td>Pre-determined price for reserve scarcity</td>
<td>Reserve Demand Curve Value</td>
<td>RCPF</td>
<td>Scarcity Reserve Demand Curve Value (SRDCV)</td>
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### 2.4.1 Overall Considerations

The CAISO, *per* the FERC Order, will implement a Scarcity Pricing mechanism very similar to that which has been implemented by the NYISO and ISO-NE. The proposed CAISO Scarcity Pricing mechanism will be similar to the NYISO and ISO-NE approach in the following aspects.

1) Under MRTU, the CAISO will co-optimize energy dispatch and reserve procurements in both the DAM and the RTM, similar to the mechanism implemented by the NYISO and the ISO-NE. The energy and reserve co-optimization model provides a foundation for implementing a Scarcity Reserve Demand Curve for Scarcity Pricing.

2) The three ISOs all have well-defined A/S zones that provide a basis for zonal Scarcity Pricing.

3) Due to the substitution capability between different types of A/S reserves and the nested A/S Regions and Sub-Regions, the reserve market clearing prices derived from the SRDCVs will cascade up from a lower quality to a higher quality reserve and from A/S Region to its more granular Sub-Regions.

In addition, the CAISO Scarcity Pricing mechanism will be different from that of NYISO and ISO-NE because of the integration of Regulation Up with Spinning and Non-Spinning Reserves in Scarcity Pricing. Under MRTU, Regulation Up can substitute for both Spinning and
Non-Spinning Reserve in meeting the minimum reserve requirements. In contrast, the ISO-NE did not include Regulation in its Scarcity Pricing mechanism since the ISO-NE is not short of Regulation Reserve. The NYISO chose to implement separate demand curves for Operating Reserve and Regulation because Regulation cannot substitute for Operating Reserve. One additional difference is that the CAISO does not have a reserve product to meet 30-minute contingencies yet as do the other two ISOs.

2.4.2 Benchmark Price for Scarcity Reserve Demand Curve

ISO-NE, NYISO, and PJM established their maximum A/S scarcity prices in reference to the energy bid cap. The CAISO, based on its research and communication with other ISOs in regarding to the selection of the Benchmark Price, is in agreement with ISO-NE that

“The RCPFs reflect the costs the ISO would be willing to incur to procure reserves given the $1,000/MW Energy Price cap. In other words, when the ISO is sufficiently short of reserves it would be willing to pay up to $1,000 for energy to create additional reserves.”

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The CAISO, therefore, proposes to establish the maximum A/S scarcity price (Benchmark Price) for the Scarcity Reserve Demand Curve based on the energy bid cap under MRTU.

According to the Tariff, the CAISO will have an energy bid cap of $500/MWh for the first year of MRTU, $750/MWh for the second year, and $1000/MWh thereafter. The Benchmark Price will therefore increase progressively based on the energy bid cap.

2.4.3 Scarcity Reserve Demand Curve Values for A/S Reserves

To determine the scarcity price for each A/S reserve, that is the SRDCVs of the Scarcity Reserve Demand Curve, the CAISO proposed to consider the following factors.

1) The SRDCVs should be set high enough in order to accommodate the offer prices of expensive generators and demand response resources (price-responsive demands). Otherwise, some available resources might not be dispatched to restore reserves during periods in which the Scarcity Pricing mechanism is triggered.

2) The SRDCVs should not be set too high for the A/S reserves that are likely to have transitory supply deficiency due to resource constraints but not in conditions where maximum generation availability is required. For example, during the morning and evening ramping up period, load sometimes picks up more quickly than generators can ramp up. Regulation Up and Spinning Reserve could face a periodic, transitory supply shortage during this time, although clearly there are sufficient generation resources available to the system such that at some cost, sufficient Regulation Up and Spinning Reserve could be available (e.g., by maintaining uneconomic units at minimum operating levels). At such times, the CAISO may desire additional reserves, and to send a price signal that indicates the value of additional reserves, but may not seek to mobilize the degree of resource response needed during, e.g., system emergencies or annual peak load hours. Hence, to minimize the cost of serving the demand, it may be appropriate to set the SRDCV for Regulation Up and Spinning Reserve at moderate levels, despite the fact that Regulation Up and

Spinning Reserve are high quality reserves, and rely on the expected correlation between shortage of Non-Spinning Reserve and more serious reliability situations to trigger high prices for Spinning. Additional details on this pricing relationship are provided below.

For example, the ISO-NE, which does not have scarcity price for Regulation Reserve, sets the demand curve price, the RCPF, for 10-minute Spinning Reserve (TMSR) to $50/MWh. “The TMSR RCPF value must serve two purposes. First, it must maintain TMSR during a capacity deficiency. Second, when the system becomes briefly ramp constrained, during the morning pick-up for example, the RCPF will trigger re-dispatch to preserve spinning reserve. The value of $50 meets both needs.” The CAISO has determined that a similar approach meets the Scarcity Pricing objectives in the CAISO markets while protecting the market from extreme price volatility in periods (such as the morning and evening ramp) that do not reflect the need for such a price signal.

3) The SRDCVs should be set to reflect the cost the ISO will pay to obtain additional supply at different levels of reserve shortage. That is, shortage of higher quality reserves should generally trigger higher scarcity prices than shortages of lower quality reserves to induce sufficient re-dispatch of generation resources (internal and external) to meet the reserve requirements. However, this pricing rule needs to be balanced, for economic reasons, with the expected frequency that a particular reserve may encounter shortages, as discussed above.

An example of such ranking is the ISO-NE rules for ranking different reserve scarcity prices. The ISO-NE offers the following rationales for setting RCPFs. “The $100/MW TMOR [Thirty Minute Operating Reserve] RCPF value is calibrated to allow for re-dispatch of the system to create reserve under the majority of system condition.” “Shortages of system TMNSR [Ten Minute Non-Spinning Reserve] represent a serious reduction of reliability…. The system TMNSR RCPF value of $850 is set high enough to create re-dispatch of virtually all internal resources. … It would allow purchases of very expensive energy from external sources and backing down internal resources.” “The RCPF of local TMOR must be set lower than system reserve.”

4) Because reserves should generally be substituted to maintain the highest quality reserve, in a reserve shortage situation, the prices should cascade up from lower quality to higher quality A/S reserves and from system region to spatially granular nested sub-regions. Specifically, the market clearing price of a higher quality A/S reserve should be higher than or equal to the price of a lower quality reserve, and the market clearing price in a sub-region should be no less than the price in its parent region. This rule is called price cascading.

5) In case of a severe reserve scarcity, the market clearing price of Regulation Up, calculated as the sum of the SRDCVs of Non-Spinning, Spinning, and Regulation Up should be equal to the Benchmark Price set for the Scarcity Reserve Demand Curve.

In order to evaluate the appropriate distribution of the SRDCV values between a minimum value for the lowest quality reserve and the maximum total scarcity value determined by the MRTU price caps the SRDCVs, the CAISO conducted analyses based on the historical

15 Direct Testimony of Marc D. Montalvo, ISO-NE, February 3, 2006, pp. 44.
16 Direct Testimony of Marc D. Montalvo, ISO-NE, February 3, 2006, pp. 41-44.
market data. The pre-MRTU market data, though not necessarily consistent with the design of MRTU, should provide useful support for determining the SRDCVs.

In Figure 1 are the distributions of SP15 Regulation Up Reserve market clearing prices based on the hourly prices from Jan. 1 2004 to Dec. 31, 2006 (during which the price cap was $400/MWh). The horizontal axis is the Regulation Up price in $/MWh, and the vertical axis is the frequency of occurrences.

Figure 1. Distribution of CAISO SP15 Regulation Up Prices

Table 2 presents a more comprehensive summary of the statistical analysis of the CAISO SP15 A/S market clearing prices.

Table 2. Statistics of Historical CAISO SP15 A/S Prices ($/MWh)

<table>
<thead>
<tr>
<th>A/S Reserve</th>
<th>Market</th>
<th>Mean</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
<th>99.5th Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reg Up</td>
<td>DAM</td>
<td>18.56</td>
<td>14.91</td>
<td>0.00</td>
<td>400.00</td>
<td>72.20</td>
</tr>
<tr>
<td>Reg Up</td>
<td>HAM</td>
<td>13.99</td>
<td>10.99</td>
<td>-0.01</td>
<td>399.99</td>
<td>213.00</td>
</tr>
<tr>
<td>Reg Down</td>
<td>DAM</td>
<td>13.76</td>
<td>9.36</td>
<td>-25.55</td>
<td>399.99</td>
<td>59.40</td>
</tr>
<tr>
<td>Reg Down</td>
<td>HAM</td>
<td>12.06</td>
<td>8.63</td>
<td>-85.69</td>
<td>399.99</td>
<td>53.80</td>
</tr>
<tr>
<td>Spinning</td>
<td>DAM</td>
<td>8.19</td>
<td>2.57</td>
<td>0.00</td>
<td>400.00</td>
<td>68.50</td>
</tr>
<tr>
<td>Spinning</td>
<td>HAM</td>
<td>5.23</td>
<td>2.15</td>
<td>-0.01</td>
<td>400.00</td>
<td>34.91</td>
</tr>
<tr>
<td>Non-Spinning</td>
<td>DAM</td>
<td>4.23</td>
<td>1.22</td>
<td>0.00</td>
<td>400.00</td>
<td>18.74</td>
</tr>
<tr>
<td>Non-Spinning</td>
<td>HAM</td>
<td>2.70</td>
<td>1.28</td>
<td>-0.01</td>
<td>399.99</td>
<td>9.34</td>
</tr>
</tbody>
</table>

From Figure 1 and Table 2 we can see that the highest market clearing price of all four A/S reached $400/MWh in both DA and RT in the three years although more than 99% of the time the prices stayed below $200/MWh. Although the level of specific SRDCVs will be determined through judgment, like other ISOs did as noted above, the ranking of the SRDCVs

and expected market clearing prices for each A/S (reflecting co-optimization) should reflect their relative quality and hence value to the system. Since there will be a bid cap on reserve under MRTU, the SRDCV for the lowest quality reserve should be greater than or equal to the bid cap. Otherwise there could be circumstances of economic scarcity in which some economic bid prices are higher than the SRDCV. The economic bids would not be fully used before the Scarcity Pricing mechanism is triggered. Historically each A/S has reached the bid cap in some peak hours and hence for the market to provide added value for each A/S, the SRDCV or expected market clearing price would have to exceed the bid cap.

Figures 2 and 3 provide a view of the system from supply side. In the charts are DA supply curves of Non-Spinning and Regulation Down Reserves of two typical hours, one in February and the other in July of 2007.

**Figure 2. Typical Hourly Supply Curves of Non-Spinning**

The supply curves of both Non-Spinning and Regulation Down, in both February and July, reached the A/S bid cap, $400/MWh. The last portion of each of the supply curves is very steep. All that suggests the scarcity price should be at least as high as the bid cap. That is necessary in order to make use of all in-market resources and to attract out-of-market resources when Scarcity Pricing is triggered. It is consistent with what we learned from the historical A/S market clearing prices. The SRDCVs of higher quality A/S should be incrementally set between the starting scarcity price and the energy bid cap to ensure that market clearing prices during reserve shortages will reflect the value ranking of the A/S.

In the Draft Proposal, the CAISO proposed a Scarcity Reserve Demand Curve with a single SRDCV for each A/S regardless of the level of A/S deficiency. Stakeholders suggested that the CAISO consider a tiered demand curve with which the scarcity price increases with the severity of shortage. The CAISO believes that this is a reasonable suggestion and proposes a demand curve that has Non-Spinning divided into three segments with three different SRDCVs.
When the shortage in Non-Spinning is smaller than certain value, there will be one SRDCV. When the shortage is greater than that value, the demand curve has another higher SRDCV.

**Figure 3. Typical Hourly Supply Curves of Regulation Down**

The CAISO conducted analysis in order to determine the breaking points of the segments of the Non-Spinning in the Scarcity Reserve Demand Curve. The analysis uses hourly Non-Spinning bid deficiency (when bid-in supply is less than requirement) data of year 2006 and 2007 to examine the volume of bid deficiency. The results show the 33rd percentile value of Non-Spinning bid deficiency of about 69 MW and 67th percentile value of 210 MW. This 33rd percentile value means that for 33% of the hours the bid deficiency is less than 69 MW (see Figure 4). The CAISO, therefore, proposes to break the Non-Spinning section of the Scarcity Reserve Demand Curve at 70 MW and 210 MW respectively.

Based on the analyses and the references from the reserve demand curves of NYISO and ISO-NE, the CAISO proposes the SRDCVs of the CAISO Region Scarcity Reserve Demand Curve as listed in Table 3. The SRDCVs are defined as percentages of energy bid cap since energy bid cap will change in the first three years of MRTU operation, as discussed in Section 2.4.2 of this proposal. In this way, the values of SRDCVs can change automatically with the energy bid cap.
Table 3. Scarcity Reserve Demand Curve Value of the CAISO Region

<table>
<thead>
<tr>
<th>Reserve</th>
<th>Percent of Energy Bid Cap</th>
<th>Bid Cap = $750/MWh ($/MWh)</th>
<th>Bid Cap = $1000/MWh ($/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation Up</td>
<td>20%</td>
<td>$150</td>
<td>$200</td>
</tr>
<tr>
<td>Spinning</td>
<td>10%</td>
<td>$75</td>
<td>$100</td>
</tr>
<tr>
<td>Non-Spinning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shortage &gt; 210 MW</td>
<td>70%</td>
<td>$525</td>
<td>$700</td>
</tr>
<tr>
<td>Shortage &gt; 70 &amp;  ≤ 210 MW</td>
<td>60%</td>
<td>$450</td>
<td>$600</td>
</tr>
<tr>
<td>Shortage ≤ 70 MW</td>
<td>50%</td>
<td>$375</td>
<td>$500</td>
</tr>
<tr>
<td>Sum</td>
<td>100%</td>
<td>$750</td>
<td>$1000</td>
</tr>
<tr>
<td>Regulation Down</td>
<td>60%</td>
<td>$450</td>
<td>$600</td>
</tr>
</tbody>
</table>

Non-Spinning Reserve is the first on the demand curve. It has three segments and three SRDCVs. They are set by the following guide lines: the starting SRDCV has to be higher than the A/S bid cap and the middle section of SRDCV should be able to trigger Demand Response resources. The SRDCVs are set by looking at the third year of MRTU from where the energy bid cap reaches the maximum currently contemplated by the MRTU tariff. As we can see from Table 2 and Figure 2, some Non-Spinning resources may not respond to a price signal lower
than the A/S bid cap ($250/MWh). So when shortage in Non-Spinning is less or equal to 70 MW, the SRDCV is $500/MWh (when energy bid cap is $1000/MWh) that is above the A/S bid cap. For shortage between 70 MW and 210 MW, the SRDCV is set at $600/MWh, which is the equivalent trigger of Interruptible Load Demand Response. When the shortage is greater than 210 MW, the SRDCV is increased to $700/MWh.

For the reasons noted above, CAISO has proposed that Spinning Reserve has a relatively low SRDCV based on the consideration of possible more frequently “ramp constraint” caused scarcity. However, when both Spinning and Non-Spinning Reserves are in shortage, the market clearing price of Spinning Reserve will be the sum of the SRDCVs of Spinning and Non-Spinning Reserves, that is $800 ($700+$100) when the energy bid cap is $1000. As shown in Table 3, with the three-segment pricing of Non-Spinning Reserves, the sum of the scarcity prices for each individual reserve, as determined by the bid cap, will only equal the bid cap when Non-Spinning Reserves are in shortages greater than 210 MW.

Regulation-Down Reserve should be always procured at the CAISO control area level. In the CAISO Region, Regulation-Down Reserve has a separate Scarcity Reserve Demand Curve from the other three upward A/S reserves.

Table 4. Scarcity Reserve Market Clearing Prices of the CAISO Region

<table>
<thead>
<tr>
<th>Reserve</th>
<th>Bid Cap = $750/MWh ($/MWh)</th>
<th>Bid Cap = $1000/MWh ($/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation Up</td>
<td>$750</td>
<td>$1000</td>
</tr>
<tr>
<td>Spinning</td>
<td>$600</td>
<td>$800</td>
</tr>
<tr>
<td>Non-Spinning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shortage &gt; 210 MW</td>
<td>$525</td>
<td>$700</td>
</tr>
<tr>
<td>Shortage &gt; 70 &amp;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 210 MW</td>
<td>$450</td>
<td>$600</td>
</tr>
<tr>
<td>Shortage ≤ 70 MW</td>
<td>$375</td>
<td>$500</td>
</tr>
<tr>
<td>Regulation Down</td>
<td>$450</td>
<td>$600</td>
</tr>
</tbody>
</table>

According to the price cascading rule, assuming that the supplies of all A/S reserves are short in the CAISO Region, the market clearing prices of the scarcity reserves can be calculated based on the SRDCVs in Table 3. The calculated market clearing prices are listed in Table 4.

The scarcity price of the lowest quality reserve, that is, the SRDCVs of Non-Spinning Reserves, are higher than the highest historic A/S bid and market clearing price, even when the A/S price cap was $400/MWh. The market clearing prices under scarcity situation should also be sufficient to provide the needed incentives to price responsive demand and supply resources when scarcity reaches to the second or third tier. The highest market clearing price, when supply of all A/S reserves are short, can get as high as the energy bid cap.

3 Other Related Issues

There are some other issues closely related to the Scarcity Pricing design that have been raised by stakeholders. These issues may have significant impacts on the design and implementation of Scarcity Pricing mechanism. The CAISO would like to take this opportunity to discuss these issues with stakeholders.
3.1 RA Resources Day-Ahead A/S Must-Offer Requirement

Under the MRTU Tariff, RA resources must offer their capacity in the form of energy, A/S or a combination there-of, into the DAM.\(^{18}\) If a RA resource fails to make 100% of its capacity available, the CAISO will insert energy bids in the DAM. Accordingly, there is no express requirement for RA resources to submit A/S bids for 100% of their A/S certified RA capacity in the DAM. Since FERC directed the CAISO to implement a Scarcity Pricing mechanism in the DAM, the fact that RA resources are not required to offer A/S in the DAM for any certified A/S capacity may create opportunities for market manipulation. For example, RA recourses could withhold A/S capacity to cause scarcity in order to benefit from the energy prices driven up by the scarcity prices of reserves. Because the CAISO will attempt to procure 100% of its A/S requirements in the DAM, economic or physical withholding in the DAM would have the most impact on consumer A/S costs.

The CAISO, therefore, proposes to include an A/S offer obligation requiring RA resources to offer 100% of their A/S certified RA capacity in the form of A/S bids into the DAM. If a RA resource fails to do so, the CAISO will insert a zero ($0/MWh) A/S bid into the DAM for any A/S certified RA capacity.\(^{19}\)

The majority of stakeholders support this proposal. Some stakeholders have also suggested the CAISO consider exemption for some RA contracts, such as existing RA contracts and RA resources self-scheduled for energy. However, due to the potential market ramifications from A/S withholding, the CAISO strongly believes that it should have the capability of co-optimizing all RA capacity regardless of when an RA contract was entered into. Further, the procurement of the RA product is a purchase of capacity. Once the capacity has been procured, the CAISO sees no legitimate reason why an RA resource that is certified to provide A/S services should not have an obligation to offer bids for such A/S products in addition to energy. Therefore, the CAISO proposes the following revisions:

1) All RA resources must submit A/S bids for 100% of their A/S certified RA capacity into the DAM, even if the RA capacity has been self-scheduled for energy. Otherwise, a zero ($0/MW) bid will be inserted;

2) All RA resources with A/S certified capacity, with the exceptions as discussed below, will always be considered for energy and A/S in the DAM IFM energy and A/S co-optimization.

3) The CAISO will honor RA capacity energy self-schedules unless it is unable to procure 100% of its A/S requirements in the DAM. In such case, the CAISO would curtail the energy self-schedule, or portion thereof, to allow certified A/S capacity to be used for A/S.

\(^{18}\) MRTU Tariff Section 40.6

\(^{19}\) In the very near future, the CAISO intends to file a motion with the CPUC seeking clarification or, in the alternative, modification of the D.06-07-031, the CPUC's “Opinion on Remaining Phase 1 Issues in R.05-12-013”. The CAISO will ask the CPUC to clarify that the Resource Adequacy product described in Section 3.11 of D.06-07-031 includes an A/S offer obligation to the extent the RA capacity is certified by the CAISO to provide A/S services. In the alternative, the CAISO will ask the CPUC to modify the Resource Adequacy product to make clear that the RA capacity has an offer obligation to the CAISO for Energy and A/S to the extent the RA capacity is certified by the CAISO to provide A/S services.
4) Due to various restrictions of operating conditions, hydro RA resources should submit A/S bids, together with their energy bids, in the day-ahead market for all their available A/S capacity based on the expected available energy. Hydro RA units submitting energy self-schedules will not be required to offer A/S in the DAM.

5) Non-Dispatchable Use Limited RA Resources will be exempted from the DAM A/S must-offer requirement.

The CAISO intends that the A/S offer requirement be in effect for RA capacity under RA contracts as of the effective date of the CAISO’s Scarcity Pricing proposal. The CAISO believes no change to the RA product is required to add the A/S offer requirement as described herein. If the CPUC seeks to impose an A/S purchase requirement on Load Serving Entities, the CAISO will work together with the CPUC on such future modification of the RA requirements.

3.2 A/S Cost Allocation

In June 20, 2008 Order FERC reaffirmed the September 21, 2006 MRTU order accepting the CAISO’s proposal for a single use rate for A/S cost allocation. “We reiterate here that the CAISO’s procurement of ancillary services supports the use of the entire CAISO control area and, therefore, it is appropriate to allocate the costs associated with this procurement to all load in the CAISO control area.”

Based on this most recent FERC order, the CAISO proposes not to consider the issue of A/S cost allocation by Sub-Regions at this time. In the future, when the situation has changed, the CAISO may open the discussion on this issue with stakeholders. The CAISO believes any future decision should be based on empirical evidence and complexity associated with implementing such a change.

3.3 Energy Price in Case of Reserve Scarcity

When there is a reserve supply shortage, the Scarcity Pricing mechanism will be triggered and the reserve market clearing prices will be set by the SRDCVs. At the same time, energy prices may either rise together with the reserve prices, or may be unaffected by the increase in reserve prices.

If a generation unit has to back down generation in order to provide one additional MW of scarcity reserve, the price of energy at the location of this generation unit could include the opportunity cost of the capacity (the shadow price of the capacity constraint) as well as the offer price of the incremental energy. On the other hand, if the incremental energy dispatched to meet load cannot be used to provide reserves due to ramp rate or other constraints, the price of energy at this location may not be directly affected by the reserve scarcity prices. The energy and reserve co-optimization models will determine the market clearing reserve prices and energy prices simultaneously.

Under MRTU the Integrated Forward Market (IFM) model performs energy and A/S co-optimization for the DAM, in which A/S has priority over energy. In RTM, energy has priority

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20 It is consistent with the MRTU Tariff Section 40.6.4.3.2.
21 As noted above in footnote 19, the CAISO will be filing a motion to clarify, or in the alternative, to modify the RA product defined by the CPUC to resolve any uncertainty as to this issue.
22 ORDER CONDITIONALLY ACCEPTING, SUBJECT TO MODIFICATION, MRTU COMPLIANCE FILINGS, 123 FERC ¶ 61,285 at P 46.
over A/S. The A/S procurement quantities and scarcity prices determined in the Hour-Ahead Scheduling Process (HASP) and Real-Time Unit Commitment (RTUC) processes will be carried over to the Real-Time Dispatch (RTD) process to optimize the procurements of energy. The opportunity costs of capacity will be reflected in the prices of A/S and energy from the co-optimization.

The “Revised Scarcity Pricing Design Numerical Examples” provides several examples covering different situations of reserve shortage. The energy price varies depending on situations of capacity shortage. They are based on a simplified energy and reserve co-optimization model, as described in the document.23

3.4 Interaction between Demand Response and Scarcity Pricing24

Twelve months after startup of MRTU, there will be three broad categories of demand response programs, including:

- Participating Load – Dispatchable Demand Response
- Non-Participating Load – Price Responsive Demand Response
- Emergency Triggered Interruptible Load

Table 5. Summary of the CPUC/CAISO Demand Response Programs

<table>
<thead>
<tr>
<th>Types of Demand Response Programs</th>
<th>Participating Load – Dispatchable DR</th>
<th>Non-Participating Load – Price Responsive DR</th>
<th>Emergency Triggered DR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>DAM, RTM</td>
<td>DAM</td>
<td>No direct participation</td>
</tr>
<tr>
<td>Product</td>
<td>Energy, A/S, RUC</td>
<td>Energy</td>
<td>No direct participation</td>
</tr>
<tr>
<td>Able to Set Market Clearing Price?</td>
<td>DA &amp; RT Nodal Prices</td>
<td>DA LAP Prices</td>
<td>No</td>
</tr>
<tr>
<td>Can be Used to Relieve Shortage?</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Demand Response Provided by Participating Load

A Participating Load will be able to submit energy bids in both DA and RT markets with fully comparable functionality to that of a generator. Besides participating in energy markets, a Participating Load can optionally choose to provide RUC and/or A/S capacity. The amount of A/S capacity that the Participating Load can offer is the load reduction it can deliver within 10 minutes. Accordingly, Participating Loads will be effective and valuable resources to eliminate or relieve reserve shortage conditions.

23 The model was initially developed by Benjamin Hobbs.

24 The Demand Response programs are developed through the Demand Response Release 1 initiative and the Markets and Performance (MAP) Demand Response initiative. This section only briefly discusses these programs and how they interact with Scarcity Pricing. For more information on Demand Response, market participants should refer to the MAP Demand Response initiatives on the CAISO website at http://www.caiso.com/1893/1893e350393b0.html.
Price Responsive Demand Provided by Non-Participating Load

Non-Participating Load can participate in the DAM by submitting a price-sensitive demand curve. The use of an hourly DA energy bid, and the opportunity to adjust demand in RT based on the market price of energy, constitute Price-Responsive Demand.

Non-Participating Load cannot bid to provide A/S or capacity for RUC, thus it cannot directly relieve a reserve shortage condition. However, it can indirectly contribute to the relief of a reserve shortage condition by reducing demand and, thus reducing the CAISO’s A/S requirements.

Emergency Triggered Interruptible Load

There is currently approximately 1,700 MW Interruptible Load that the CAISO can call upon only after a Stage 2 or Stage 3 Emergency has been declared. This program, which is administrated by the utilities and approved by the CPUC, is set up for reliability purposes only. The Interruptible Load does not participate in the CAISO market therefore cannot help relieve a reserve shortage condition until a Stage 2 or Stage 3 Emergency has been declared.

3.5 Scarcity Pricing and Capacity Payments

Some stakeholders raised the concern that suppliers might be overcompensated for their fixed costs when both a Scarcity Pricing mechanism and a capacity market are implemented. Some stakeholders suggested that generators receiving capacity payments should be disqualified from Scarcity Pricing.

The capacity market focuses on long-term supply sufficiency. LSEs need to secure sufficient capacity to meet the long-term resource adequacy requirements. The capacity price is based in part on expected revenues of resources in the energy and ancillary service markets. Sufficient supply will stabilize the market price in the long run and minimize the chances of scarcity. The capacity price is thus important guidance for long-term generation investments.

Scarcity Pricing, on the other hand, is a solution for short-term resource shortage while also making more explicit the reliability value of energy and A/S. It provides incentives for loads to improve price responsiveness and for existing generation owners to make more generation capacity available during the peak demand periods. The price signal will further attract supply from outside of the CAISO control area. The increased price volatilities in spot markets will encourage LSEs to pursue long-term bilateral contracts in order to hedge the wholesale price risks. Scarcity Pricing does let generation owners, especially the owners of flexible generation units, recover a portion of their investments.

It is therefore clear that capacity markets and Scarcity Pricing do not overlap, but rather complement each other. Implementing both will let the ISO make best use of all available resources according to market demand.

Currently, in California, capacity is procured through the CPUC administrated Resource Adequacy (RA) program. RA contracts are negotiated bilaterally and their prices are non-transparent. RA resources are paid to show up in the CAISO markets, just like non-RA resources receiving Residual Unit Commitment (RUC) payments that have to show up in RTM. As proposed in this proposal, RA resources will be subject to both energy and A/S must-offer requirements, which may reduce energy and A/S price spikes and the chances of Scarcity Pricing being triggered. The CAISO does not believe it is appropriate for the CAISO Tariff to exempt RA resources from receiving scarcity rents. Instead, the sellers and buyers should take into account the revenue from Scarcity Pricing in the negotiation of RA contracts.
On the other hand, capacity revenue adjustment could be done more explicitly with the implementation of a centralized capacity market (if the CPUC determines to pursue such a design). For example, ISO-NE, which has a scarcity pricing mechanism similar to the one being proposed here, will implement an ex post revenue adjustment based on Peak Energy Rent with the implementation of the Forward Capacity Market in 2010.25

Therefore, the CAISO proposes that the Scarcity Pricing design not disqualify bilateral RA resources from receiving scarcity prices, nor to adjust capacity payments to RA resources before the implementation of a centralized capacity market. Capacity payment adjustment could be implemented with a centralized capacity market, as a part of capacity market design. The CAISO will review the performance of the Scarcity Pricing mechanism after the capacity market is implemented.

4 Past Activities and Next Steps

The following is a summary of the past activities in the Scarcity Pricing stakeholder process and proposed schedules for future events.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 31, 2007</td>
<td>CAISO Issue Paper</td>
</tr>
<tr>
<td>June 6, 2007</td>
<td>Initial Stakeholder Meeting</td>
</tr>
<tr>
<td>September 5, 2007</td>
<td>CAISO Straw Proposal</td>
</tr>
<tr>
<td>September 12, 2007</td>
<td>Stakeholder Meeting</td>
</tr>
<tr>
<td>November 1, 2007</td>
<td>Stakeholder Panel Conference Call</td>
</tr>
<tr>
<td>November 19, 2007</td>
<td>CAISO Revised Straw Proposal</td>
</tr>
<tr>
<td>November 26, 2007</td>
<td>Stakeholder Meeting</td>
</tr>
<tr>
<td>January 29, 2008</td>
<td>CAISO Draft Proposal</td>
</tr>
<tr>
<td>February 13, 2008</td>
<td>Stakeholder Meeting</td>
</tr>
<tr>
<td>May 20, 2008</td>
<td>CAISO Revised Draft Proposal</td>
</tr>
<tr>
<td>May 27, 2008</td>
<td>Stakeholder Conference Call</td>
</tr>
<tr>
<td>June 3, 2008</td>
<td>Stakeholder Comments Due</td>
</tr>
<tr>
<td>July 11, 2008</td>
<td>CAISO Final Proposal</td>
</tr>
<tr>
<td>July 18, 2008</td>
<td>Stakeholder Conference Call</td>
</tr>
<tr>
<td>July 25, 2008</td>
<td>Stakeholder Comments Due</td>
</tr>
<tr>
<td>September 8-9, 2008</td>
<td>Presentation to CAISO Board of Governors</td>
</tr>
</tbody>
</table>

The CAISO will discuss this Final Proposal with stakeholders on a conference call on July 18, 2008. Stakeholders are welcome to submit written comments to SPComments@caiso.com by close of business on July 25, 2008. The CAISO will post a template for stakeholder comments to its website at

The proposal and stakeholder comments will be presented to the CAISO Board of Governors for decision in September 2008.