California Independent
System Operator Corporation

Memorandum

To: ISO Board of Governors

From: Keith Casey, Vice President - Market & Infrastructure Development

Date: December 9, 2009

Re: **Decision on Reserve Shortage Scarcity Pricing Design**

This memorandum requires Board action.

EXECUTIVE SUMMARY

Scarcity pricing is a mechanism that allows market prices for ancillary services to rise automatically, potentially beyond any applicable bid cap, when there is a shortage of supply in the market. Scarcity pricing should enhance short-term and long-term market efficiency and reliability by stimulating demand response, attracting additional supply, creating incentives for generation availability during peak load periods, and promoting long-term contracting for energy and ancillary services.

The Federal Energy Regulatory Commission (FERC) directed the California Independent System Operator Corporation (ISO) to file tariff language and implement a reserve shortage scarcity pricing mechanism within 12 months of the startup of the new market.[1]

Through a multi-year process, Management and stakeholders have developed a balanced design proposal for a scarcity pricing mechanism, guided by the following principles:

1. Compliance with FERC orders;
2. Consistency with current market design;
3. Adaptation based on other independent system operators' design and operational experience;
4. Interaction between scarcity pricing and other market components; and
5. Mitigation of market power.

Management proposes a scarcity pricing mechanism that:

- Applies in both the day-ahead and real-time markets;

[1] *Order Conditionally Accepting the California Independent System Operator Corporation's Electric Tariff Filing to Reflect Market Redesign and Technology Upgrade*,116 FERC ¶ 61,274 (2006) ("September 21 Order") at P 1078.

- Is triggered by insufficient supply to meet the minimum ancillary service requirements, as defined in the tariff;

- Is based on a joint scarcity reserve demand curve for the three upward reserves (regulation up, spinning, and non-spinning) and a scarcity reserve demand curve for regulation down; and

- Ties administratively determined demand curve values to the energy maximum bid price.

Management recommends that the Board approve the proposal for scarcity pricing as described in this memorandum. FERC requires the ISO to implement its scarcity design by April 1, 2010.

Moved, that the ISO Board of Governors approves the proposal to implement reserve shortage scarcity pricing, with the design elements detailed in the memorandum dated December 9, 2009; and

Moved, that the ISO Board of Governors authorizes Management to make all of the necessary and appropriate filings with the Federal Energy Regulatory Commission to implement the proposed tariff change.

DISCUSSION AND ANALYSIS

Background

Scarcity pricing is intended to address one of the recognized market inefficiencies caused by bid caps. Bid caps are necessary for mitigating the potential exercise of market power due to the inelasticity of demand in the ISO markets. However, to maintain the reliability of the ISO system during periods of supply scarcity, we need to ensure prices rise sufficiently high enough to attract supply and demand response resources. Bid caps, however, can prevent market prices from rising high enough to reach this goal.

FERC directed the ISO to implement a reserve shortage scarcity pricing mechanism as an enhancement to the current market design, providing the following guidelines:

- When there is a supply shortage, "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."[2]

- The scarcity pricing mechanism "applies administratively-determined graduated prices to various levels of reserve shortage."[3]

- "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."[4]

[2] *Id.* at P 1077.
[3] *Id.* at P 1079.

DESIGN ELEMENTS AND MANAGEMENT RECOMMENDATIONS

Scope of scarcity pricing mechanism

The ISO procures ancillary services, including regulation up, regulation down, spinning reserve, and non-spinning reserve, in both day-ahead and real-time markets. Management proposes to implement a scarcity pricing mechanism to apply to these ancillary services in both day-ahead and real-time markets.

Trigger of scarcity pricing mechanism

The ISO tariff defines two ancillary service regions, the *system region* (i.e., the ISO balancing authority area) and the *expanded system region* (i.e., the system region and the intertie scheduling points with adjacent balancing authority areas), and eight sub-regions within them. [5]

North American Electric Reliability Corporation (NERC) and Western Electricity Coordinating Council (WECC) reliability criteria set minimum requirements for the ancillary services in the expanded system region. The ISO may establish minimum requirements for ancillary services in the system region and sub-regions to ensure that ancillary services are dispersed appropriately throughout its balancing authority area. [6]

Management proposes to use the minimum requirements for ancillary services to trigger the scarcity pricing mechanism. When supply is insufficient to meet any of these requirements, whether in the day-ahead market or real-time market, the scarcity pricing mechanism will apply in the region or sub-region in which the shortage occurs.

Approach of scarcity pricing design

Management proposes to implement scarcity pricing using scarcity reserve demand curves, consistent with an approach proposed by FERC. [7]

The demand curve will clear the ancillary services market with administratively-determined prices when there is supply shortage. Graduated prices will reflect the various levels of shortage. The prices are transparent and set automatically in a scarcity condition. Market participants do not need to change their bidding behavior in anticipation of a scarcity condition. The demand curve values also act as price caps that can prevent exercise of market power. The scarcity pricing design of all other independent system operators reflects this demand curve approach.

Scarcity reserve demand curves

Management had to address a critical issue for demand curve design: how to determine demand curve prices. The graduated prices should correspond to various levels of reserve shortages in the ancillary

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[4] Id. at P 1079.
[5] ISO Tariff section 8.3.3
[6] ISO Tariff section 8.3.3.2
[7] *Wholesale Competition in Regions with Organized Electric Markets*, 125 FERC ¶ 61,071 (2008) ("Order 719") at P 208.

service regions and sub-regions. Through discussions with stakeholders, we have considered the following factors in the proposed demand curve design:

- **Maximum reserve scarcity price in the expanded system region**

  The scarcity pricing mechanism will improve reliability by reducing demand and increasing generation availability during periods of scarcity. The scarcity prices should reflect the economic values of the reserves necessary to resolve the shortage but not expose consumers to unreasonably high prices. Management proposes to set the maximum scarcity price in the expanded system region equal to the energy maximum bid price. Management believes this scarcity price approximates the maximum opportunity cost that could occur for reserves. It will enable the ISO to make full use of economic generation and demand response resources in a scarcity condition.

- **Administratively-determined demand curve values**

  Scarcity in each type of ancillary service has different reliability implications and should have different demand curve values. For example, scarcity caused by extreme ramping conditions usually occurs in regulation and spinning reserve products. Such events are transient and have relatively little impact on reliability. As a result, Management proposes relatively low incremental demand curve values for such reserves to avoid large price swings.

  "Genuine" scarcity is caused by a shortage of total supply capacity. Such events, which usually start with shortage in non-spinning reserve, may have significant impact on reliability. As a result, Management recommends setting the demand curve values for non-spinning reserve at higher levels.

  Regulation down is the only downward reserve. The regulation down scarcity price should be high enough to provide an adequate incentive for renewable resources, such as wind generation, to respond to the ISO demand.

  To disperse ancillary services appropriately throughout the ISO balancing authority area, Management can set minimum requirements for ancillary services in ISO sub-regions. When supplies in these sub-regions are insufficient to meet the requirements, there is no violation of NERC and WECC reliability standards. It is a less serious threat to reliability as compared to a scarcity condition in the expanded system region. Management proposes to set the demand curve values for the sub-regions at a lower level than those for the expanded system region to reflect the value of scarce resources. But these demand curve values should be sufficient for re-dispatch of resources to resolve the shortages.

- **Tiered demand curves for non-spinning and regulation down reserves**

  Management proposes tiered demand curves for non-spinning and regulation down reserves. The demand curve values increase with the levels of shortage. We developed these tiers based on the ancillary service bid deficiency data between 2006 and 2007. Since the startup of the new markets on April 1, 2009, the ISO has not experienced any ancillary service supply

shortages yet and thus, there is no new market data to support the development of the demand curves.

Based on analysis and discussion with stakeholders, Management proposes scarcity reserve demand curves as presented in *Table 1*.

Table 1. Proposed Scarcity Reserve Demand Curves

Reserve	Demand Curve Value ($/MWh)					
	Percent of Energy Max Bid Price		Energy Max Bid Price = $750/MWh		Energy Max Bid Price = $1000/MWh	
	Expanded System Region	System Region and Sub-Region	Expanded System Region	System Region and Sub-Region	Expanded System Region	System Region and Sub-Region
Regulation Up	20%	10%	$150	$75	$200	$100
Spinning	10%	10%	$75	$75	$100	$100
Non-Spinning		25%		$188		$250
Shortage > 210 MW	70%		$525		$700	
Shortage > 70 & ≤ 210 MW	60%		$450		$600	
Shortage ≤ 70 MW	50%		$375		$500	
Upward Sum	**100%**	**45%**	**$750**	**$338**	**$1000**	**$450**
Regulation Down						
Shortage > 84 MW	70%		$525		$700	
Shortage > 32 & ≤ 84 MW	60%		$450		$600	
Shortage ≤ 32 MW	50%		$375		$500	

When supplies of all reserves are short in the expanded system region and a sub-region, the scarcity price may rise as high as 145% of energy maximum bid price.

Other related issues

Based on discussion with stakeholders, Management also proposes to:

- Review the ISO's scarcity pricing design at least every three years and discuss with stakeholders how to improve the design;
- Issue a market notice to inform stakeholders before the ISO changes its rules for determining the minimum ancillary service requirements based on either NERC/WECC reliability criteria or ISO operational needs; and
- Issue a market notice to inform stakeholders when a scarcity condition arises, until such time as the ISO can automate this process through its *Open Access Same-time Information System* site.

During the scarcity pricing stakeholder process, the ISO identified that, in its current market design, prices for ancillary services and energy are determined in two different market clearing processes. Currently, the ISO procures 100% of its forecast ancillary services requirements in the day-ahead market and only a small incremental amount of ancillary services in the real-time market, if needed. The real-time market procurement occurs in the *real time unit commitment* (RTUC) process every 15 minutes. Energy and ancillary services are co-optimized in the RTUC process, but only ancillary service prices and awards are financially binding. Financially binding energy prices and schedules are determined in the subsequent 5-minute, *real time dispatch* (RTD) process through an energy-only optimization. As a result, in some instances the RTD energy prices may not correctly reflect the ancillary service opportunity costs determined in the RTUC co-optimization.

The ISO discussed this matter and its possible impact on scarcity pricing with stakeholders. Management believes this issue will have a relatively limited impact on market prices since the ISO procures only a small incremental amount of ancillary services in the real-time market.[8] Management proposes to initiate a stakeholder process in 2010 to undertake a comprehensive review of the real-time market design and examine improvements that may include refining the current co-optimization approach.

POSITIONS OF THE PARTIES

The ISO stakeholder process for scarcity pricing began in May 2007, with a break from July 2008 through August 2009 to focus on the startup of the new markets. In the process, Management published several whitepapers and held multiple meetings and conference calls. Management has incorporated feedback from stakeholders in this proposal. Stakeholder comments are summarized in *Attachment A – Stakeholder Matrix*.

Management has tried to develop a balanced proposal. Revising the original proposal in response to stakeholder suggestions, we:

- Designed tiered demand curves for non-spinning and regulation down reserves;
- Postponed discussion of demand curves in sub-regions until after startup of the new markets;
- Established a process to inform stakeholders before the ISO changes its rules about minimum ancillary service requirements; and
- Developed a process to monitor and review the performance of the scarcity pricing design periodically, and propose potential improvements.

The majority of stakeholders support the Management proposal. However, differences of opinions on a few issues remain.

Some stakeholders believe that scarcity pricing should pay the same scarcity premiums, whether the shortages are in the expanded system region or sub-regions. Management recognizes this view is based on the Midwest ISO design. Though our proposal differs from theirs, it is based on reliability

[8] From April through July 2009, the average RTPD procurements of the four types of ancillary services were between 30 to 55 MW.

justifications. As stated above, when a scarcity condition occurs in a sub-region, it is a less serious threat to reliability as compared to a scarcity condition in the expanded system region. Management's proposed demand curve values reflect this fact. Our proposal is also consistent with the designs of ISO-NE and NYISO.

The CPUC suggested delaying scarcity pricing implementation until April 2011 to allow sufficient time to develop effective proxy demand response resource. Otherwise, the CPUC argues, the existing generation and demand response resources might not be sufficient to mitigate scarcity pricing in the real-time market. Management believes that the ISO already has demand response tools at its disposal. Also, other price-responsive demand that load serving entities have developed can help mitigate scarcity conditions. Management hopes that by implementing this proposed scarcity design, the ISO will provide incentives for resources to participate in demand response programs.

MARKET SURVEILLANCE COMMITTEE OPINION

The ISO's Market Surveillance Committee (MSC) has provided an opinion on the Management's scarcity pricing proposal. The MSC supports the proposal. The opinion also recommends that the ISO:

- Develop a cohesive and consistent framework for valuing the scarcity of resources based on loss-of-load probability and value of lost load;
- Undertake additional studies, using the framework described above, to derive penalty parameters that better reflect the reliability costs of relaxing operating constraints than the proposed demand curve values for both the expanded system region and sub-region;
- Consider starting stakeholder process for addressing the potential shortcoming in real-time market co-optimization; and
- Improve the proxy demand resource proposal in order to have a well-functioning scarcity pricing proposal.

Management appreciates the MSC's support as well as its constructive recommendations for refining scarcity pricing. As the MSC also pointed out, developing the suggested framework is extremely difficult and very time-consuming. This scarcity pricing design needs to be implemented within the FERC required timeframe. Our proposal for the demand curve values is based on reliability and economic justifications. We have proposed to review the design at least every three years. The ISO may consider the MSC suggestions in the future as improvement to the scarcity pricing mechanism.

Management has also proposed to initiate a stakeholder process in 2010 to review the real-time market co-optimization issue. The ISO is working with stakeholders to develop effective demand response resources. The proposed scarcity pricing design should provide economic incentives for the development of demand response programs.

The MSC opinion is *Attachment B* to this memorandum.

MANAGEMENT RECOMMENDATION

Management recommends that the Board approve the proposal for scarcity pricing design as described in this memorandum. FERC requires the ISO to implement its scarcity design by April 1, 2010.