California Independent
System Operator Corporation

Update to
CAISO Draft Final Proposal
on
Uneconomic Adjustment Policy and Parameter Values

October 16, 2008

Department of Market and Product Development

Update to Draft Final Proposal on Uneconomic Adjustment Policy and Parameter Values

1. Introduction

This paper provides the California Independent System Operator's (ISO's) updates to:

- The ISO's draft final proposals, published on September 19, 2008, on several issues related to uneconomic adjustments in the markets being implemented under the Market Redesign and Technology Upgrade (MRTU) project, and
- The recommendations of the Department of Market and Product Development (MPD) for the uneconomic adjustment parameter values, which either are already being used or will soon be implemented in the market simulation software.

The updates to the September 19 proposals reflect the ISO's consideration of concerns raised during the discussions at the September 25 meeting, the written comments submitted by stakeholders following that meeting, and the comments of the Market Surveillance Committee.

The September 19 proposal addressed the following topics:

1. Setting real-time 5-minute interval prices based on the energy bid cap when there is supply shortfall;
2. Using the energy bid cap as the pricing run parameter on transmission constraints that are relaxed in the scheduling run in the integrated forward market (IFM) or the real-time market;
3. Adopting an energy price cap and price floor to limit potentially extreme LMPs that can arise due to the interaction of multiple constraints;
4. Enforcing in the reliability procurement mechanism provided by residual unit commitment (RUC) any energy limits submitted in the day-ahead market for use-limited resources;
5. Providing financial firmness to holders of existing rights if their submitted, valid IFM self-schedules are unbalanced by uneconomic adjustment in the IFM; and
6. Maintaining the uneconomic adjustment parameter values in the business practice manuals (BPMs), and the process whereby the parameter values may be revised.

The present update describes revised proposals for the following two items:

- The pricing parameter value to be used when there is insufficient supply of an ancillary service to meet the procurement requirement (Section 2 of this paper; not addressed in the Sept. 19 paper but raised at the Sept. 25 meeting and in the MSC comments); and
- Treatment of existing rights self-schedules (TOR, ETC, CVR) under uneconomic adjustment (Section 3 of this paper, item 5 of the Sept. 19 paper).

Section 4 then provides updated values for the uneconomic adjustment parameters.

2. Revised Proposal on Pricing Parameter under Ancillary Service Supply Shortfall

Introduction

In the ISO's September 19 Draft Final Proposal on MRTU Uneconomic Adjustment and Parameter Tuning, the ISO proposed to set the pricing run ancillary service (A/S) penalty price to zero for any A/S procurement requirement that could not be fully met in the market (Zero Penalty Price Approach). After considering the comments of the stakeholders and the Market Surveillance Committee (MSC) during the September 25 public meeting the ISO is now revising the proposal to set the pricing run A/S penalty price to the A/S bid cap, which is $250 per MW/hour (Bid Cap Penalty Price Approach).

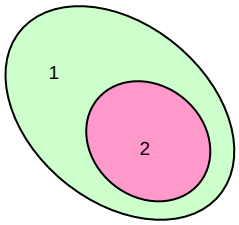
The rest of this section of the document analyzes the two approaches by focusing on their formulations in the software and their outcomes. It is intended to help stakeholders understand the differences between the two approaches and the intent of the ISO proposal.

Basic Assumptions

In order to be comparable the two approaches have to be put on the same basis. The discussions in this document are based on the following common assumptions:

1) The two approaches have the same scheduling run A/S requirements and results

2) There are two A/S regions - Region 2 is a sub-region within the ISO system and Region 1 is the ISO system excluding Region 2



3) There is one A/S reserve

4) The supply is insufficient to meet the A/S requirement of Region 2 and the requirement of the ISO system (Region 1 plus Region 2); i.e., both the sub-region and the ISO system are short of supply

5) A/S requirements are adjusted in pricing run by the amounts of deficiency identified in scheduling run.

Scheduling run A/S requirement formulations are the same for both approaches and are based on current MRTU software design for A/S modeling. That is:

Scheduling Run A/S Constraint Formulation

$$\sum_{i \in Region2} AS_i + Slack_2 \geq Req_2$$

$$\sum_{i \in Region2} AS_i + \sum_{j \in Region1} AS_j + Slack_1 \geq Req_2 + Req_1$$

In the above formulation, Req_1 and Req_2 are inputs to the software, determined by the ISO based on forecast operating needs for the relevant operating interval. Note that the absence of $Slack_2$ in the second equation means that if there is insufficient supply in A/S for Region 2 in the scheduling run, the software will attempt to procure additional A/S for Region 1 in order to meet the overall requirement for the ISO system (Region 1 + Region 2).

In the pricing run, the two approaches still utilize a common formulation of the AS requirement constraints. However, the pricing run formulation differs from the scheduling run formulation by incorporating S_2, the slack variable for the inner sub-region, into the A/S requirement constraint for the ISO system, as shown in the second equation below. Such constraint formulation will prevent what is called "pancaking" of non-zero penalty prices, that is, setting AS prices at multiples of the penalty price when there are simultaneous shortages of A/S in multiple nested regions.

Pricing Run A/S Constraint Formulation

$$\sum_{i \in Region2} AS_i + S_2 \geq Req_2 - Slack_2 + \delta_2$$

$$\sum_{i \in Region2} AS_i + \sum_{j \in Region1} AS_j + S_2 + S_1 \geq Req_2 + Req_1 - Slack_1 + \delta_1$$

$$S_1 \leq \varepsilon, \quad S_2 \leq \varepsilon$$

Where:

AS_i = A/S procurement from resource *i*

Req_k = minimum A/S requirement of Region *k* (*k* = 1, 2)

$Slack_k$ = scheduling run slack variable for Region *k* A/S requirement (*k* = 1, 2)

S_k = pricing run slack variable for adjusted Region *k* A/S requirement (*k* = 1, 2)

ε, δ_1 and δ_2 are small constants with $\varepsilon > \delta_1 > \delta_2$. δ_1 and δ_2 are added to help the stability of the co-optimization.

Zero Penalty Price Approach

The Zero Penalty Price Approach sets the pricing run A/S penalty prices to zero. This approach assumes that there is no A/S supply deficiency in pricing run so the ASMPs are always set by economic bids with opportunity costs, if there is any.

The ISO's original intent in proposing this approach was to avoid A/S penalty price pancaking when A/S supplies are deficient in multiple nested regions. As discussed at the September 25 meeting, the ASMPs set under this approach do not reflect the situation of A/S supply deficiency and relaxation of the procurement requirement in the scheduling run. Also, since the ASMPs will always be set by the economic bids, bidding behavior will affect the final outcomes of the pricing run co-optimization. For example, suppliers may raise their bid prices

when A/S supply deficiency is anticipated. In any event, the ASMPs could still be set higher than the A/S bid cap due to the effects of opportunity cost.

Assuming the ASMP in Region 1 is ASMP_0_1 and in Region 2 is ASMP_0_2 under the Zero Penalty Price Approach, the numerical examples in the Appendix ("Pricing Run – Zero Penalty Price Approach" section) demonstrate how they are set by economic bids. They will be compared with the ASMPs of the Bid Cap Penalty Price Approach.

Bid Cap Penalty Price Approach

The Bid Cap Penalty Price Approach sets the pricing run A/S penalty prices at the A/S bid cap ($250/MW/hour per the MRTU Tariff). This approach may be view as an improvement over the Zero Penalty Price Approach because the resulting ASMPs will be affected by the $250 pricing run parameter, reflecting the A/S supply deficiency situation. In particular, the ASMPs under the Bid Cap Penalty Price Approach are set to the higher of the costs of economic bids (bid prices plus the opportunity cost of not providing energy) and the pricing run penalty price (the A/S bid cap).

Assuming ASMP_BCPP_1 and ASMP_ BCPP_2 are the ASMPs of Region 1 and Region 2 respectively under the Bid Cap Penalty Price Approach, they are set according to the following rules:

$$ASMP\_BCPP\_1 = \max(ASMP\_0\_1, 250)$$

$$ASMP\_ BCPP\_2 = \max(ASMP\_0\_2, 250)$$

If the cost of the last economic bid in a region is lower than the A/S bid cap the ASMP in that region will be raised automatically to the A/S bid cap when there is A/S supply deficiency. This is the only difference from the Zero Penalty Price Approach.

According to the rules, the ASMP in the inner region can get only as high as the penalty price when the ASMP is not set by an economic bid. Thus the penalty price pancaking effect is avoided in situations of A/S supply deficiency in multiple nested regions.

As in the Zero Penalty Price Approach, when the ASMPs are set by economic bids they will be affected by bidding behavior, and they can be set higher than the A/S bid cap due to opportunity costs.

The "Pricing Run – Bid Cap Penalty Price Approach" section of the Appendix presents two examples of this approach.

Summary

The pricing run characteristics of the two A/S penalty price approaches analyzed in this document are summarized in the table below.

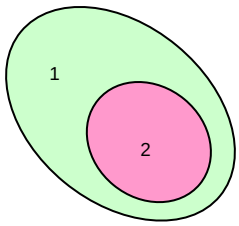
Approach	Characteristics
Zero Penalty Price	– Penalty price is set at $0/MWh – ASMPs are always set by economic bids

	– ASMPs do not explicitly reflect A/S supply deficiency, except to the extent that economic bid prices (A/S offer prices plus opportunity cost) are high – Bidding behavior matters – No penalty price pancaking
Bid Cap Penalty Price	– Penalty price is set at A/S bid cap ($250/MWh) – ASMPs are set by the higher of the costs of economic bids (bid prices plus opportunity costs) and the penalty price – ASMPs may reflect A/S supply deficiency explicitly due to the minimum price set by the A/S bid cap – Bidding behavior matters – No penalty price pancaking

Appendix: Numerical Examples of A/S Pricing Parameters

This appendix presents numerical examples to support the analysis of the two A/S penalty price approaches in this document. The examples demonstrate how each of the approaches determines the A/S procurements and ASMPs in the energy and A/S co-optimization process based on different pricing parameters.

All the examples in this appendix follow the basic assumptions below:



1) All examples have the same scheduling run A/S requirement constraints and results
2) There are two A/S regions: Region 2 is a sub-region within the ISO system and Region 1 is the ISO system excluding Region 2
3) There is one A/S reserve
4) The supply is insufficient to meet the A/S requirement for region 2 and the requirement for the ISO system (Region 1 plus Region 2)
5) A/S requirements are adjusted in pricing run by the amounts of deficiency identified in scheduling run
6) There are both energy and A/S requirements for each of the two regions
7) There are four suppliers. Supplier 1 and 2 are in Region 1 and Supplier 3 and 4 are in Region 2

8) Each supplier bids into both A/S and energy markets for its A/S certified capacity and the total capacity for energy and A/S

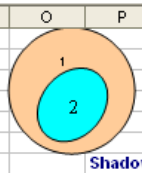
The examples cover two cases. One has a pricing run A/S price set by the last economic bid (bid price plus opportunity cost) higher than two times of the A/S bid cap in Region 2. The other has an A/S price set by economic bid lower than the A/S bid cap in both regions. The cases are set up so that different characteristics of the A/S pricing approaches discussed in this document can be demonstrated.

Scheduling Run Setups

Below are the setups and results of the scheduling runs of the two cases.

1. Case 1

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1		**Scheduling Run - AS deficiency in Region 1 & 2 - Case 1**										© 2008 CAISO				
2																
3		Variables	AS1,1	AS1,2	AS2,3	AS2,4	E1,1	E1,2	E2,3	E2,4	XAS1	XAS2				
4		Variable Values	38	160	5	80	4462	288	1495	5	2	5				
6		Obj Function Coef	6	10	12	18	25	30	50	355	2000	2000				
8																
25		Constraint Coefficients*Variable											LHS	>=	RHS	Shadow Price
26		Region 2 - AS			5	80						5	**90**	>=	**90**	2000
27		Region 1 & 2 - AS	38	160	5	80					2		**285**	>=	**285**	2000
28		Region 2 - Energy							1495	5			**1500**	>=	**1500**	355
29		Region 1 - Energy					4462	288					**4750**	>=	**4750**	30
30		AS Cap 4 in Region 2				80							**80**	<=	**80**	-3982
31		AS Cap 3 in Region 2			5								**5**	<=	**5**	-3683
32		AS Cap 2 in Region 1		160									**160**	<=	**160**	-1990
33		AS Cap 1 in Region 1	38										**38**	<=	**38**	-1989
34		Total Capacity 4				80				5			**85**	<=	**100**	0
35		Total Capacity 3			5				1495				**1500**	<=	**1500**	-305
36		Total Capacity 2		160				288					**448**	<=	**500**	0
37		Total Capacity 1	38				4462						**4500**	<=	**4500**	-5



where:

ASi,j – A/S procurement from supplier *j* in region *i* (MW)

Ei,j – energy procurement from supplier *j* in region *i* (MW)

XASi – A/S requirement slack variable for region *i* (MW)

Obj Function Coef – A/S and energy bid prices by the suppliers and penalty prices for the slack variables ($/MWh)

Variable Values – the optimal values of the variables from the co-optimization (MW)

LHS – the sum of the variable values for each of the constraints (MW)

RHS – the A/S and energy requirements and maximum capacity limits (MW)

Shadow Price – shadow price of each constraint calculated in the co-optimization ($/MWh). ASMP of Region 1 equals the shadow price of constraint "Region 1 & 2 – AS" constraint and ASMP of Region 2 equals the sum of the shadow prices of "Region 1 & 2 – AS" and "Region 2 – AS" constraints.

In the table below are the results of Case 1 scheduling run, including A/S and energy procurements, A/S deficiencies, and market clearing prices. As we can see there is a 5 MW A/S

supply shortage in Region 2 and a 2 MW shortage in the total of Region 1 and Region 2. The A/S market clearing prices are set by the penalty prices at $2000/MWh in Region 1 and $4000/MWh in Region 2.

Variable Value (MW)	AS1,1	AS1,2	AS2,3	AS2,4	E1,1	E1,2	E2,3	E2,4	XAS1	XAS2
	38	160	5	80	4462	288	1495	5	2	5
Clearing Price ($/MWh)	AS1	AS2	E1	E2						
	2,000	4,000	30	355						

2. Case 2

The only change from Case 1 is the energy offer price by supplier 4. It is dropped from $355/MWh to 185/MWh in order to lower the opportunity cost in the A/S price of Region 2 so that the pricing run A/S price set by the last economic bid will be lower than the A/S bid cap (see Case 2 of Zero Penalty Price Approach section below).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1		**Scheduling Run - AS deficiency in Region 1 & 2 - Case 2**										© 2008 CAISO				
2																
3		Variables	AS1,1	AS1,2	AS2,3	AS2,4	E1,1	E1,2	E2,3	E2,4	XAS1	XAS2				
4		Variable Values	38	160	5	80	4462	288	1495	5	2	5				
6		Obj Function Coef	6	10	12	18	25	30	50	185	2000	2000				
8																
25		Constraint Coefficients*Variable											**LHS**	>=	**RHS**	**Shadow Price**
26		Region 2 - AS			5	80						5	**90**	>=	**90**	2000
27		Region 1 & 2 - AS	38	160	5	80					2		**285**	>=	**285**	2000
28		Region 2 - Energy							1495	5			**1500**	>=	**1500**	185
29		Region 1 - Energy					4462	288					**4750**	>=	**4750**	30
30		AS Cap 4 in Region 2				80							**80**	<=	**80**	-3982
31		AS Cap 3 in Region 2			5								**5**	<=	**5**	-3853
32		AS Cap 2 in Region 1		160									**160**	<=	**160**	-1990
33		AS Cap 1 in Region 1	38										**38**	<=	**38**	-1989
34		Total Capacity 4				80				5			**85**	<=	**100**	0
35		Total Capacity 3			5				1495				**1500**	<=	**1500**	-135
36		Total Capacity 2		160				288					**448**	<=	**500**	0
37		Total Capacity 1	38				4462						**4500**	<=	**4500**	-5

Below are the results of Case 2 scheduling run. They are the same as that of Case 1 except the energy price in Region 2.

Variable Value (MW)	AS1,1	AS1,2	AS2,3	AS2,4	E1,1	E1,2	E2,3	E2,4	XAS1	XAS2
	38	160	5	80	4462	288	1495	5	2	5
Clearing Price ($/MWh)	AS1	AS2	E1	E2						
	2,000	4,000	30	185						

Pricing Run – Zero Penalty Price Approach

The Zero Penalty Price Approach assumes that there is no deficiency in pricing run. The penalty prices are set at zero. The ASMPs are always set by economic bids with opportunity costs, if there is any.

1. Case 1

In the pricing run, the volume of the two new slack variables, *S1* and *S2*, are capped at 0.01 MW. They have a $0/MWh penalty price.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1		**Pricing Run - Zero Penalty Price - Case 1**										© 2008 CAISO				
2																
3		Variables	AS1,1	AS1,2	AS2,3	AS2,4	E1,1	E1,2	E2,3	E2,4	S1	S2				
4		Variable Values	37.9917	160	4.99333	80	4462.01	287.992	1495.01	4.99333	0.01	0.01				
6		Obj Function Coef	6	10	12	18	25	30	50	355	0	0				
8																
25		Constraint Coefficients*Variable											LHS	>=	RHS	Shadow Price
26		Region 2 - AS			4.99333	80						0.01	85.0033	>=	85.0033	306
27		Region 1 & 2 - AS	37.9917	160	4.99333	80					0.01	0.01	283.005	>=	283.005	11
28		Region 2 - Energy							1495.01	4.99333			1500	>=	1500	355
29		Region 1 - Energy					4462.01	287.992					4750	>=	4750	30
30		AS Cap 4 in Region 2				80							80	<=	80	-299
31		AS Cap 3 in Region 2			4.99333								4.99333	<=	5	0
32		AS Cap 2 in Region 1		160									160	<=	160	-1
33		AS Cap 1 in Region 1	37.9917										37.9917	<=	38	0
34		Total Capacity 4				80				4.99333			84.9933	<=	100	0
35		Total Capacity 3			4.99333				1495.01				1500	<=	1500	-305
36		Total Capacity 2		160				287.992					447.992	<=	500	0
37		Total Capacity 1	37.9917				4462.01						4500	<=	4500	-5
38		S1 Upper Limit									0.01		0.01	<=	0.01	-11
39		S2 Upper Limit										0.01	0.01	<=	0.01	-317

As we can see in the table below, the ASMPs are set by economic bids, with opportunity costs of not providing energy, at $11/MWh and $317/MWh in Region 1 and Region 2 respectively. Slack variables are used up to their maximum allowed volumes. They do not set the prices.

Variable Value (MW)	AS1,1	AS1,2	AS2,3	AS2,4	E1,1	E1,2	E2,3	E2,4	S1	S2
	37.9917	160	4.99333	80	4462.01	287.992	1495.01	4.99333	0.01	0.01
Clearing Price ($/MWh)	AS1	AS2	E1	E2						
	11	317	30	355						

2. Case 2

Case 2 pricing run is identical to Case 1 except the energy offer price of Supplier 4, which is reduced from $355/MWh to $185/MWh.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1		**Pricing Run - Zero Penalty Price - Case 2**										© 2008 CAISO				
2																
3		Variables	AS1,1	AS1,2	AS2,3	AS2,4	E1,1	E1,2	E2,3	E2,4	S1	S2				
4		Variable Values	37.9917	160	4.99333	80	4462.01	287.992	1495.01	4.99333	0.01	0.01				
6		Obj Function Coef	6	10	12	18	25	30	50	185	0	0				
8																
25		Constraint Coefficients*Variable											LHS	>=	RHS	Shadow Price
26		Region 2 - AS			4.99333	80						0.01	85.0033	>=	85.0033	136
27		Region 1 & 2 - AS	37.9917	160	4.99333	80					0.01	0.01	283.005	>=	283.005	11
28		Region 2 - Energy							1495.01	4.99333			1500	>=	1500	185
29		Region 1 - Energy					4462.01	287.992					4750	>=	4750	30
30		AS Cap 4 in Region 2				80							80	<=	80	-129
31		AS Cap 3 in Region 2			4.99333								4.99333	<=	5	0
32		AS Cap 2 in Region 1		160									160	<=	160	-1
33		AS Cap 1 in Region 1	37.9917										37.9917	<=	38	0
34		Total Capacity 4				80				4.99333			84.9933	<=	100	0
35		Total Capacity 3			4.99333				1495.01				1500	<=	1500	-135
36		Total Capacity 2		160				287.992					447.992	<=	500	0
37		Total Capacity 1	37.9917				4462.01						4500	<=	4500	-5
38		S1 Upper Limit									0.01		0.01	<=	0.01	-11
39		S2 Upper Limit										0.01	0.01	<=	0.01	-147

The lower energy offer price by Supplier 4 reduces the opportunity cost and therefore the ASMP in Region 2. The ASMP in Region 2 is now only $147/MWh. It is still set by an economic bid.

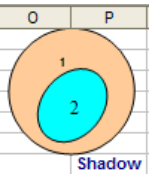
Variable Value (MW)	AS1,1	AS1,2	AS2,3	AS2,4	E1,1	E1,2	E2,3	E2,4	S1	S2
	37.9917	160	4.99333	80	4462.01	287.992	1495.01	4.99333	0.01	0.01
Clearing Price ($/MWh)	AS1	AS2	E1	E2						
	11	147	30	185						

Pricing Run – Bid Cap Penalty Price Approach

The only change from the Zero Penalty Price Approach is the value of the penalty price. Under this approach it is set at the A/S bid cap ($250/MWh) instead of $0/MWh.

1. Case 1

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1		**Pricing Run - Bid Cap Penalty Price - Case 1**										© 2008 CAISO				
2																
3		Variables	AS1,1	AS1,2	AS2,3	AS2,4	E1,1	E1,2	E2,3	E2,4	S1	S2				
4		Variable Values	38	160	4.99333	80	4462	288	1495.01	4.99333	0.00167	0.01				
6		Obj Function Coef	6	10	12	18	25	30	50	355	250	250				
8																
25		Constraint Coefficients*Variable											LHS	>=	RHS	Shadow Price
26		Region 2 - AS			4.99333	80						0.01	85.0033	>=	85.0033	67
27		Region 1 & 2 - AS	38	160	4.99333	80					0.00167	0.01	283.005	>=	283.005	250
28		Region 2 - Energy							1495.01	4.99333			1500	>=	1500	355
29		Region 1 - Energy					4462	288					4750	>=	4750	30
30		AS Cap 4 in Region 2				80							80	<=	80	-299
31		AS Cap 3 in Region 2			4.99333								4.99333	<=	5	0
32		AS Cap 2 in Region 1		160									160	<=	160	-240
33		AS Cap 1 in Region 1	38										38	<=	38	-239
34		Total Capacity 4				80				4.99333			84.9933	<=	100	0
35		Total Capacity 3			4.99333				1495.01				1500	<=	1500	-305
36		Total Capacity 2		160				288					448	<=	500	0
37		Total Capacity 1	38				4462						4500	<=	4500	-5
38		S1 Upper Limit									0.00167		0.00167	<=	0.01	0
39		S2 Upper Limit										0.01	0.01	<=	0.01	-67



In this case the ASMP in Region 1 is set by the penalty price since the last economic bid in Region 1 has a cost of $11/MWh (bid price plus opportunity cost), which is lower than the penalty price. The slack variable, *S1*, becomes the marginal supply and sets the ASMP.

In Region 2 the ASMP is $317/MWh, the same as it is under the Zero Penalty Price Approach. This is because the slack variable, *S2*, has a cost of $250/MWh (the penalty price). It is lower than that of the last economic bid in Region 2, which is $317/MWh (the Region 2 ASMP in Case 1 under the Zero Penalty Price Approach). *S2* is therefore more economic than the last economic bid and used up to it maximum allowed volume, 0.01 MW. The last economic bid becomes the marginal supply and sets the ASMP in this case.

Variable Value (MW)	AS1,1	AS1,2	AS2,3	AS2,4	E1,1	E1,2	E2,3	E2,4	S1	S2
	38	160	4.99333	80	4462	288	1495.01	4.99333	0.00167	0.01
Clearing Price ($/MWh)	AS1	AS2	E1	E2						
	250	317	30	355						

2. Case 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1		**Pricing Run - Bid Cap Penalty Price - Case 2**										© 2008 CAISO				
2																
3		Variables	AS1,1	AS1,2	AS2,3	AS2,4	E1,1	E1,2	E2,3	E2,4	S1	S2				
4		Variable Values	38	160	5	80	4462	288	1495	5	0.00167	0.00333				
6		Obj Function Coef	6	10	12	18	25	30	50	185	250	250				
8																
25		Constraint Coefficients*Variable											LHS	>=	RHS	Shadow Price
26		Region 2 - AS			5	80						0.00333	85.0033	>=	85.0033	0
27		Region 1 & 2 - AS	38	160	5	80					0.00167	0.00333	283.005	>=	283.005	250
28		Region 2 - Energy							1495	5			1500	>=	1500	185
29		Region 1 - Energy					4462	288					4750	>=	4750	30
30		AS Cap 4 in Region 2				80							80	<=	80	-232
31		AS Cap 3 in Region 2			5								5	<=	5	-103
32		AS Cap 2 in Region 1		160									160	<=	160	-240
33		AS Cap 1 in Region 1	38										38	<=	38	-239
34		Total Capacity 4				80				5			85	<=	100	0
35		Total Capacity 3			5				1495				1500	<=	1500	-135
36		Total Capacity 2		160				288					448	<=	500	0
37		Total Capacity 1	38				4462						4500	<=	4500	-5
38		S1 Upper Limit									0.00167		0.00167	<=	0.01	0
39		S2 Upper Limit										0.00333	0.00333	<=	0.01	0

The ASMP in Region 1 is still set by the penalty price, as it is in Case 1. It is different for Region 2. The last economic bid now has a cost of $147/MWh (see Case 2 of the Zero Penalty Price Approach) that is lower than the penalty price. The slack variable, *S2*, becomes the marginal supply of Region 2. The ASMP in Region 2 is therefore set by the penalty price at $250/MWh. In this case, the whole system has a uniform ASMP at $250/MWh.

Variable Value (MW)	AS1,1	AS1,2	AS2,3	AS2,4	E1,1	E1,2	E2,3	E2,4	S1	S2
	38	160	5	80	4462	288	1495	5	0.00167	0.00333
Clearing Price ($/MWh)	AS1	AS2	E1	E2						
	250	250	30	185						

3. Revised Proposal on Treatment of Existing Rights under Uneconomic Adjustment

The ISO now proposes, for the integrated forward market, to set the values of the scheduling parameters associated with self-schedules submitted under existing rights (existing transmission contracts (ETC), converted rights (CVR) and transmission ownership rights (TOR)) to a level higher than the scheduling parameter associated with internal transmission constraints to ensure that existing rights self-schedules will not be curtailed in the IFM. With this proposal the September 19 proposal on financial firmness, which was intended to offset the congestion cost impact to existing rights self-schedules that are subject to uneconomic adjustment in the IFM, is no longer needed and is therefore being dropped from the ISO proposal.

The ISO recognizes that some parties offered specific proposals for addressing the concerns expressed by the existing rights holders. In particular there was considerable support for at least exploring revisions to the scheduling provisions for load scheduled in the IFM under existing rights, to schedule such load at the relevant default LAP rather than the actual load location. Also some of the existing rights holders identified additional ISO settlement charges which they believe any financial offset should address in addition to the exposure to congestion costs.

After considering the various options presented, the ISO now proposes what it believes to be the simplest solution, one which effectively addresses the concerns expressed while being fully

compatible with the current provisions for existing rights self-schedules and the MRTU software. Management proposes to increase the integrated forward market parameter values used for ETC, CVR and TOR self-schedules up to a level slightly above the parameter value for relaxing internal transmission constraints. (Specific values for these parameters are provided in Section 4 of this paper.) Under such parameter settings in the IFM scheduling run, the software will see that adjustments to existing rights self-schedules look more expensive than relaxation of transmission constraints. Therefore, when there is a binding transmission constraint near the location of a supply or load resource self-scheduled under an existing right, the FIM software will relax the transmission constraint rather than curtail the existing right self-schedule. This simple proposal will guarantee that existing rights self-schedules are not curtailed in the IFM, and will thus obviate the need for any financial adjustments for day-ahead schedule reductions because day-ahead existing rights self-schedules will not be reduced.

4. Updated Uneconomic Adjustment Parameter Values

The following parameter values, which have been confirmed through ongoing testing, represent the CAISO's current recommended values for the Integrated Forward Market.

4.1. Integrated Forward Market (IFM) Parameter Values

Penalty Price Description	Scheduling Run Value[1]	Pricing Run Value	Comment
Market energy balance	6500	500	In the scheduling run, it is essential to produce supply matching demand plus losses. In the pricing run, the penalty price is the same as for transmission constraints to ensure that LMPs remain within a reasonable range. This is relevant to the MPM passes in which the objective is to meet CAISO Forecast Demand.
Transmission constraints: Intertie scheduling	7000	500	Intertie scheduling constraints are explicitly excluded from the LAP clearing mechanism described in section 31.3.1.3. Once LAP schedules have cleared in the scheduling run, this constraint has the same penalty price as other transmission constraints.
Reliability Must-Run (RMR) pre-dispatch curtailment (supply)	-6000	-30	The CAISO considers transmission constraints when determining RMR scheduling requirements. However, for this and other parameters listed below, bid prices are limited to between -$30 and

[1] Penalty values are negatively valued for supply reduction and positively valued for demand reduction.

			$500 in the pricing run.
Pseudo-tie layoff energy	-6000	-30	Pseudo-tie layoff energy is scheduled under contractual arrangements with the Balancing Authority in whose area a pseudo-tie is located.
Transmission constraints: branch, corridor, nomogram (base case and contingency analysis)	5000	500	In the scheduling run, the guideline applied to transmission constraints is that an Economic Bid should be accepted if it is priced at the bid cap and is at least 10% effective in relieving a transmission constraint. In the pricing run, two penalty price segments are available: one is priced at the Energy Bid cap for consistency with the Real-Time Market, extending from the original limit to any constraint relaxation resulting from the scheduling run, minus a small amount called “epsilon”, then the second of “epsilon” around the relaxed limit must equal the penalty price of the scheduling run in order to ensure reasonable LMPs. The CAISO is initially setting the second penalty price segment also at the bid cap for pricing run, but will continue to monitor results of further testing and market operations to determine which level results in pricing outcomes that are most consistent with market schedules and operational constraints.
TOR self schedule	5900, -5900	500, -30	A TOR Self-Schedule will be honored in the market scheduling in preference to transmission constraints, but may be adjusted as needed by CAISO operators.
ETC self schedule	5100 to 5900, -5100 to -5900	500, -30	An ETC Self-Schedule will be honored in the market scheduling in preference to transmission constraints, but may be adjusted as needed by CAISO operators. The typical value is set at $5500, but different values from $5100 to $5900 are possible if differential priorities are established among ETC rights.
Converted Right (CVR) self schedule	5500, -5500	500, -30	A CVR Self-Schedule is assigned the same priority as the typical value for ETC Self-Schedules.
Ancillary Service Region Regulation-up and Regulation-down Minimum Requirements	2500	250	In the event of bid insufficiency, AS minimum requirements would be honored in priority to serving generic Self-Scheduled demand, but not at the cost of overloading transmission into AS regions. In the pricing run, the penalty price of $250 applies to a very small amount (on the order of “epsilon”) of capacity, which

			applies in the event of supply insufficiency.
Ancillary Service Region Spin Minimum Requirements	2250	250	Spin reserve minimum requirement is enforced with priority lower than regulation up minimum requirement in scheduling run.
Ancillary Service Region Non-Spin Minimum Requirements	2000	250	Non-spin reserve minimum requirement is enforced with priority lower than spin minimum requirement in scheduling run.
Ancillary Service Region Maximum Limit on Upward Services	1500	250	In the event of multiple AS regional requirements having bid insufficiency, it is undesirable to have the multiple constraints produce AS prices significantly exceeding the AS bid cap. An alternative for enforcing sub-regional AS requirements is to enforce a maximum AS requirement on other AS regions, thereby reducing the AS prices in the other regions without excessive AS prices in the sub-region with bid insufficiency.
Self-scheduled CAISO demand and self-scheduled exports using identified non-RA supply resource	1000	500	Pursuant to section 31.4, the uneconomic bid price for self-scheduled demand in the scheduling run exceeds the uneconomic bid price for self-scheduled supply and self-scheduled exports not using identified non-RA supply resources.
Self-scheduled exports not using identified non-RA supply resource	800	500	Self-scheduled exports using RA capacity would be priced at 50% of generic self-schedules for demand.
Regulatory Must-Run and Must Take supply curtailment	-750	-30	Regulatory must-run and must-take supply received priority over generic self-schedules for supply resources.
Price-taker supply bids	-550	-30	Generic self-schedules for supply receive higher priority than Economic Bids at the bid cap, and would be priced 10% higher in the scheduling run.
Conditionally qualified Regulation Up or Down self-provision	-285	NA	Conversion of AS self-schedules to Energy pursuant to section 31.3.1.3 will give higher priority to maintaining the availability of regulation, over spinning and non-spinning reserve.
Conditionally qualified Spin self-provision	-280	NA	Conversion of AS self-schedules to Energy pursuant to section 31.3.1.3 will give higher priority to maintaining the availability of spinning reserve, over non-spinning reserve.
Conditionally qualified Non-Spin self-provision	-275	NA	The CAISO has determined this penalty price for conversion of self-provided non-spinning reserves through empirical testing, as a value that balances the

			maintenance of AS self-schedules with ensuring that the conversion to energy occurs before transmission constraints are relaxed.
Conditionally unqualified Reg Up or Down self-provision	-75	NA	In instances where AS self-provision is not qualified pursuant to the MRTU tariff, the capacity can still be considered as an AS bid, along with regular AS bids. The price used for considering unqualified AS self-provision is lower than the AS bid cap, to allow it to be considered as an Economic Bid.
Conditionally unqualified Spin self-provision	-50	NA	Same as above.
Conditionally unqualified Non-Spin self-provision	-35	NA	Same as above.

4.2. Residual Unit Commitment (RUC) Parameter Values

Penalty Price Description	Scheduling Run Value	Pricing Run Value	Comment
Transmission constraints: Intertie scheduling	2000	250	The Intertie scheduling constraint must retain higher relative priority than other RUC constraints.
Market energy balance	1600	0	The RUC procurement may be less than the Demand forecast if the CAISO has committed all available generation and accepted intertie bids up to the intertie capacity.
Transmission constraints: branch, corridor, nomogram (base case and contingency analysis)	1250	250	These constraints affect the final dispatch in the Real-Time Market, when conditions may differ from Day-Ahead.
Limits on Minimum load energy, Quick start capacity, and Minimum generation	250	0	These constraints affect the RUC capacity reservations, but not at a cost exceeding the RUC bid cap in the scheduling run, and are $0 in the pricing run so that the last accepted bid will set the market price.
Day-Ahead energy schedules resulting from the IFM run, and estimated Hour-Ahead self schedules for energy	250	250	These schedules are assigned the RUC bid cap in both the scheduling run and pricing run, in order to preserve these schedules without excessively impacting RUC LMPs.

4.3. Real Time Market Parameter Values

Penalty Price Description	Scheduling Run Value	Pricing Run Value	Comment
Energy balance/Load curtailment and Self-Scheduled exports utilizing non-RA capacity	6500	500	In the scheduling run, it is essential to produce supply matching demand plus losses. Using the energy bid cap as the parameter in the pricing run, the energy price will rise to at least the energy bid cap to reflect the energy supply shortage. Since Self-Scheduled Exports supported by Non-RA capacity receive the same priority as the CAISO Demand Forecast, the same priority is used for Exports. (Tariff Section 34.10.1).
Transmission constraints: Intertie scheduling	7000	500	Intertie scheduling constraints are assigned a penalty price above the energy balance constraint because intertie scheduling constraints are explicitly excluded from the LAP clearing mechanism described in the MRTU tariff section 31.3.1.3. The pricing run parameter is set to the energy bid cap to be consistent with other transmission constraint relaxation penalty prices.
Reliability Must-Run (RMR) pre-dispatch curtailment (supply), and Exceptional Dispatch Supply	-6000	-30	In the scheduling run, the CAISO considers transmission constraints with lower priority for protecting from relaxation when determining RMR scheduling requirements. In the pricing run, the bid floor is used as the pricing parameter for any type of self-schedule.
Pseudo-tie layoff energy	-6000	-30	Pseudo-tie layoff energy is scheduled under contractual arrangements with the Balancing Authority in whose area a pseudo-tie is located.
Transmission constraints: branch, corridor, nomogram (base case and contingency analysis)	5000	500	In the scheduling run, the guideline applied to transmission constraints is that an Economic Bid should be accepted if it is priced at the bid cap and is at least 10% effective in relieving a transmission constraint. In the pricing run, a single penalty price segment is modeled priced at the Energy Bid cap. This is consistent with the pricing parameter value for energy balance relaxation under a global energy supply shortage.
Real Time TOR Self Schedule	5900, -5900	500, -30	A TOR self-schedule will be protected by the assignment of a schedule adjustment parameter higher than transmission constraint relaxation. Schedules may be

			adjusted as needed to maintain reliability by CAISO operators.
Real Time ETC Self Schedule	5100 to 5900, -5100 to -5900	500, -30	An ETC self-schedule will be protected by the assignment of a schedule adjustment parameter higher than transmission constraint relaxation. Schedules may be adjusted as needed to maintain reliability by CAISO operators. The typical value is set at $5500, but different values from $5100 to $5900 are possible if differential priorities are established among ETC rights.
Ancillary Service Region Reg-Up and Reg-Down Minimum Requirements	2500	250	In the event of bid insufficiency, AS minimum requirements would be honored in priority to serving generic Self-Scheduled demand, but not at the cost of overloading transmission into AS regions. In the pricing run the pricing parameter is set to the ancillary services market bid cap so that the ancillary service price will rise at least to that level under an ancillary service supply shortage.
Ancillary Service Region Spin Minimum Requirements	2250	250	Penalty price for scheduling run is less than the one for regulation-up requirement for lower in priority.
Ancillary Service Region Non-Spin Minimum Requirements	2000	250	Penalty price for scheduling run is less than the one for spin requirement for lower in priority.
Ancillary Service Region Maximum Limit on Upward Services	1500	250	Penalty price of scheduling run for maximum limit upward services less than the one for minimum requirement is intended for avoiding an otherwise system shortage through procuring AS from sub-region that exceeds its maximum limit.
Self-scheduled exports not using identified non-RA supply resource	800	500	Self-scheduled exports using RA capacity would be priced at 50% of generic self-schedules for demand.
Regulatory Must-Run and Must Take supply curtailment	-750	-30	Regulatory must-run and must-take supply received priority over generic self-schedules for supply resources.
Final IFM Supply Schedule	-650	-30	
Price-taker supply bids	-550	-30	Generic supply self-schedules receive higher priority than Economic Bids at the bid cap, and would be priced 10% higher in the scheduling run.
Conditionally qualified Reg Up or Down Real Time self-provision (RTPD only)	-285	NA	Conversion of AS self-schedules to Energy pursuant to section 31.3.1.3 will give higher priority to maintaining the availability of regulation, over spinning and non-spinning reserve.

Conditionally qualified Real Time Spin self-provision (RTPD only)	-280	NA	Conversion of AS self-schedules to Energy pursuant to section 31.3.1.3 will give higher priority to maintaining the availability of spinning reserve, over non-spinning reserve.
Conditionally qualified Real Time Non-Spin self-provision (RTPD only)	-275	NA	The CAISO has determined this penalty price for conversion of self-provided non-spinning reserves through empirical testing, as a value that balances the maintenance of AS self-schedules with ensuring that the conversion to energy occurs before transmission constraints are relaxed.
Conditionally unqualified Reg Up or Down Real Time self-provision (RTPD only)	-75	NA	In instances where AS self-provision is not qualified pursuant to the MRTU tariff, the capacity can still be considered as an AS bid, along with regular AS bids. The price used for considering unqualified AS self-provision is lower than the AS bid cap, to allow it to be considered as an Economic Bid.
Conditionally unqualified Spin Real Time self-provision (RTPD only)	-50	NA	Same as above.
Conditionally unqualified Non-Spin Real Time self-provision (RTPD only)	-35	NA	Same as above.