Contingency Modeling Enhancements
Comments on Issue Paper as of May 15, 2013

Company	Date	Submitted By
Calpine	April 9, 2013	

Calpine Supports Market Mechanisms instead of ExD and MOC

The use of out-of-market mechanisms like ExD and price suppressive MOC have long been the bane of many market participants. Calpine appreciates the CAISO's focus on creating a market constraint for sustained outage (N-1-1) conditions such as those addressed in the Issue Paper.

Calpine concurs with most of the conclusions reached by the Market Surveillance Committee when they reviewed this proposal in January. Specifically, Calpine agrees that any redispatch that is made to address pre-contingency concerns and post-contingency System Operating Limits ("SOL") should be reflected in LMPs. In this regard, congestion values should reflect the locational value of units that are beneficial in a constrained zone.
We also agree that the capacity reserved to meet the potentially required re-dispatch should be compensated. This would include all forms of capacity that are useful in potentially solving the constraint, including capacity above awarded energy schedules, capacity created by reducing generation below that which would be otherwise optimally economic, and capacity that is created through the optimal commitment of generation to Pmin.

All of this capacity assists the CAISO in securing the grid, and the value of all of this capacity to the CAISO is the same. In this regard, we agree with the Technical Paper attached to the Issue Paper, at page 14 where it says that all units in a constrained region "have the same marginal value".

As such, all units that contribute to meeting the needs of the constraint should be paid same capacity payment. If PCC is the mechanism of final choice, every resource should be paid the marginal opportunity cost for the capacity it contributes to meeting the constraint. If the unit contributes to multiple constraints, it should, as in the energy markets, receive a payment that is reflective of all constraints it resolves.
Paying all contributing resources will encourage the bidding of, and possibly, investments in flexible resources. As said in the Technical Paper, the capacity payment will provide incentives "to improve ramping capacity." Resources that can move fast might be beneficially redispatched – and the benefits would flow to the generator through compensation, to the CAISO through reliability assurance, and to loads as avoidance of load-shedding risk. Units that self-schedule will not be available for redispatch or capacity payments for that portion of the capacity that is price-taking.

CAISO Response

The straw proposal reintroduces the preventive-corrective constraint from the technical paper. ISO is of the position that the preventive-corrective constraint should allow for compensation at the LMCP, which will be paid to all resources at each location. This is because the LMCP reflects: 1) a resource's opportunity costs; 2) marginal congestion cost savings; and/or 3) the marginal capacity value to follow dispatch (see Section 7.3.2).

Which Enhancements Should be Explored?

Calpine supports the further refinement of the PCC approach. We appreciate the comparison table on page 15 of the Technical Paper where the CAISO compares the Weak (today), Preventative-Corrective, and Strong Preventative (N-2) proposals. Calpine agrees that the Weak approach should be abandoned, as it requires the use of ExD and MOC. We also

understand that treating all N-1-1 contingencies as if they were simultaneous N-2 outages (Strong Preventative) may create a highly constrained grid that creates a high cost for reliability.

We believe that the CAISO should include in the next Straw Proposal, an analysis of explicit bid-based reserves. Indeed, the CAISO's PCC obtains a reserve product that is co-optimized with energy; it is, however not explicitly bid. Calpine understands the difficulties that the CAISO has identified with existing reserve products (e.g., the demand for PCC is not static, and the geography of need is not static.) Nonetheless, Calpine believes that the use of 10-minute and possibly the long-discussed 30-minute bid-based reserve product should be discussed and compared to PCC as in Table 5. While a 10-minute (or 30-minute) reserve product may not be necessary given the 30 minute NERC and WECC requirements, it is certainly sufficient to meet the need.

CAISO Response

A discussion and comparison between the ISO's current 10 minute reserves and the effectiveness of a hypothetical 30 minute reserve product are provided in Sections 6.2 and 6.7.

As noted in Section 10, the ISO would like to hear from stakeholders in written comments on why bidding should or should not be allowed under the preventive-corrective constraint. Detailed written explanations should include (but are not limited to):

- Assuming bids are technically feasible:
  - What type of cost or lost opportunity would a bid signify?
  - Would a bid be appropriate day-head, real-time, or both? Why?
  - What are potential bidding parameters (such as bid cap)? Why?
  - Are there market power concerns with allowing bids and how can the ISO mitigate those bids?
- Given the above answers, how could ISO evaluate the cost-benefit analysis of including bid functionality? In other words, how much would the benefit be as compared to the added complexity of modeling bid functionality?

Company	Date	Submitted By
Department of Market Monitoring	April 9, 2013	

Comparison to Capacity Only Solution

A possible alternative to the ISO's proposal would be to create a capacity only solution, such as a 30 minute capacity product or a refined AS product. The preventive-corrective constraint can be met by procuring more capacity,[1] reducing flows across a line, or a combination of both. The market optimization will choose this mix so as to minimize the costs of meeting these constraints. This makes the ISO's proposal more efficient than a capacity only solution.

To the extent that an AS/capacity requirement is non-dynamic or an AS/capacity region does not match the set of resources effective at relieving the corrective constraint complications could arise. For instance, more capacity may be procured than is required, or the shadow price from the constraint may be applied to more capacity than is effective on the constraint; or the constraint may not be satisfied. These situations would lead to increased costs and potentially more out of market dispatch than under the ISO's proposal.

[1] Corrective capacity can be procured either by unloading capacity at a generator, or by moving resources to dispatch levels with higher ramp rates.

CAISO Response

The ISO agrees and provides a detailed discussion on these issues and the alternative solutions considered in Sections 6.2 and 6.7.

Compensation of Corrective Capacity

Resources that provide corrective capacity should be paid the LMCP for all capacity contributing to the resolution of the corrective constraint. Doing so will:

• Compensate the capacity that is procured to meet corrective constraints at its market value.
• Create the incentive for resources to maintain and increase flexibility in order to receive increased corrective capacity payments.
• Align incentives to increase corrective capacity payments through increased flexibility with the minimization of system costs.

DMM believes that resources should be compensated for the value their corrective capacity provides to the ISO system. The LMCP, as described in the technical paper, correctly prices the corrective capacity at its locational marginal value.

It is important to note that the LMCP is not simply the opportunity cost of corrective capacity. It is derived from the shadow prices on corrective constraints, which are the amount that system costs would be reduced if the constraint were relaxed by one MW.

If the shadow price is set by a resource reducing energy sales in order to provide corrective capacity, the shadow price will represent the marginal cost to the system of this forgone production, which by definition will cover opportunity cost of the resource. If the shadow price were set by the marginal cost of reducing flows across a constraint, it would represent the cost of re-dispatching to reduce flows. In this case, any resource that does forego energy production will still have its opportunity cost at least covered by its LMCP. In all cases the LMCP will represent the marginal value of corrective capacity at that location.

To illustrate, consider the first example from the technical paper (starting on page 12). The demand for corrective capacity is the preventive line limit minus the corrective limit, 350 MW. The supply of corrective capacity is the marginal cost of providing the corrective capacity.[2] G2 can provide up to 200 MW for $0/MWh, G3 can provide up to another 400 MW for $15/MWh, and the flows on the line can be reduced at a cost of $20/MWh for another 550 MW. Figure 1 shows the supply and demand curves for corrective capacity. The market value of corrective capacity is the $15/MWh LMCP. Even though the G2 corrective capacity has zero marginal costs, it does have positive marginal benefits. If the last MW of corrective capacity G2 provided was not available then system energy costs would increase by $15. If G2 were to provide one more MW of corrective capacity then system energy costs would decrease by $15. Compensating G2 for corrective capacity aligns its incentives to increase capacity, and thus receive more capacity payments, with minimizing system costs.[3]

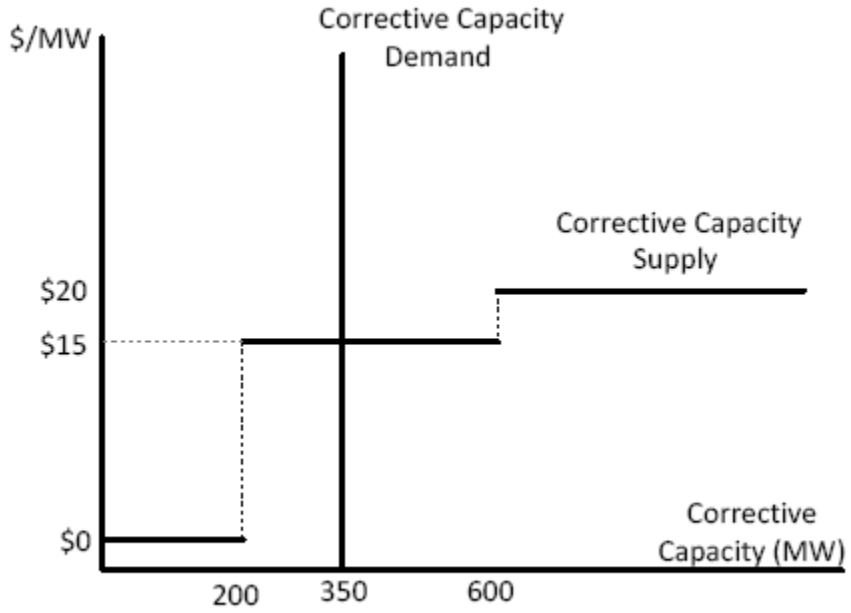

Figure 1 - Implied Supply and Demand for Corrective Capacity

[2] The marginal costs of corrective capacity are a function of submitted bids, assuming resources bid their marginal energy costs.

[3] In the ISO's example the total system costs would remain the same as G2 adds corrective capacity reducing energy costs by $15 and increasing capacity payments by $15 up to the point where it would add 151 MW. At this point it would reduce capacity payments to zero and have saved 150MW*$15/MW in energy costs. It is easy to imagine a less extreme circumstance where the market level corrective capacity supply curves have more segments and total system costs are reduced in a more incremental rather than binary way. Also, if the demand for corrective capacity is uncertain, as it will be given the dynamic nature of the constraints, there is a probability that demand will be less than or equal to 350 MW in which case the LMCP will equal $0/MW. An increase in G2's ability to provide corrective capacity can both increase its expected capacity payments and reduce expected overall system costs due to more instances of $0 LMCPs and reduced energy costs.

CAISO Response

The ISO agrees with DMM's comments and is of the position that the preventive-corrective constraint should allow for compensation at the LMCP, which will be paid to all resources at each location. This is because the LMCP reflects: 1) a resource's opportunity costs; 2) marginal congestion cost savings; and/or 3) the marginal capacity value to follow dispatch (see Section 7.3.2).

Restrictions on Available Corrective Capacity

All AS capacity permissible and effective on the corrective constraint should be counted as supplying corrective capacity. Furthermore, DMM is generally opposed to any measures that would further restrict capacity from being used for, or force capacity to be used as, corrective capacity. Such restrictions would reduce the options available to the optimization, reduce the efficiency of the solution, and increase costs. They may also introduce opportunities to

manipulate corrective capacity supply, LMCPs, and energy LMPs through the co-optimized solution.

CAISO Response

The ISO agrees and the existing 10 minute reserves will be used as appropriate. This is explained in Section 7.3.1. In addition, the corrective capacity can be supplied by online generators, offline generators (if they can start within the given time frame), demand response, and pump storage.

Potential for Local Market Power in Corrective Capacity

The inclusion of corrective constraints into the market optimization may create the opportunity for resources to raise the LMCP by bidding below their marginal energy costs. This strategy exists under both the proposed compensation schemes.

Current local market power mitigation (LMPM) measures will apply to the corrective constraints congestion impact on energy LMPs. However, current LMPM will not be able to detect or mitigate potential market power in corrective capacity. Because a resource's capacity "bid" is determined inversely to its energy bid, it can increase its capacity bid by lowering its energy bid. In areas with locally constrained corrective capacity, this could create the opportunity for exercising local capacity market power.

To illustrate, consider again the first example from the technical paper. The LMCP is the decrease in system costs of marginally relaxing the corrective constraint as calculated from the energy bids, in this case, $15/MWh ($50 - $35). What would happen if G3 had bid $30.01/MWh? The dispatch would not change, but the LMCP would now be $19.99/MWh ($50 - $30.01). G3 can unilaterally set the LMCP without changing dispatch bounded only by the LMP

			Base Bids		Strategic Bids		
Gen	P^0	ΔP^{kc}	LMP	LMPC	LMP	LMPC	Gain
G1	700	-	$30	$0	$30	$0	$0.00
G2	250	200	$50	$15	$50	$19.99	$998.00
G3	250	150	$50	$15	$50	$19.99	$748.50

Table 1 - Manipulating LMCP with Lower Energy Bids Example 1

at node A.

Consider also a slight variation on the second example in the technical paper. Instead of just one generator at node A, what if there were generators G1a bidding 500 MW at $20/MWh and G1b bidding 300 MW at $30/MWh. The base dispatch would award G1a 500MW and G1b 50MW. The LMP at node A would be $30/MWh. The market results at node B would be the same as the technical paper. The LMCP is also still $20/MWh ($50 - $30). Assume that G1b and G2 are controlled by the same Scheduling Coordinator (SC). The SC can manipulate the LMCP by reducing its bid to $20.01/MWh. The LMCP would now be $29.99/MWh. The SC would lose $9.99/MWh on the 50 MW of energy it sells at node A, but gain $9.99/MWh on the 200 MW of corrective capacity it sells at node B.

			Base Bids		Strategic Bids		
Gen	P^0	ΔP^{kc}	LMP	LMPC	LMP	LMPC	Gain
G1a	500	-	$30	$0	$20.01	$0	-$4,995.00
G1b	50	-	$30	$0	$20.01	$0	-$499.50
G3	650	200	$50	$20	$50.00	$29.99	$1,998.00
						Net Gain for SC	**$1,498.50**

Table 2 - Manipulating LMCP with Lower Energy Bids Example 2

The current LMPM operates by reducing energy bids down to estimated marginal costs under conditions where local energy market power may be exercised. This will not mitigate local capacity market power which can be exercised by reducing energy bids. Measures to detect and mitigate this potential strategy need to be considered.

CAISO Response

We believe DMM has a valid argument for both examples and we will work with all stakeholders to consider the conditions under which such behavior may develop and how to address them. Some of the behavior reflects a general concern about capacity-based products, which affects the contingency modeling enhancement initiative, ancillary service products, and the flexible ramping product. We will consider the impact of each product or constraint as well as the collective impact. We also welcome stakeholder input on these issues.

Physical Withholding Through Bid-in Ramp Rates

The wholesale electricity industry is increasingly introducing market elements that explicitly procure and value ramp. In addition to the current proposal there exists a proposal for an additional spot market ramp product (the Flexible Ramping Product) and forward procurement of ramp in the bilateral RA market as well as potentially through a centralized capacity market. Currently, physical generators have the option to bid-in their ramp rate at a value not to exceed their maximum ramp rate. DMM views the ramp rate as a physical characteristic of a resource and not a market mechanism that should be varied based on market conditions. It is, in light of increased demand and explicit valuation of ramping energy, a mechanism that can easily be used to physically withhold ramping energy from the markets. DMM recommends that the option to bid in a resource's ramp rate be eliminated prior to implementing any additional market instruments that require and value ramping energy.

CAISO Response

As discussed in Section 10, the ISO proposes removing bid-in ramp rate functionality from the market. We believe this is no longer needed now that multi-stage generating resources are more accurately modeled. Removing the functionality would minimize gaming opportunities in the market and directly benefit the preventive-corrective constraint. As an exception, a resource could still change its ramp rate if it experiences a change in operating capability. We would like to hear from stakeholders on why the bid-in ramp rate functionality should be retained or removed, and potential inefficiencies or benefits from its removal.

Company	Date	Submitted By
NRG Energy, Inc. ("NRG")	April 9, 2013	Brian Theaker

Is it appropriate to provide compensation to generators for corrective capacity, and, if so, what is the appropriate basis to determine the amount of capacity compensated?

Contingency reserves – capacity held available to provide energy in the event of a contingency – are currently compensated for their capability to produce energy when directed, not for any dispatched movement directed to provide this capability. Said another way, while it may be appropriate under Order 755 to provide a mileage payment for resources providing regulation (in part because it is expected that such resources will be dispatched within their regulation range, while it is far less likely that energy from contingency reserves will be dispatched), it is more appropriate to provide resources that are providing corrective capacity based on the amount of corrective capacity they provide. If a resource is dispatched to a lower energy output to provide additional corrective capacity, the compensation for that resource should include –but not be limited to – the resource's energy opportunity cost. However, that compensation should be based on the amount of corrective capacity provided.

CAISO Response

The ISO is of the position that the preventive-corrective constraint should allow for compensation at the LMCP, which will be paid to all resources at each location. This is because the LMCP reflects: 1) a resource's opportunity costs; 2) marginal congestion cost savings; and/or 3) the marginal capacity value to follow dispatch (see Section 7.3.2).

Should all resource capacity contributing to meeting the corrective action be compensated at the resource location locational marginal capacity price or should only those resources that demonstrate a lost opportunity receive compensation?

The CAISO's current contingency reserve design provides compensation that includes both a biddable capacity payment and the resource's energy opportunity cost. The corrective capacity that the CAISO contemplates is essentially location-specific contingency reserve, and, as such, should mimic the current market design by providing both a biddable capacity payment and an energy opportunity cost.

Contemplating location-specific contingency reserves will surface, invariably, the issue of local market power. NRG expects that, consistent with the current energy market design, where the CAISO must obtain corrective capacity in situations in which there is a non-competitive supply of corrective capacity, the capacity bids associated with that supply of corrective capacity will be mitigated. What the mitigated capacity bid price should be is a topic for further discussion.

CAISO Response

As noted in Section 10, the ISO would like to hear from stakeholders in written comments on why bidding should or should not be allowed under the preventive-corrective constraint. Detailed written explanations should include (but are not limited to):

- Assuming bids are technically feasible:
  - What type of cost or lost opportunity would a bid signify?
  - Would a bid be appropriate day-head, real-time, or both? Why?
  - What are potential bidding parameters (such as bid cap)? Why?
  - Are there market power concerns with allowing bids and how can the ISO mitigate those bids?

- Given the above answers, how could ISO evaluate the cost-benefit analysis of including bid functionality? In other words, how much would the benefit be as compared to the added complexity of modeling bid functionality?

When there are multiple system operating limit constraints binding such that a resource is contributing to meeting the corrective capacity of multiple constraints, how should the resource be compensated considering its contribution to multiple constraints?

The CAISO's current market software is capable of calculating a Locational Marginal (energy) Price in situations in which a resource is providing counter-flow to more than one binding constraint. NRG expects that the Locational Marginal (capacity) Price of a resource providing corrective capacity could be determined from the resource's energy and capacity bids in a similar way.

CAISO Response

As shown in Section 7.4.4, the ISO agrees that the current market software is capable of considering more than one binding constraint. Similarly, the preventive-corrective constraint can also consider more than one binding constraint and accurately reflect that in the LMCP, based on the resource's energy bids and capacity bids, should the constraint eventually include capacity bids.

Company	Date	Submitted By
PG&E	**April 12, 2013**	**Will Dong (415) 973-9267** **Paul Gribik (415) 973-6274**

The CAISO Should Survey How Other RTOs Are Addressing the NERC/WECC Requirements

PG&E understands the importance of the NERC and WECC post-contingency 30-minute reliability standard, but we are not yet convinced that a complex software solution, as described in the technical paper, is the solution. The CAISO market currently employs six ancillary products.[2] The addition of a seventh AS capacity type (i.e., 30-minute capacity) strikes us as possibly excessive. At some point additional market complexity has diminishing returns, and, in fact, can have detrimental impacts on the performance and understanding of the market.

PG&E understands that at least one RTO deploys its operating reserves as part of the post-contingency corrective re-dispatch process. After a contingency occurs this RTO, like the CAISO, may deploy some of its operating reserves to maintain system reliability. However, if contingency reserves remain post contingency deployment, these reserves are available to address the 30-minute SOL requirement. Use of the contingency reserve along with adjustments to the Real-Time Unit Commitment (RTUC) and Security Constrained Economic Dispatch (SCED) appear sufficient to address the SOL requirement.

This approach can be especially cost-effective if an RTO relaxes its contingency reserve requirement for a short period of time. After a contingency, RTUC and SCED must address two competing needs: re-dispatch to meet the SOL requirement within 30 minutes, and replenishment of any operating reserves deployed to address the contingency. Relaxing the need to immediately replenish the reserves, allows resources to address the 30-minute SOL requirement first. It has a secondary advantage of minimizing the potential of price spikes stemming from an immediate need to procure additional reserves. [3]

The CAISO should explore this alternative approach or other approaches used by the eastern RTOs before pursuing a particular design, especially a complex design that adds another reserve capacity type. The burden is on the CAISO to demonstrate that the proposed modeling enhancements are superior to the status quo and that the approaches used by other RTOs are either inferior or more expensive than the CAISO's proposal.

Finally, the CAISO should clarify for stakeholders if there are specific NERC requirements, CAISO rules or practices that prevent the use of operating reserves to meet the SOL requirement and when it is required to replenish operating reserves following a contingency.

[2] The current ancillary products are regulation up, regulation down, regulation energy management, 10-minute spin, 10-minute non-spin, and flexible ramping.
[3] Price spikes can occur when attempting to replenish reserves immediately after a contingency, due to the likely tighter system condition

CAISO Response

The WECC and NERC standards and practices in the other ISOs and RTOs are described in Sections 4, 5 and 6.7. The limitations of the current 10 minute ancillary services are discussed in Sections 6.2 and 6.7. The limitations of other mechanisms at the ISO's disposal are discussed in Sections 6.5 and 6.6. The proposed preventive-corrective constraint will use the existing 10 minute reserves as explained in Section 7.3.1.

Any Design Change Should Incorporate Flexible Elements To Prevent Overpayment

The issue paper introduces a new mechanism to procure additional capacity to address the SOL requirement ("SOL Capacity") that would be used independently from operating reserves[4]. This approach seems overly restrictive and may unnecessarily drive up costs by over-procuring all reserves. If the enhancements proposed in the technical paper are the best solution (PG&E is not yet convinced it is), the design should incorporate flexible elements such as:

a. ***The ability to commit off-line resources to meet the 30-minute requirement***

So long as there are off-line resources that could be committed within the time frame required, the CAISO should be able to commit them *after* a contingency occurs. This is consistent with current market rules for the 10-minute non-spin products, which can be committed in response to a contingency.

Not allowing this flexibility restricts the CAISO to deploying only on-line resources in the corrective dispatch process to meet the SOL requirement. This drives up costs to California consumers by requiring potentially costly adjustments to dispatch on-line resources or the unnecessary commitment of resources in anticipation of a contingency (through the contingency modeling enhancement process).

b. ***All AS capacity should be accessible to the CAISO to satisfy any type of contingency***

Instead of creating separate capacity types to address preventative and corrective requirements, products procured to address contingencies should be allowed to be used for corrective actions as well. The CAISO should be able to use operating reserves to address the SOL requirement, so long as they satisfy the performance requirements and are cost effective. Conversely, the CAISO should consider whether this SOL capacity can offset the procurement of traditional operating reserves. Without this flexibility, the

CAISO may be forced to either over-procure reserves in total or overpay for the reserves it needs.

c. *Substitution of other superior AS products should be allowed to meet the 30-minute requirement*

This new mechanism should be designed to be compatible with substitution rules of the existing AS design. When less expensive, superior AS products should be substituted for SOL capacity to meet the SOL requirement. If the outcome of the stakeholder process results in the use of clearing prices for SOL capacity, the price of SOL capacity would should not exceed those of the "superior" AS products.[5]

[4] As stated by CAISO staff during the March 26 CAISO stakeholder teleconference.

[5] This is consistent with the substitution concept in the current AS design (http://www.caiso.com/Documents/FinalProposal-ScarcityPricing04-Nov-2009.pdf)

CAISO Response

The first statement above is incorrect. The proposed preventive-corrective constraint will use the existing 10 minute reserves as explained in Section 7.3.1. In addition, the corrective capacity can be supplied by online generators, offline generators (if they can start within the given time frame), demand response, and pump storage.

PG&E refers to "clearing prices." It is not clear what these are. If this refers to bids, we have asked stakeholders in Section 10 to provide written comments on why bidding should or should not be allowed under the preventive-corrective constraint. Detailed written explanations should include (but are not limited to):

- Assuming bids are technically feasible:
  - What type of cost or lost opportunity would a bid signify?
  - Would a bid be appropriate day-head, real-time, or both? Why?
  - What are potential bidding parameters (such as bid cap)? Why?
  - Are there market power concerns with allowing bids and how can the ISO mitigate those bids?
- Given the above answers, how could ISO evaluate the cost-benefit analysis of including bid functionality? In other words, how much would the benefit be as compared to the added complexity of modeling bid functionality?

The CAISO Should Perform a Cost Benefit Analysis

The 30-minute SOL requirement is being successfully addressed today by both market processes (MOCs) and out-of-market actions (EDs) at some cost which can be estimated by the CAISO. Because the NERC/WECC requirements are being satisfied today, the current processes do not need to change. An important consideration in the decision to use a different process is whether the proposed mechanism is more cost-effective than the business-as-usual approach. PG&E asks the CAISO to compare the cost of procurement under any proposed mechanism to the today's business as usual case.

Assessing the costs and benefits of a major new initiative is good practice, and PG&E recommends including a cost-benefit analysis as a standard part of any stakeholder process

when the CAISO is considering a new major initiative.

CAISO Response

Sections 6.5 and 6.6 explain that the current use of exceptional dispatches do not provide a superior level of reliability or market efficiency than the proposed preventive-corrective constraint. As Section 6.6 further explains, the ISO has been directed by FERC to decrease reliance on exceptional dispatches and increase use of market mechanisms. Moreover, the preventive-corrective constraint will be optimized in the market, which is more efficient and can lead to lower cost than the currently used mechanisms.

As shown in the technical attachment to the issue paper in Figure 1 (and reproduced in the straw proposal as Figure 2), the ISO estimated the SOL related exceptional dispatches for 2012 varied from 21 percent to 77 percent month by month based on MWh of total exceptional dispatch volume. The ISO will further process the data to try to provide stakeholders with the dollar amounts associated with these MWh volumes.

Company	**Date**	**Submitted By**
SDG&E	**May 7, 2013**	

SDG&E recommends that the CAISO include dispatchable *demand* and controlled load drop of non-sensitive *loads* as potential options for preparing the system for an N-1-1 contingency condition.

There is one aspect of the CAISO's proposal that SDG&E believes needs further consideration. The CAISO's March 11, 2013 issue paper appears to assume that following an N-1 contingency, only *generation* will be redispatched to prepare the system for an N-1-1 contingency condition. SDG&E recommends that the CAISO include dispatchable *demand* and controlled load drop of non-sensitive *loads* as potential options for preparing the system for an N-1-1 contingency condition.

As SDG&E interprets applicable reliability standards, controlled load drop following an N-1 contingency is an acceptable method of preparing the system to withstand a subsequent contingency (an N-1-1 contingency condition). Controlled load drop has the distinct advantage that it is automated and can be activated quickly. In addition, there are situations where controlled load drop may be the only effective option available to the CAISO. Finally, SDG&E expects that controlled load drop will prove more economical in certain instances than redispatching generation, especially if the available generation has limited effectiveness in addressing the particular contingency(ies) at issue.

A complication of using controlled load drop is that unlike generation, most loads do not submit price/quantity bids to the CAISO on a nodal basis. SDG&E recommends that the CAISO consider ways of placing an economic value on nodal loads which would be curtailed (e.g., the value-of-lost-load) and use this value as a proxy price that would be used to decide whether it is economic to curtail load as preparation for an N-1-1 contingency condition. Non-sensitive loads would logically have a much lower proxy price than sensitive loads.

Controlled load drop is an important tool for maintaining grid reliability in the face of multiple contingencies. The CAISO should keep this tool in mind as it develops its contingency

modeling enhancements.

CAISO Response

As noted at the end of Section 4, the ISO is somewhat limited in its ability to use load shedding under the WECC SOL standard. However, demand can be considered in the preventive-corrective constraint. As mentioned in Section 7.3.1, the corrective capacity can be supplied by online generators (including the existing 10 minute reserves), offline generators (if they can start within the given time frame), demand response, and pump storage.

Company	Date	Submitted By
Southern California Edison	**April 9, 2013**	**Wei Zhou (626) 302-3273** **Aditya Chauhan (626) 302-3764**

The CAISO should define the problem it is trying to solve, including details such as magnitude of the need and relation between the problem and its proposal.

Anticipating every contingency goes against prudent planning – setting reasonable, acceptable margins is the optimal approach Electricity markets are applicable to economic situations where systems are running as intended with supply meeting demand and constraints being satisfied. Contingencies such as N – 1, N – 1 – 1, etc., are low probability events met by appropriate planning and setting margins of acceptable risk. Contingencies that are more severe than N – 1 – 1 can also occur regardless of design. The goal of any design is to optimize with respect to risk and cost. Thus, Exceptional Dispatches (ED), will always be an instrument necessary to meet unanticipated Real Time states. The CAISO's goal should not be to "economize" reliability tools such as ED.

The proposal pays in advance to resolve a low probability event as if it will occur
The CAISO already incorporates contingency constraints within the current Security Constrained Economic Dispatch (SCED) market process. Beyond this, a contingent state should only be considered when planning appropriate reserve margins relevant to the acceptable risk. Instead, the CAISO wants to incur costs as if the low probability event will have already occurred. CAISO has ignored the existing market products accommodating reliability protocols and they make no effort to adjust them in their proposal to remove cost duplication. Such a proposal will result in additional costs that are neither just nor reasonable.

The integrity of the LMP structure and the Energy and AS co-optimization should not be breached just to solve a problem that is not well defined
Although the LMP structure and the Energy and AS co-optimization may have problems that may or may not have been identified to date, the integrity of the LMP structure and the Energy and AS co-optimization should not be breached just to solve a problem that is not well defined. The CAISO Issue Paper fails to, as a minimum, even detail how many EDs are caused by post-contingency events and how many of those EDs are unavoidable through other mitigation measures. Such measures could include committing fast-start units or deploying procured A/S capacity or Flexible Ramp capacity. However, it's clear that the current LMP structure and the Energy and AS co-optimization are well accepted across the nation including at other ISOs. Without careful and complete evaluation, introducing new components to the LMP and mixing the capacity pricing within the LMP pricing will breach the integrity of such structure which may result in adverse effects to a well-established market design. SCE is extremely concerned that,

without the rigor of ***any*** academic research or ***any*** real-world demonstration of the validity of this approach, the CAISO instead would force the California market to be a guinea pig for this radical and unsupported proposal. Until such a demonstration, we urge the CAISO to use proven and accepted practice found elsewhere in the grid.

CAISO Response

Section 4 provides a detailed explanation of the WECC reliability standard the ISO needs to meet, which is unique among the US ISOs and RTOs. The WECC reliability standard applies regardless of the probability of the contingency. This issue paper is not intended to debate the merits of the WECC reliability standard.

We agree that some level of exceptional dispatches will always be needed in any market but as Sections 6.5 and 6.6 explain, exceptional dispatches do not provide a superior level of reliability or market efficiency than the proposed preventive-corrective constraint. As Section 6.6 further explains, the ISO has been directed by FERC to decrease reliance on exceptional dispatches and increase use of market mechanisms. Moreover, the preventive-corrective constraint will be optimized in the market and as Section 7.4.4 shows, does not suffer from "cost duplication" because it can correctly account for multiple contingencies.

As shown in the technical attachment to the issue paper in Figure 1 (and reproduced in the straw proposal as Figure 2), the ISO estimated the SOL related exceptional dispatches for 2012 varied from 21 percent to 77 percent month by month based on MWh of total exceptional dispatch volume. The ISO will further process the data to try to provide stakeholders with the dollar amounts associated with these MWh volumes.

The CAISO should explain why it has not first considered current products and market design.

The CAISO has failed to justify why current products and market design constructs have been overlooked. With one of the reasons for this effort being inability to flow zonally procured Ancillary Services (AS) to local areas needed for reliability[2], deliverability would most directly be resolved by addressing procurement. For instance, more granular procurement, leveraging the pre-contingency process/scheduling run, would be a productive and reliable fix, and would work within the proven constructs of our LMP design.

[2]As stated by CAISO staff during March 26. CAISO Webconference.

CAISO Response

This is explained in Sections 6.2 and 6.7, specifically for the 10 minute ancillary services products and a hypothetical 30 minute reserve product. Sections 6.3 through 6.6 provide background on other mechanisms that the ISO is using and their effectiveness in addressing reliability standards and their efficiency.

The CAISO should explain why it has not first considered existing design practices of other ISOs.

The CAISO has failed to consider the design practices of other ISOs. To our knowledge, no other ISO has proposed such radical and unproven changes, such as this proposal, when faced with these low probability events. The CAISO has in the past, proposed measures used by other ISOs for a variety of situations[3]. Yet for this proposal the CAISO considers other ISOs as not comparable[4]. We reject this assertion. The CAISO should study other ISO approaches to the

problem it attempts to define and implement such tested solutions. The CAISO should fully describe to stakeholders these other proven approaches before determining if they should reinvent the wheel.

[3] The CAISO proposed MISO's method of stakeholders allowing security interest in their receivables in Order 741 efforts. The CAISO proposed NYISO and IESO Ontario approaches to convergence bids in the Intertie Pricing and Settlement. The CAISO proposed PJM's approach to costs in its FLRR filing.
[4]As stated by CAISO staff during March 26. CAISO Webconference.

CAISO Response

This is addressed in Sections 4, 5 and 6.7.

The CAISO's proposal raises concerns on its design. Under the CAISO proposal, there's no guarantee that the capacity paid and reserved will be actually utilized when a N – 1 – 1 contingency occurs

Under the CAISO proposal, capacity is reserved by enforcing the post-contingency transmission constraints where the amount of the capacity is determined purely based on the system operating point (such as unit availability and ramp rates) with no consideration of the AS bid price of the available units, or the energy cost associated with the capacity. Therefore, even as an N – 1 – 1 contingency occurs, as the system operating point will change, the procured capacity through the post-contingency constraints may no longer be optimal to solve the problem and there is no guarantee that the procured capacity will be actually utilized. Even this design flaw is recognized, but not addressed, in the issue paper[5]. Further, the CAISO proposal does not answer the fundamental question: ***why is there a need to price and compensate such capacity if there is no guarantee that the capacity will be utilized when it is needed?***

[5] Page 9. *Preventive-Corrective Market Optimization Model*. In Issue Paper. The second to the last paragraph: "However, the actual re-dispatches may be different from delta_P(kc), as the energy cost would be considered in the actual re-dispatch".

CAISO Response

The first statement above is incorrect. The proposed preventive-corrective constraint will use the existing 10 minute reserves as explained in Section 7.3.1.

The proposed preventive-corrective constraint is an improvement over the current mechanisms which do not guarantee that the capacity procured will be utilized when needed. This is explained in Sections 6.2 through 6.7. In fact, the ability to optimize the preventive-corrective constraint will increase the accuracy of procurement for both quantity and location (because the analysis is flow-based) and reduce over-procurement.

The need to price and compensate the capacity is described in Sections 6.6 and 7.3.2.

The CAISO's proposal raises concerns on its design. Under the CAISO proposal, the markets, especially the Real-Time market, will become more volatile and unpredictable and harm liquidity and price transparency.

The impact of the power balance constraint on price is well observed in the Real-Time market. As noted by the DMM report[6], a significant portion of the price spikes are associated with the power balance constraint relaxation. Introduction of additional, multiple power balance constraints to the model, even under normal conditions with no contingencies, can only

aggravate the issues that have arisen from Real-Time price volatility. Further, it will lead to reduced transparency in price formation and price discovery. If more price spikes arise simply due to the N – 1 – 1 contingencies (that may never occur), distinguishing price spikes that are due to the true supply shortage or price spikes that are due to the N – 1 – 1 contingencies becomes a difficult task at best, if at all possible.

[6] Figure 1.8. Page 13. http://www.caiso.com/Documents/2012FourthQuarterReport-MarketIssues-Performance-Feb_2013.pdf

CAISO Response

See section 7.3.1. The power balance constraint for the base case is energy constraints. In contrast, the new power balance constraints for corrective contingencies are capacity constraints. If there is transmission constraint violation in any contingency case, the optimization may resolve the violation with corrective capacities. The capacity balance constraints are needed to make sure the established energy balance in the base case is not adversely affected in the transmission congestion management process, such as resulting in involuntary load shedding. The capacity balance constraints do not directly affect the feasibility of the energy balance constraint in the base case, because the energy dispatches do not participate in the capacity balance constraints.

It is questionable that the CAISO's proposal incentivizes flexible capacity

Very likely, contradictory to its intent, the CAISO's current proposal will not incentivize flexible capacity and fast ramping resources. SCE illustrates this point with examples.

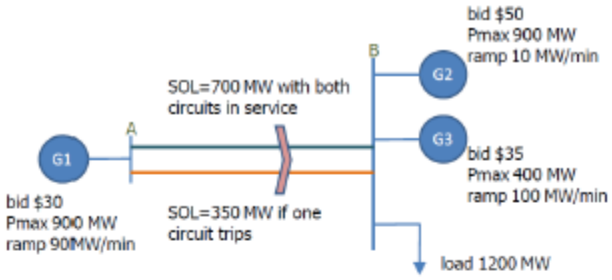

Figure 1: System in CAISO' example

Under the CAISO's proposal, the solution is to dispatch G2 at 250MW and G1 at 250MW. The "corrective capacity" for G2 is 200MW and for G1 is 150MW. As shown in Table 3 in the issue paper, also duplicated below, G2 will receive a revenue of $12,500 for the 250MW energy dispatch, and a revenue of $0 for its "corrective capacity" (based on opportunity cost) or a revenue of $3,000 for its "corrective capacity" (based on locational capacity-energy mixed price). The total revenue for G2 will be at least $12,500.

	Energy					Corrective Capacity		
Gen	P^0	LMP	Bid cost	Revenue	Profit	ΔP^{kc}	LMCP | opportunity cost	Profit LMCP | opportunity cost
G1	700	$30	$21,000	$21,000	$0	-350	$0 | $0	$0 | $0
G2	250	$50	$12,500	$12,500	$0	200	$15 | $0	$3,000 | $0
G3	250	$50	$8,750	$12,500	$3,750	150	$15 | $15	$2,250 | $2,250
total	1,200	N/A	$42,250	$46,000	$3,750	0	N/A	$5,250 | $2,250

TABLE 3: PREVENTIVE-CORRECTIVE SOLUTION AND LMCP COMPENSATION

Under the CAISO's solution, there would be no incentives for G2 to advance its technology and improve its ramping rate. The limited ramping capability of G2 contributes to the problem and if G2 were to improve that ramping, the problem may not exist, hence, G2 would not be paid. To illustrate the point, below is a scenario to show that the revenue of G2 will reduce if G2 improves its ramp rate.

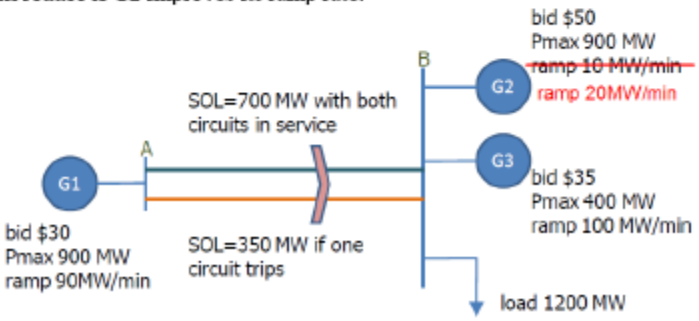

Figure 2: Same system except now G2 has improved its ramp rate

Scenario: G2 improves its ramp rate

As G2 increases its ramp rate to 20/MW/min, after the N – 1 – 1 contingency occurs, G2 can dispatch up by 350MW within 17.5min. So even considering the N – 1 – 1 contingency, the dispatch solution will be the same as the solution without considering the N – 1 – 1 contingency. The solution without considering the N – 1 – 1 contingency is shown in Table 1 in the CAISO issue paper, duplicated below. G2 is dispatched at 100MW and receives revenue of $5,000 for energy. Notice the "corrective capacity" for G2 is 0MW, even though G2's capacity beyond the energy, which is 800MW (Pmax 900MW – 100MW), is readily available to the system should the contingency occur.

Generator	Dispatch	LMP^{EN}	LMP^{CONG}	LMP	Bid cost	Revenue	Profit
G1	700	$50	-$20	$30	$21,000	$21,000	$0
G2	100	$50	$0	$50	$5,000	$5,000	$0
G3	400	$50	$0	$50	$14,000	$20,000	$6,000
total	1,200	N/A	N/A	N/A	$40,000	$46,000	$6,000

Table: Dispatch solution under the CAISO's proposal with an improved ramp rate for G2

The table below summarizes the reduced revenue for G2 after it improves its ramp rate from 10MW/min to 20MW/min under the CAISO current proposal.

G2 Revenue	Revenue from energy dispatch	Revenue from "corrective capacity"		**Total Revenue**	
		Based on opportunity cost	Based on LMCP	Based on opportunity cost	Based on LMCP
With 10MW/min	$12,500	$0	$3,000	$12,500	$15,500
With 20MW/min	$5,000	$0	$0	$5,000	$5,000
Reduced Revenue after the increase in ramp rate					
				$7,500	**$10,500**

Table: The revenue of G2 will reduce after it improves its ramp rate under the CAISO's proposal

In summary, under the CAISO's proposal, the revenue for G2 will reduce by at least $7,500 after it improves its ramp rate. The situation is worse if G2 is paid for its "corrective capacity" based on LMCP. Therefore it is doutbful that the CAISO's proposal incentivizes flexible capacity with faster ramp rate.

CAISO Response

See section 7.4.1. The ISO's nodal electricity market clears all products at marginal prices. For example, LMP is the marginal cost of serving extra load at a location, and a constraint shadow price is the marginal cost saving of extra transmission capacity. A marginal price only holds its value for a limited parameter change, and may not hold the same value when a big change is introduced into the market. For example, the LMP may change when an extra unit is committed, and the transmission shadow price may diminish if there is a major transmission upgrade. The example demonstrated above involves changing G2's ramp rate from 10 MW/min to 20 MW/min, which is equivalent to increase the 20-minute ramping capability by 10*20=200 MW. With such a big change, the LMCP diminishes because the total supply exceeds the SOL demand 350 MW. This does not mean the LMCP does not provide the correct incentive. To the contrary, this means the incentive that LMCP provides is not only correct in encouraging investment, but also correct in discouraging over investment.

Is it appropriate to provide compensation to generators for corrective capacity, and, if so, what is the appropriate basis to determine the amount of capacity compensated?

Is it appropriate to provide compensation to generators for corrective capacity, and, if so, what is the appropriate basis to determine the amount of capacity compensated? For example, a resource is moved to a lower dispatch point in order to provide a larger upward corrective capacity after a contingency. Should the appropriate compensation be based on the movement (downward in this example) or the corrective capacity that is created (for the resource to

eventually move upward)?

Answer: No, it is not appropriate to compensate generators for "corrective capacity". Until the CAISO justifies the appropriateness of this radical change to our market – either through rigorous academic research or through real-world application elsewhere, we have insufficient information to judge the appropriateness of "corrective capacity", and it is inappropriate to even propose this concept for consideration for implementation. There is no clear difference between "corrective capacity" and regular capacity that's available in the system. For example, suppose a resource is marginal and is dispatched for energy below its full capacity. The capacity below its Pmax and above its dispatch will be readily available to the system. Clearly such capacity should not be compensated because its bid price is higher than the market price and that's why the unit is not dispatched at Pmax. However, if a contingency occurs and the market price goes up, the resource will be dispatched for additional energy. It will not be fair to the units that provide regular capacity if the resource that provides "corrective capacity" is compensated.

CAISO Response

ISO is of the position that the preventive-corrective constraint should allow for compensation at the LMCP, which will be paid to all resources at each location. This is because the LMCP reflects: 1) a resource's opportunity costs; 2) marginal congestion cost savings; and/or 3) the marginal capacity value to follow dispatch (see Section 7.3.2).

Should all resource capacity contributing to meeting the corrective action be compensated at the resource location locational marginal capacity price or should only those resources that demonstrate a lost opportunity receive compensation?

Answer: Until the CAISO justifies the appropriateness of this radical change to our market – either through rigorous academic research or through real-world application elsewhere, we have insufficient information to judge the appropriateness of "corrective capacity", and the CAISO is in no position to even propose this concept for implementation.

CAISO Response

The ISO believes this approach is appropriate (see the above answer). The approach is supported in academia (see Section 7.1). Via this stakeholder process it is also reviewed by ISO internal staff with advanced electrical engineering and economics degrees, the Department of Market Monitoring, and the Market Surveillance Committee.

When there are multiple system operating limit constraints binding such that a resource is contributing to meeting the corrective capacity of multiple constraints, how should the resource be compensated considering its contribution to multiple constraints?

Answer: Until the CAISO justifies the appropriateness of this radical change to our market – either through rigorous academic research or through real-world application elsewhere, we have insufficient information to judge the appropriateness of "corrective capacity", and the CAISO is in no position to even propose this concept for implementation.

CAISO Response

See answer above.

Company	Date	Submitted By
WPTF	**April 10, 2013**	**Ellen Wolfe, Resero Consulting for WPTF (916) 791-4533 ewolfe@resero.com**

Locational Marginal Capacity Price (LMCP) should be used to compensate resources contributing to the preventative network needs.

The ISO has posed in its CME paper the choice between using opportunity cost pricing and marginal pricing to compensation resources that contribute to the satisfaction of the ISO's new preventative needs. WPTF strongly supports the application of the marginal value as the ISO defines as the LMCP in its March 11, 2013 CME paper. As the ISO identifies, paying only opportunity cost would fail to provide a price signal to those resources that are also satisfying the preventative contingency and system operating limit (SOL) needs, and paying only bid cost recovery may fail to compensate at all for the service.

Such a pricing approach is consistent with the fundamental economic underpinning of LMP markets that providing a marginal price signal provides the correct incentives for market participants. WPTF also believes the MSC strongly supports the application of a locational, marginal price signal for resources providing this capacity.
Secondly, WPTF sees parallels between this contingency capacity the ISO is contemplating for the flexible capacity product (FCP), and WPTF asks that the ISO consider adding the ability for participants to consider bidding the capacity into the market.
Lastly, the ISO raised the question about the applicable compensation when multiple SOL or contingency constraints are applicable. Although we do not present the mathematics herein, it seems the application of a capacity shadow prices and shift factors should result in overall LMCPs at any particular location and that thereby multiple constraints could be handled collectively.

CAISO Response

ISO is of the position that the preventive-corrective constraint should allow for compensation at the LMCP, which will be paid to all resources at each location. This is because the LMCPP reflects: 1) a resource's opportunity costs; 2) marginal congestion cost savings; and/or 3) the marginal capacity value to follow dispatch (see Section 7.3.2).

As noted in Section 10, the ISO would like to hear from stakeholders in written comments on why bidding should or should not be allowed under the preventive-corrective constraint. Detailed written explanations should include (but are not limited to):

- Assuming bids are technically feasible:
  - What type of cost or lost opportunity would a bid signify?
  - Would a bid be appropriate day-head, real-time, or both? Why?
  - What are potential bidding parameters (such as bid cap)? Why?
  - Are there market power concerns with allowing bids and how can the ISO mitigate those bids?
- Given the above answers, how could ISO evaluate the cost-benefit analysis of including bid functionality? In other words, how much would the benefit be as compared to the added complexity of modeling bid functionality?

As shown in Section 7.4.4, the ISO agrees that the current market software is capable of

considering more than one binding constraint. Similarly, the preventive-corrective constraint can also consider more than one binding constraint and accurately reflect that in the LMCP, based on the resource's energy bids and capacity bids, should the constraint eventually include capacity bids.
More Information Should be Provided about the Contingency Limits and the SOLs.
The ISO in its technical paper discusses several types of limits, including N-1 contingencies, pre-contingency operating limits, and SOLs. WPTF requests additional discussion about these constraints and asks the ISO to consider how it can provide more information about each constraint the ISO plans to consider in its model. As part of this discussion the ISO should include consideration of whether the information release needs to be protected.
CAISO Response
The ISO is considering this question and related information security issues. We will work with stakeholders towards a resolution using established procedures.
The Policy Process Should Include Consideration of Transparency and Processes for Setting and Changing Limits.
WPTF requests that the ISO include in its policy discussions consideration of how transparency will be provided about the constraints being invoked, including how participants will be aware of and understand the implications of the constraints being modeled, the outages or other contingency events that might affect the constraint, and the resulting shadow prices and LMCPs.
CAISO Response
The ISO is considering this question and related information security issues. We will work with stakeholders towards a resolution using established procedures.