Issue Paper

Near-term Enhancements to Congestion Revenue Rights (CRR)

August 14, 2009

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1. Introduction

The Federal Energy Regulatory Commission's (FERC) approval of the February 2006 tariff filing in support of the California ISO's new market design, and several subsequent filings and associated orders, established the policy for Congestion Revenue Rights (CRRs) in the ISO's current market. The ISO has released short-term and long-term CRRs for the start of its new market design through the allocation and auction processes for CRRs that have been in effect since April 1, 2009. The ISO is now conducting both annual and monthly CRR allocation and auction processes for the release of prospective CRRs. This experience provides an opportunity to consider refinements in some details of CRR and related processes.

Through the weekly CRR conference calls with market participants and its own evaluation the ISO has identified the issues listed below as candidates for further refinements. This Issue Paper is the beginning of a stakeholder process to address the issues and develop appropriate solutions to them.[1]

CRR Related Credit Issues

- CRR credit policy changes: The ISO will review and refine current credit requirements for participation in CRR auctions to improve the ISO's credit coverage. The ISO will seek to implement these enhancements prior to the November 2009 annual auction.
- Process for re-selling CRRs of a defaulting CRR holder: Experience during 2009 revealed that in the event of a credit default, there is a need to better define the process for re-selling the CRRs of the defaulting CRR holder.
- Re-evaluation of holding credit requirements for extraordinary circumstances: Circumstances such as extended outages can result in changes in holding credit requirements. A business process has been defined, and will be reviewed.

Non-Credit Policy Issues

- Revise load migration process: The current process for transferring CRRs due to load migration between LSEs requires the ISO to handle data on retail end-use customers. These data are not otherwise the type of data for which the ISO is responsible for handling and processing. Alternatives will be considered that do not require the ISO to receive such data.
- Revise modeling and treatment of trading hubs in CRR allocation: The current CRR allocation process disaggregates a nominated trading hub CRR into separate CRRs

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[1] Note that two issues that needed early resolution have been approved at the July 2009 Board meeting, and filed at FERC: elimination of CRR payment pro-rationing in preliminary settlement statements, and assignment of LMPs for disconnected pricing nodes.

for each constituent PNode of the trading hub, resulting in holdings of many small CRRs. A revised approach for allocating and tracking CRRs having a trading hub source or sink could streamline this process.

- Eliminate multi-point CRRs from CRR design: Market participants strongly desire the ability to sell CRRs in the auction, but multi-point CRRs make it difficult to implement the sale of CRRs. Eliminating multi-point CRRs facilitates the sell function. Having the multi-point function in the CRR system complicates the implementation of almost every new feature that might be desired while offering very little offsetting benefit.
- Weighted least squares objective function: The current CRR allocation software maximizes the release of CRRs by utilizing the most effective nominated CRR, from among the CRR requests, to mitigate congestion in the simultaneous feasibility test. As a result the software does not equitably distribute the reduction from CRR allocation requests among participants. The use of a weighted least squares CRR optimization algorithm would balance equity with maximum CRR release.
- Move to single tier in monthly allocation: The current monthly CRR allocation uses two tiers even though the incremental amount of CRRs released after the annual CRR process is limited. A single allocation tier would make the monthly allocation process more streamlined.

Non-Credit Business Process Issues

- Sale of CRRs in the CRR auctions: CRRs cannot be directly sold in the auction. If market participants intend to dispose of CRRs through the auction, participants may purchase CRRs in the auction that are in the opposite direction of the originally released CRR. Alternatively, a market participant may transact a trade through the Secondary Registration System. Implementation of the sell function in the auction software is in process, and will be reviewed with market participants.
- Modeling approaches to reinforce CRR revenue adequacy: In the initial months of operation of the new ISO markets, the ISO has lacked data regarding the impact of transmission outages on CRR revenue adequacy to accurately determine the optimal amount of monthly CRRs for release. As a result there were significant CRR revenue shortfalls in the CRR balancing account for the first three months. Based on the post go-live experience, the ISO will consider ways to improve its modeling of anticipated outages for the monthly CRR release, to better balance the objectives of revenue adequacy and optimum CRR release.
- Tracking of Long Term CRRs in CRR system: The ISO’s current process involves manual work-arounds, which will be automated. These processes are internal to the ISO and do not impact either the CRR holdings or the business processes of market participants, but the ISO will explain the issues and the proposed process improvements through this stakeholder process.

This initiative is to develop the principles for business processes that will implement the new or existing policies. Some issues involve software changes, while others are process changes. The principles for business processes will then be documented in the CRR Business Practice Manual, and implemented in Market Operations software and business practices. The ISO’s goal is to implement solutions to the CRR-related credit issues by late 2009. The timing of other issues will vary with the complexity of the issue, and will be determined as the needs for policy resolution and software development are assessed.

2. Process and Proposed Timetable

Following the publication of this Issue Paper, the stakeholder process is proposed to begin with a stakeholder conference call for the purpose of identifying in collaboration with stakeholders the priority of the issues identified in this document and to begin identifying and evaluating alternatives. Pursuant to such discussions. the ISO will provide as straw proposal as identified below and on September 8, 2009 a stakeholder meeting will be held to discuss the CRR-related credit issues identified below. The remaining items will be discussed subsequently in either additional meetings or in subsequent conference calls.

The schedule for issue identification on all issues, and resolution of CRR-related credit issues, is as follows:

Date	**Activity or milestone**
August 14	Publish Issue Paper
August 21	Stakeholder conference call on CRR-Related Credit Issues in Issue Paper, and preliminary questions on other issues
August 28	Stakeholder comments on Issue Paper
September 1	Straw Proposal on CRR-Related Credit Issues
September 8	Stakeholder meeting (or conference call) on CRR-Related Credit Issues Straw Proposal and on Issues Paper for other issues
September 15	Stakeholder comments on CRR-Related Credit Issues Straw Proposal and on Issues Paper for other issues
September 22	Draft Final Proposal on CRR-Related Credit Issues
Late September	Stakeholder Conference Call on Draft Final Proposal on CRR-Related Credit Issues
October	Board decision on CRR-Related Credit Issues
November	FERC Filing on CRR-Related Credit Issues
Schedule for non-credit topics will be determined after the preliminary meeting to discuss the issues and priorities based on initial stakeholder input.	
Implementation dates will vary depending on policy resolution and software development.	

3. Criteria for Evaluating Potential Solution Approaches

The ISO's proposed resolution of all issues will be developed based on consideration of stakeholder inputs, sound market design, and evaluation of the ISO's ability to implement alternative solutions in a timely manner. The specific factors to be considered will be identified separately for each topic area.

4. Issues to be Addressed

In the subsections below, this Issue Paper describes the issues that need to be addressed, and in some cases describe one potential solution in order to further illustrate the issues. Along with feedback from stakeholders regarding whether the ISO has appropriately identified the issues that need to be addressed, the ISO invites feedback regarding whether these potential solutions would in fact address the issues, and whether the potential solutions present additional issues that would need to be addressed.

4.1. CRR-Related Credit Issues

4.1.1. CRR Credit Policy Changes

4.1.1.1. Revisions to CRR pre-auction credit requirements

The ISO's credit policy for Congestion Revenue Rights (CRR) is designed to protect the financial interests of market participants against risks associated with CRRs. On the other hand the credit policy must not create unnecessary barrier to entry for participating in the ISO's CRR market. To achieve that balance, the ISO continues to improve the existing CRR credit policy based on the outcomes of market operation and the feedback from stakeholders.

To resolve the issues in this area, the ISO is considering an enhancement to the existing CRR credit policy, specifically to the calculation of pre-auction credit requirement. The enhancement may reduce pre-auction credit requirements for some market participants. It will, however, not compromise the credit coverage for the CRR auction.

4.1.1.2. Existing Pre-auction Credit Requirement

The pre-auction credit requirement is designed such that the collateral required for participating in the auction should be sufficient to cover both the payments due to the ISO for winning the auction and the credit requirement for holding the winning CRRs. In other words, the auction winner should not need to post any additional collateral in order to hold the winning CRRs.

According to the existing ISO tariff, the credit requirement for participating in CRR auction is calculated as:

$$Pre-Auction\ \ Credit\ \ Requirement$$
$$= \max[\$500{,}000, \sum_i (|bid_i| + Credit\,Margin_i \times \overline{MW}_i)]$$

where $\overline{MW}_i$ is the maximum MW value of the bid for CRR_i.[2]

In the ISO's CRR Business Practice Manual, $|bid_i|$ is defined as the maximum bid credit exposure based on the bid curve for CRR_i.[3] This definition ensures that the pre-auction credit requirement will be sufficient to cover both the auction payment due to the ISO (for positive-valued CRRs) and the holding credit requirement when the bidder wins the auction for CRR_i. The maximum bid credit exposure, $|bid_i| = \max_{MW_i} |Bid\,Price_i \times MW_i|$ ($0 \le MW_i \le \overline{MW}_i$), is often found at MW_i that is different from $\overline{MW}_i$. Two different values of MW used in the calculation could result in an excessive pre-auction credit requirement.

The existing ISO tariff also requires auction winners of negative-valued CRRs to post sufficient collateral to meet the holding credit requirements before they are paid for winning the auction. This requirement is reflected in the calculation of pre-auction credit requirement. That is the bidder for a negative-valued CRR has to post collateral to cover both bid credit exposure and credit margin credit exposure. Based on this rule, there is money swap at the auction settlement process that may not be necessary. For example, the auction winner of a -$100,000 CRR needs to post a collateral of $100,000 plus credit margin (say $50,000) before he is paid the $100,000 winning bid. The $100,000 took a round trip between the winner and the ISO at the auction settlement. Changing $|bid_i|$ to $\max(0, bid_i)$ in the pre-auction credit requirement calculation could avoid the money swap and lower the credit requirement for bidding for negative-valued CRRs. The change will not weaken the credit coverage for the auction.

4.1.1.3. Proposed Enhancement

The ISO proposes to change the calculation of credit requirement for participating in CRR auction to:

$$
\begin{aligned}
&Pre-Auction\ Credit\ Requirement \\
&\quad = \max[\$500{,}000, \sum_i \max_{MW_i}(\max(0,\ BidPrice_i \times MW_i) + Credit\,Margin_i \times MW_i)]
\end{aligned}
$$

where,

MW_i - the MW value within the range of the bid curve for CRR_i, i.e., $0 \le MW_i \le \overline{MW}_i$

$BidPrice_i$ - the bid price ($/MW) corresponding to MW_i on the bid curve for CRR_i

$\max_{MW_i}(\max(0,\ BidPrice_i \times MW_i) + Credit\,Margin_i \times MW_i))$ finds the maximum credit exposure of this bid for CRR_i by varying MW_i value within the range between 0 and $\overline{MW}_i$. The maximum credit exposure will be the pre-auction credit requirement for this bid. The pre-auction credit requirement for a bid portfolio submitted by a bidder will be the greater of $500,000 and the sum of calculated pre-auction credit requirements for all bids in the portfolio.

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2 The ISO Tariff Section 12.6.2.

3 The ISO Business Practice Manual for Congestion Revenue Rights, Version 5, Attachment H.

The examples included in this proposal demonstrate that with the proposed method the pre-auction credit requirement could be lowered while still providing sufficient credit coverage for the CRR auction.

4.1.1.4. Numerical Examples

The following examples illustrate the differences between the existing and proposed methods in the calculation of pre-auction credit requirement. The sufficiency of the pre-auction credit requirement calculated based on the proposed method is also analyzed based on the examples.

Example 1: Pre-auction credit requirement for a positive-valued CRR bid

In this example, the bidder submits a bid curve for a positive-valued (monthly or seasonal) CRR. The bid curve has four segments, as shown in Table 1. The credit margin of the CRR in this example is assumed to be $4/MW over the month or season. The total credit exposures calculated using the existing method and the proposed method are listed in Table 1.

Table 1. Comparison of Credit Exposures

Bid Curve		Existing Method			Proposed Method		
Bid Segment (MW)	Bid Price ($/MW)	Bid Segment Credit Exposure ($)	Credit Margin Credit Exposure ($)	Total Credit Exposure ($)	Bid Segment Credit Exposure ($)	Credit Margin Credit Exposure ($)	Total Credit Exposure ($)
0~5	15	75	200	275	75	20	95
5~20	13	260	200	**460**	260	80	340
20~35	7	245	200	445	245	140	**385**
35~50	3	150	200	350	150	200	350

Both methods calculate bid segment credit exposure in the same way. It is the product of the maximum MW value and the bid price of each bid curve segment.

With the existing method, credit margin credit exposure is calculated as the product of the maximum MW value of the bid curve and credit margin (50x4). Total credit exposure is the sum of bid segment credit exposure and credit margin credit exposure. In this example, the maximum total credit exposure is $460 that occurs at the 20 MW value on the bid curve. The pre-auction credit requirement for this bid curve is set to $460 in order to cover the largest possible credit exposure of this bid curve.

The proposed method calculates credit margin credit exposure for each segment of the bid curve as the product of the maximum MW value of the segment and credit margin. Therefore, the bid segment credit exposure and credit margin credit exposure are calculated using the same MW value. The maximum total credit exposure is $385 at the 35 MW value on the bid curve. It is also the pre-auction credit requirement for this bid. The proposed method produces a lower pre-auction credit requirement than the existing method does in this example.

Now we need to see if the $385 pre-auction credit requirement is sufficient to cover both the auction payment due to the ISO and the holding credit requirement if the bidder wins the auction. The analysis is summarized in Table 2.

Table 2. Pre-auction Credit Requirement vs. Holding Credit Requirement

Bid Curve		Market Clearing Price ($/MW)	Payment Due to the ISO ($)	Holding Credit Requirement ($)	Pre-Auction Credit Requirement ($)	Additional Collateral Needed ($)
Bid Segment (MW)	Bid Price ($/MW)					
0~5	15	15	75	0	385	0
5~20	13	12	240	0	385	0
20~35	7	7	245	0	385	0
35~50	3	2	100	100	385	0

Assuming the auction market clearing price for the CRR is $15/MW, this bid will clear 5 MW. The auction payment due to the ISO is $75 and the credit requirement for holding this 5 MW CRR is $0.[4] The total collateral required at the auction settlement is $75. The $385 pre-auction credit requirement is sufficient for that purpose.

If the market clearing price is $2/MW, the auction payment due to the ISO is $100 and the holding credit requirement is $100. The total collateral required at the auction settlement is $200, which is fully covered by the $385 pre-auction credit requirement. There is no need for any additional collateral.

Example 2: Credit requirement for a negative-valued CRR bid

In this example, the bid curve has the same four segments as in Example 1, but with negative bid prices (see Table 3). The credit margin of the CRR in this example is $4/MW, the same as in Example 1.

[4] Based on $Holding\ Credit\ Requirement = (-Auction\ Price + Credit\ Margin) \times MW$ and no negative credit requirement.

Table 3. Comparison of Credit Exposures

Bid Curve		Existing Method			Proposed Method		
Bid Segment (MW)	Bid Price ($/MW)	Bid Segment Credit Exposure ($)	Credit Margin Credit Exposure ($)	Total Credit Exposure ($)	Bid Segment Credit Exposure ($)	Credit Margin Credit Exposure ($)	Total Credit Exposure ($)
0~5	-3	15	200	215	0	20	20
5~20	-7	140	200	340	0	80	80
20~35	-13	455	200	655	0	140	140
35~50	-15	750	200	**950**	0	200	**200**

The existing method calculates bid segment credit exposure as the absolute value of the product of the maximum MW value and the bid price of each bid curve segment. The proposed method has zero segment credit exposure because the auction wining value will be counted toward the holding credit requirement.

The calculation of credit margin credit exposure is the same as in Example 1 for both methods.

The maximum bid credit exposure is $950 with the existing method and $200 with the proposed method. They are also the pre-auction credit requirements determined by the two methods. The proposed method produces a lower pre-auction credit requirement than the existing method does.

Table 4. Pre-auction Credit Requirement vs. Holding Credit Requirement

Bid Curve		Market Clearing Price ($/MW)	Auction Wining Value ($)	Holding Credit Requirement ($)	Pre-Auction Credit Requirement ($)	Additional Collateral Needed ($)
Bid Segment (MW)	Bid Price ($/MW)					
0~5	-3	-4	20	40	200	0
5~20	-7	-9	180	260	200	0
20~35	-13	-13	455	595	200	0
35~50	-15	-20	1000	1200	200	0

With the proposed method, the value the bidder won in the auction (market clearing price times the cleared MW value) will not be paid to the bidder. Instead it will be used to meet the credit requirement for holding the wining CRR. The analysis of the sufficiency of pre-auction credit requirement calculated based on the proposed method is summarized in Table 4.

If the auction market clearing price for the CRR is -$4/MW, this bidder will clear 5 MW. The wining value the ISO will hold is $20. The credit requirement for holding this 5 MW CRR is $40. The total collateral required at the auction settlement is $20 (40-20) that will be covered by the $385 pre-auction credit requirement. The $365 remaining collateral will be returned to the bidder.

If the auction price is -$20/MW, the wining value by the bidder is $1000. The holding credit requirement for the 50 MW wining CRR is $1200. The total collateral required at the auction settlement is $200 that will come from the $200 pre-auction credit requirement. This is the only situation the pre-auction credit requirement will be fully used, in conjunction with the CRR revenues that will be withheld, to meet the holding credit requirement. In each of the cases above, under the proposed methodology, the CRR revenue that the bidder would have been paid plus the $200 of posted collateral for the credit margin is sufficient to cover the holding credit requirement.

4.1.1.5. Summary

In both examples, the pre-action credit requirements determined based on the proposed method are lower than that based on the existing method. The pre-auction credit requirements, together with the auction wining values, are sufficient to cover the credit requirement for holding the wining CRRs.

There are other situations where both methods will produce the same pre-action credit requirements and provide the same coverage for the auction.

4.1.2. Process for liquidating the CRRs of a defaulting CRR holder

The ISO tariff section 12.5.1(e) provides authority for the ISO to resell to the market the CRRs that were held by a CRR Holder determined to be in default.[5] The purpose of the present proposal is to try to specify an approach whereby such resale would be accomplished. As such the proposal does not discuss the provisions for determining that a CRR Holder is in default, but rather takes the fact of the default as a starting assumption and proceeds to the next step of reselling the defaulted party's CRR holdings. The objectives of reselling such CRRs are to mitigate as far as reasonably possible the financial risk to the rest of the market as a result of a default, and to discourage defaults by CRR holders while avoiding undue or unfair impacts to defaulting parties. The proposal described in this section is intended as a straw proposal for discussion purposes. The ISO welcomes suggestions as to how the approach may be improved.

A starting assumption of this proposal is that the CRR portfolio of the defaulting party has a net negative expected future value, although it may be comprised of both negative value and positive value individual CRRs. There is nothing in the proposal, however, that would prevent it being applied to a net positive value CRR portfolio. Ideally the ISO should be able to re-sell CRRs through the CRR auctions as well as bilaterally through the Secondary Registration System (SRS). At this time, however, the CRR software does not support the ability to offer to sell a pre-existing CRR, so the only option is to use the SRS. As discussed elsewhere in this paper, implementation of the CRR auction sell function is a high priority for the ISO, so the ISO expects that the need to rely exclusively on the SRS should be relatively short-lived. In any event, the approach described below could apply to auction sales in the future as well as SRS sales.

The ISO proposes to offer for resale all CRRs in the defaulting party's portfolio, not just the positive-value ones. Some CRR market participants may willingly take on negative-value CRRs if they expect the up-front price they receive for taking on the liability is greater than the stream

[5] Through a separate process, the ISO will document the rules and procedures for declaring a CRR holder in default and for allowing a CRR holder to cure a default.

of payments they will make to the ISO over the term of the CRR. If the price the ISO offers to pay a CRR holder is chosen prudently, such a sale could reduce the financial risk to the rest of the market as a result of the default. Alternatively, if the ISO attempts to re-sell only the positively valued CRRs, both the defaulting party and the net creditors may complain that the ISO has not sufficiently tried to stop or contain the harm to the market by selling the negatively valued CRRs. Also, positive or negative values are based on expectations of future streams of payments and charges, and expectations change as more market experience is gained. It would be inappropriate for the ISO to assume, ex ante, that it will not be possible to sell the negative value CRRs at a price that reduces the financial exposure of the rest of the market. Finally, if the ISO takes a somewhat risk-averse perspective with respect to protecting the interests of the market as a whole, there would be a benefit to realizing a known up-front payment from the re-sale of a CRR rather than waiting to realize the uncertain IFM settlement value of the CRR, as long as the up-front payment does not reflect an unduly large discount to the expected IFM value of the CRR. This would be true both for negative-value and positive-value CRRs. Accordingly, to minimize the risk to the market as a whole, the ISO believes it would be best to try to sell all the CRRs in a defaulting party's portfolio, recognizing it may not be possible to find qualified buyers willing to purchase all of the CRRs at acceptable prices.

For sales through the auction, the ISO would offer the CRRs into the first available monthly auction for the full month by time of use. For sales through the SRS, the ISO would offer the CRRs for sale on a particular date and announce a definite period during which it will accept offers, at the end of which the ISO can accept the best offer if it meets the threshold price, or not sell the CRR if no offer meets the threshold price. If some CRRs remain unsold for lack of acceptable offers, this would not preclude the ISO from trying to sell them through the SRS again at a later date. The ISO would offer individual CRRs for sale, where an individual CRR is defined by source location, sink location, MW quantity, time-of-use (TOU), term (season or month). In a monthly auction the term would have to be the month, of course.

The ISO believes it is appropriate to establish a minimum sale price for each CRR, as a way to try to maximize the benefit of the re-sale to the rest of the market. If the ISO were to sell one of these CRRs at too deep a discount from its expected value, the market participants exposed to the impacts of the default could be worse off than if the ISO were to hold that CRR rather than resell it. Thus a minimum sale price for a CRR can be thought of as the price at which the parties exposed to the default would be financially indifferent between re-selling or not re-selling the CRR, based on the information available at the time of the sale and their tolerance for uncertainty.

The ISO proposes that the minimum price for each CRR should be a certain percentage of the most recent auction price of the CRR, adjusted to reflect the portion of its term that has already transpired. The ISO will seek stakeholder inputs on the percentage value and suggest a specific formulation of this approach to present at the upcoming stakeholder discussion.

Funds related to the re-sale of CRRs would be managed through a separate collateral fund based on the defaulting party's collateral held by the ISO. The ISO believes that the default of a CRR holder and the funds resulting from any resale of the CRR holder's CRRs should not affect the CRR balancing account. Because the CRR balancing account receives all net revenues from the CRR auctions, it has already received the auction payment for any positive value CRRs, and has made auction payments to CRR holders who were awarded negative value CRRs, which are held by the ISO as a part of the collateral. Thus the CRR balancing account is already "whole" with respect to the auction revenues associated with these CRRs. The funds associated with re-sale of these CRRs really reflect the transfer of ownership from one party to another, comparable to a bilateral SRS transaction between any two CRR holders, so there should be no impact on the CRR balancing account. Most importantly, the whole purpose of the

ISO re-sale of the CRRs is to mitigate the impact of the default on the parties who bear the default allocation, so it is appropriate to manage these funds outside the CRR balancing account.

4.1.3. Credit requirements for extraordinary circumstances

Each CRR Holder, whether it obtains CRRs through allocations, auctions, SRS trades or load migration, must maintain an Aggregate Credit Limit in excess of its Estimated Aggregate Liability including the credit requirement for holding the Congestion Revenue Right (CRR) portfolio determined as described in Section 12.6.3 of the Tariff. Credit requirements for holding CRRs are calculated on a portfolio level based on the corresponding CRR auction prices and the credit margin data and re-evaluated in a regular basis.

Extraordinary circumstances such as extended transmission outage or other abnormal grid conditions could dramatically increase (or decrease) the payment obligations for a CRR. Although, over time, the CAISO will be able to incorporate historical outage information in the calculations of historical expected values, that calculation may not adequately cover near-term anticipated prospective obligations associated with extraordinary events that could dramatically change the risk profile of a CRR portfolio. In a previous stakeholder process, CAISO suggested it might clarify its tariff authority so that the CAISO could impose additional credit requirements under any extraordinary circumstance.

Stakeholders have favored the concept for adjusting CRR holding credit requirements due to extraordinary circumstances, but several commentators also recommended that the CAISO clearly establish in advance the methodology it would use to calculate the increased credit requirements. The requirement to have the CAISO develop in advance the methodology for such calculations was rejected by FERC. Under the tariff, CAISO may request additional security when warranted but we will have to provide the justification at that time. Although CAISO expects to develop these methodologies, CAISO will have the ability to request the security at any time if there are concerns to need it subject its justification even if it is different from one of the CAISO's pre-developed methodologies. Under the scenario where CRR holding credit requirements vary, CAISO through its Finance department and following its standard credit policy will determine if sufficient collateral exists to cover the additional liability, and if a collateral call will be made. CAISO believes that it has the authority to request additional security in the event it finds that existing credit coverage is not sufficient to cover the prospective liabilities.

On March 2009, the ISO posted a proposal to reevaluate credit requirements under extraordinary circumstances. Afterwards, the ISO held a conference call with stakeholders to discuss the proposal, and stakeholders subsequently submitted comments on this. CAISO posted responses to these comments. All related documents are available at http://www.caiso.com/1b8c/1b8cdf25138a0.html.

4.1.3.1. Standard Evaluation of CRR Holding Credit Requirements

CRR holding credit requirements are computed systematically for each CRR holder based on its entire CRR portfolio within the CRR system. The goal of the credit requirement computation is to determine whether a CRR holder has sufficient credit to cover the potential financial risk from its CRR portfolio. Under normal conditions, CRR holding credit requirements will be re-evaluated once a week. This is to account for changes in both the CRR portfolios and the auction prices which in general will make the credit requirements vary over time even under normal conditions[6].

For any CRR in the *H-th* CRR holder's portfolio, regardless of their origin (allocation, auction, load migration or SRS trades), the associated holding credit requirement is calculated as follows[7]:

$$CR_{i,p}^{H} = -\sum_{m=1}^{M_{i,p}} \sum_{d=1}^{D_{i,m,p}} \min\left(\Psi_{i,d,m,p}, \lambda_{i,d,m,p}\right) MW_{i,d,m,p}^{H} + \frac{\sum_{m=1}^{M_{i,p}} \sum_{d=1}^{D_{i,m,p}} CM_{i,d,m,p}^{Daily} \times MW_{i,d,m,p}^{H}}{\sqrt{\sum_{m=1}^{M_{i,p}} D_{i,m,p}^{H}}}, \quad \forall i, p, H \qquad \textbf{(1)}$$

where the super-index *H* stands for *H-th* CRR holder; the sub-index *i* stands for the *i-th* CRR in the holder's CRR portfolio; the sub-index *p* is for TOU period; the set M_{ip} comprises the remaining months in the term of *i-th* CRR for TOU period *p*; the set $D_{i,m,p}$ is the number of days the *i-th* CRR has in month *m* and TOU period *p*; $MW_{i,d,m,p}$ *is the* volume (MW) of the *i-th* CRR on day *d* in month *m* and TOU period *p*; $CM_{i,d,m,p}^{Daily}$ stands for the daily credit margin ($/MW-Day) for the *i-th* CRR on day *d* in month *m* and TOU period *p*; $\lambda_{i,d,m,p}$ is the daily auction price ($/MW-Day) of the *i-th* CRR on day *d* in month *m* and TOU period *p*. $\Psi_{i,d,m,p}$ stands for the historical expected value of the *i-th* CRR for TOU *p* in month *m* and day *d* based on historical Day Ahead congestion prices from actual MRTU operation.

The summation through all CRRs for both TOUs in each CRR holder's portfolio is the Total CRR value (TCV) or net credit requirement; *i.e.*,

$$TCV^{H} = \max\left(0, \sum_{i,p} CR_{i,p}^{H}\right), \quad \forall H \qquad \textbf{(2)}$$

If this value is negative, then the CRR holder's portfolio is expected to have an associated net positive congestion revenue stream and then the credit requirement for its holder is set to zero. These credit requirement values that will be passed on to CAISO's Finance.

4.1.3.2. Extraordinary Events

Given the complexity to define a priori what events can be defined as extraordinary, CAISO will communicate to market participants when an event is deemed to be extraordinary. At this time CAISO plans to develop methodologies that would be used for outages of either transmission or generation facilities that may be systematically modeled. Thus, the discussion will refer only to

[6] Over time some CRRs will eventually expiry and new CRRs will be acquired through upcoming allocations, auctions, SRS trades or load migration. Also, a new set of monthly auction prices will become available after each auction process.

[7] This formula represents the credit enhancement to account for historical expected value of CRRs that will apply after one year of actual MRTU operation. The formula as of today only relies on auction prices.

extraordinary events that lead to planned or forced outages of elements of the system. Rather than describing the event per se, the goal is to define the events by their impact they may have on the system. The values of obligation-type CRRs are bidirectional entitlements for their holders and are based on the congestion component of LMPs from the Day-Ahead Market (DAM) only. The LMP congestion component reflects the value of scarce transmission. Therefore, congestion revenues will be affected by changes on the system congestion in the IFM market. Congestion is primarily driven by the economical bids and the condition of the transmission system, such as de-rates and outages. This confines the definition of an extraordinary circumstance as any event that alters the congestion of the system beyond typical patterns. For instance, a major outage due to fires can lead to atypical flow reversal or could dramatically exacerbate congestion in some areas of the system, which will alter the usual congestion pattern. In contrast, changes of flow patterns, such as flow reversal on Path 15 during winter time may not be considered a trigger for the reevaluation of credit. CRRs already accommodate seasonality. Neither may typical de-rates or outages on transmission elements due to scheduled or forced outages be a trigger for reevaluation as they are very frequent occurrence. Their inclusion would otherwise lead to a continuous re-evaluation of credit requirements, defeating the purpose of having the current credit requirement functionality.

Unexpected but time limited events that do not impact the IFM outcome will not trigger the re-evaluation of credit. Furthermore, as congestion revenues accrue on a monthly basis and credit requirements apply for CRRs valid over the subsequent 12 months, the unusual variation within a single day may not meaningfully distort the final cumulative result. For instance, if there is a sudden loss of Path 15 at 1400hrs on July 13th and it is expected to return to service by 2300hrs on the same day, by the time this forced outage happens, the IFM for Trade Date (TD) of July 13th was already run on July 12th, and indeed the IFM for TD of July 14th was already run by 1300hrs on July 13th. Hence, such an outage will not be reflected in either IFM for TD of July 13th or 14th, even though it was an extraordinary event and impacted system. This outage, however, will be accommodated in the RTM of July 13th. Consequently, such outage will not impact congestion revenues for those days, as CRRs are settled only on IFM congestion prices, which is the premise for reevaluating credit requirements.

For already-known extraordinary events that can be modeled by means of transmission outages the CRR team will rely on outage information. CAISO will model such outages with the set-up of the most current monthly auction available to determine the change of credit requirement under such conditions, if any. It is important to note that certain planned events will be already accounted for in the monthly release of CRRs under the umbrella of the 30-day rule. This rule allows the CAISO to know the outages at least 30 days prior to the start of the calendar month for which the outage will occur so that this can be reflected in the network model used in the monthly process to release CRRs. The purpose of this procedure is to ensure revenue adequacy by controlling the transmission capacity released through CRRs. However, if an outage reported under the 30-day rule is classified also as an extraordinary event, it will be automatically accommodated in the standard evaluation of credit requirements once the auction prices become available in the CRR system.

4.1.3.3. Reevaluation of Credit Requirements

With the extraordinary event identified and characterized as an outage, the most current available monthly CRR auction will be rerun with the outage now included. It is important to mention that the modeling of the outage will be the sole modification that will be done to the setup of the auction. All other set-ups such as bids from participants, de-rate factors, and fixed CRRs will remain unchanged. The clearing of the auction will provide a new set of auction prices. These prices will be converted into hourly prices ($\overline{\Psi}_{i,d,m,p}$), in the same fashion the prices for the standard evaluation are computed.

Such hourly prices will be used to compute the credit requirements for each CRR holder. Notice that the new hourly prices for all CRRs will be used only for the period of days, Δ, in which the extraordinary event occurs. For any other day outside this period, the original auction price or expected values will still be used, following the standard computation of the CRR system. This can be hard coded in the manual computation of the reevaluation process as follows:

$$\overline{CR_{i,p}^{H}} = -\sum_{m=1}^{M_{i,p}} \sum_{d=1}^{D_{i,m,p}} \min(\lambda_{i,d,m,p},\ \Omega_{i,d,m,p}) MW_{i,d,m,p}^{H} + \frac{\sum_{m=1}^{M_{i,p}} \sum_{d=1}^{D_{i,m,p}} CM_{i,d,m,p}^{Daily} \times MW_{i,d,m,p}^{H}}{\sqrt{\sum_{m=1}^{M_{i,p}} D_{i,m,p}^{H}}} \quad \textbf{(3)}$$

where

$$\Omega_{i,d,m,p} = \begin{cases} \overline{\Psi}_{i,d,m,p} & if\ d \in \Delta \\ \Psi_{i,d,m,p} & if\ d \notin \Delta \end{cases} \quad \textbf{(4)}$$

This computation is equivalent to re-evaluating the credit requirement only for the period of time in which the extra-ordinary event occurs.

When the credit requirements exceed the current posted collateral there may be a need to call for more collateral; if the reevaluation actually decreases the credit requirement, then the current credit requirement remains valid. The credit CRR holding requirement for each CRR holder is then defined as:

$$TCV^{H} = \max(0, \sum_{i,p} CR_{i,p}^{H}, \sum_{i,p} \overline{CR_{i,p}^{H}}), \quad \forall H \quad \textbf{(5)}$$

where CR^{H} is the most current system-based credit requirement as defined in Expression 1, and $\overline{CR}^{H}$ is the most recent re-evaluation of credit requirements due to extraordinary circumstances as defined in Expression 3.

Given the inherent uncertainty on the data to compute credit requirements under extraordinary circumstances, the monitoring of congestion revenues for each CRR holder will be a companion measurement to any reevaluation as it is one indicator of the evolution over time of the financial position of CRR holders.

4.2. Non-Credit Policy Issues

4.2.1. Process for adjusting CRR holdings to reflect load migration

The basis for the allocation of CRRs to Load Serving Entities (LSEs) in the annual and monthly CRR allocation processes is the amount of load served by each LSE. Existing ISO policies for CRR allocation are founded on the principle that, fundamentally, CRRs are associated with the end-use customers served by the LSE, and that the LSE acts on behalf of its end-use customers when it requests and is allocated CRRs. Thus, when end-use customers migrate between LSEs (for example, in the retail Direct Access market), the CRRs that were allocated on behalf of the end-use customers are reassigned from the old to the new LSE.

To perform this transfer of CRRs, the ISO currently performs a two-stage process. First, the ISO receives load migration data from each of the utility distribution companies (UDCs). Using these data, the ISO calculates the net load migration between each pair of LSEs. Second, the ISO calculates the appropriate transfers of CRRs between LSEs. The current process is governed by tariff sections 36.8.5 and is described in sections 7.3 of the business practices manual (BPM) for CRRs.

The current process for transferring CRRs due to load migration between LSEs requires the ISO to handle data on individual retail end-use customers. These data are not otherwise the type of data for which the ISO is responsible for handling and processing, and the current process requires the ISO to develop business processes that do not serve other ISO functions and that expose the ISO to risks in data management that it would not otherwise face. The ISO seeks to discuss the alternative arrangements that would be consistent with the current methodology developed previously as reflected in the BPM for CRRs but that would not require the ISO to receive and be required to manage such data.

The ISO proposes to revise this process so that UDCs will perform the first part of the process described above, and will report to the ISO the net load migration between each pair of LSEs serving load within its distribution service territory. The ISO would continue to perform the second part of the process under the revised procedure, to transfer the allocated CRRs between LSEs.

4.2.2. Method for handling trading hubs in the CRR release process

Under the ISO's current procedures, participants in CRR allocations and auctions may request sources reflecting Trading Hubs. However, there are limits to the availability of these and other sources for CRR awards in that the available transmission network capacity is limited to 75% of the full capacity, and the full physical network capacity is further reduced by 6% of the MVA (mega-volt-ampere) rating to account for reactive power and transmission losses. In order for CRRs that have Trading Hubs as their source reflect the congestion charges that market participants would face in the market, the Trading Hubs would need to maintain the same distribution factors among generators that will be used in the Day-Ahead Market. The result of this limitation is that if the requested Trading Hub CRRs were maintained as being sourced at Trading Hubs, a network constraint that limits further awards from a single generator within its Trading Hub would prevent further awards from the Trading Hub as a whole. However, a value that is very similar to the value of the Trading Hub can be achieved by converting the Trading Hub's CRR nomination to a portfolio of individual generator nominations. This can be particularly problematic if a constraint to an individual generator becomes limiting in Tier 1, since no further capacity is then available for awards using Trading Hubs in Tier 2, or Tier 3 of the CRR allocation process.

The current approach for handling CRR nominations for the allocation process when the CRR source is a trading hub involves unbundling the nominated CRR into multiple, often fractional MW CRRs whose sources are the individual PNodes that comprise the Trading Hub. This approach leads to a proliferation of large quantities of small MW value CRRs, which is both inefficient and burdensome from the perspective of CRR holders and the ISO alike. The following alternative approaches for handling Trading Hub CRRs will be considered: (1) limit the MW amounts for CRR nominations using Trading Hubs in Tier 1 of the annual CRR process so that the probability of a constraint becoming binding in tier 1 is greatly decreased, or (2) directly reserve transmission capacity for allocation in tier 2, during the execution of Tier 1.

The ISO will illustrate specific concerns about the current approach, and potential benefits of alternative approaches, in its Straw Proposal. In the meantime, the ISO invites stakeholder feedback concerning these potential solutions, and suggestions for additional alternatives.

4.2.3. Elimination of multi-point CRRs

The current CRR process allows for multi-point CRRs, i.e., CRRs that can be defined by multiple sources or multiple sinks or both (current rules vary between the allocation and auction). Multi-point CRRs were originally proposed early in the design of the CRR release process, before the stakeholders and the ISO agreed on the tiered structure of the CRR allocation process that was eventually filed and approved by FERC. The last point is important to illustrate the reason why multi-point CRRs were created, namely, to enable participants in the CRR allocation process to assign different priorities to the CRRs they nominate so that the simultaneous feasibility test (SFT) would reduce lower priority nominations first when reductions are needed to achieve simultaneous feasibility. The ability to designate priorities was important in the context of the single-step process for allocating CRRs that was under consideration at that time. With the adoption of the three-tier annual allocation process, however, the tier structure now provides the opportunity for parties to designate their priorities through their choice of which CRRs to nominate in each tier. Thus the primary motive for having multi-point CRRs no longer exists, and the ISO is now considering that they should be eliminated from the CRR design.

In addition to the argument above, there is another reason for eliminating mult-ipoint CRRs. The ISO has previously committed to providing a “sell function” in the CRR auction system, whereby a CRR holder can offer a previously-acquired CRR for sale in the auction and can thereby eliminate from its CRR holdings as many MW of that CRR as are sold in the auction (see the next section for a full discussion of the sell function). The ISO has determined, through discussions with its vendor, that in order to move forward expeditiously to implement the CRR sell function it will be much more complex and costly to implement to implement this functionality if the CRR system must continue to support multi-point CRRs. The complexity and cost of having this functionality impacts almost every aspect of the CRR software.

Finally, multi-point CRRs have had extremely limited use since the start of the CRR market, and the ISO therefore believes that it would not impose any detriment to the market to eliminate this feature. To provide some context for how often the multi-point CRR alternative was selected, for the 2009 annual CRR Allocation and CRR Auction we had a total of just over ½ of 1% (.007) of the total CRRs released as multi-point CRR. For all these reasons, the ISO now believes there is reason to eliminate multi-point CRRs.

4.2.4. Weighted least squares objective function in the SFT

There are two basic objective function formulations that can be utilized for allocating CRRs:

- Maximizing CRR MW (Max CRR)
- Weighted Least Squares (WLS).

The ISO's CRR allocation process currently utilizes the Max CRR formulation. The ISO is now considering moving to a WLS formulation because, when a constraint becomes binding in the simultaneous feasibility test (SFT) for the allocation and some CRR nominations must be curtailed, the Max CRR formulation will minimize the quantity of curtailed nominations, which will tend to impose most if not all of the curtailment on a single allocation participant. Under this formulation the nomination that is most effective in relieving the constraint will be curtailed completely before going to the next most effective nomination. In contrast, the WLS will distribute the curtailment across all CRR nominations that are effective in relieving the congestion, and thus will spread the curtailment among multiple allocation participants. The ISO believes therefore that the WLS is a more equitable formulation for the CRR allocation process.[8]

The purpose of this section is to provide an overview of both formulations so that stakeholders can understand the pros and cons of both approaches and the reasons for considering a change to the WLS. This section does not provide all of the rigorous details, but provides sufficient detail for a basic understanding of how the control variables will change to alleviate a single constraint overload in each case. Further comparisons will be presented as this issue is considered further in the stakeholder process.

4.2.4.1. Optimization Formulations

Let X_i represent the MW value of a Point-to-Point CRR. We let $\overline{X}_i$ represent the nominated value. In both the Max CRR and WLS formulations, X_i, represents the control variable. We assume there are N control variables. The Max CRR and the WLS optimization formulations are shown in Table 1 below. Note that only Point-to-Point nominations are considered for simplicity.

[8] This problem is relevant to the allocation process only, not to the CRR auction. In a CRR auction the auction participants use their bid prices to convey their value on each CRR, and the auction objective is to maximize the financial surplus resulting from clearing the auction. As a result, when there is a congested constraint the SFT will curtail CRR bids based on the participants' bid prices so as to minimize the reduction in the financial surplus. In an allocation process there are no economic bids, so all nominated CRRs are identical from a financial perspective.

Table 1. Max CRR and the WLS formulations

Formulation Part	Maximizing CRR MW	Weighted Least Squares Mathematical Equation	Terminology/Notes
Objective function	$\max\left(\sum_{i=1}^{N}\alpha_i \cdot X_i\right)$	$\min\left(\sum_{i=1}^{N}\alpha_i\left(\overline{X}_i - X_i\right)^2\right)$	α_i are proxy weighting factors with $\alpha_i \geq 0$
Flow Constraints for each constraint, *l*	$\sum_{i=1}^{N} X_i \cdot SF_{i,l} \leq OTC_l$		$SF_{i,l}$ is the shift factor (calculated from the Full Network Model) for the i^{th} control variable on the l^{th} constraint. OTC_l is the limit for the l^{th} constraint.
Control Variable upper and lower bound constraints for each variable, X_i	$0 \leq X_i \leq \overline{X}_i$		

4.2.4.2. Analysis of the Max CRR Objective Function

For a simple situation of one overloaded constraint (due to the application of the nominations at the nomination MW value to the Full Network Model), the control variable that has the largest positive shift factor on the overloaded constraint will be reduced exclusively to alleviate the constraint. This means that this control variable could be set to zero MW and if the constraint is still overloaded, the optimization formulation will then look at the next highest shift factor to adjust. Thus, the CRRs that are the most effective (have the highest shift factor) in alleviating a constraint are adjusted first.

The reason that the most effective CRR nominations are adjusted first is that this reduces the total amount of CRR MW the least. The objective function is to maximize the CRR MW and the adjusting the most effective CRRs maximizes the CRR MW.

Max CRR Example

Assume to CRR nominations that create an overload on an enforced constraint (constraint *k*). Assume the overload to be 5 MW. Assume the α_i are unity. Assume nomination #1 to be 100 MW and the nomination #2 to be 50 MW. Assume $SF_{1,k}$ = 0.5 and $SF_{2,k}$ = 0.2. In this case, the control variable #1 (has the shift factor $SF_{1,k}$) will be used exclusively to alleviate the constraint overload since ($SF_{1,k}$ = 0.5) > ($SF_{2,k}$ = 0.2). In this case, control variable #1 is reduced by overload/ $SF_{1,k}$ = 5/0.5 = 10 MW. In this case, the CRR MW cleared is 100 – 10 + 50 = 140 MW.

If control variable #2 was used to alleviate the constraint, the reduction to control variable #2 would be overload/ $SF_{1,k}$ = 5/0.2 = 25 MW. In this case, the CRR MW cleared is 100 + 50 - 25

= 125 MW, which is less than the total cleared using control variable #1. Thus, adjusting control variable #1 maximizes the CRR MW.

Note that any combination of adjusting both control variables #1 and #2 will result in a cleared MW amount that is less than 140 MW.

In situations where the two shift factors are very close to each other, e.g., $SF_{1,k}$ = 0.61 and $SF_{2,k}$ = 0.6, the control variable with the slightly larger shift factor will be reduced first. This is an unattractive feature of the Max CRR objective function.

4.2.4.3. Analysis of the WLS Objective Function

Assume the □ are unity. Based on the nominated amounts, assume an overload on k^{th} constraint with the overload equal to ΔV_k. Assume, in fact, the k^{th} constraint is the only enforced constraint in this formulation. $\Delta V_k = \sum_{i=1}^{N} \overline{X}_i \cdot SF_{i,k} - OTC_k$. Thus, the control variables must be reduced. Let $\Delta X_i = \overline{X}_i - X_i$ and $\Delta V_{k,i} = \Delta X_i \cdot SF_{i,k}$. $\Delta V_{k,i}$ is the reduction of the flow on the k^{th} constraint due to the reduction in the i^{th} control variable, ΔX_i. Assume that all shift factors are positive with respect to the constraint overload. The solution of least squares optimization problem provides the following relationships.

The reduction of the overload is attributed to each control variable, □$V_{k,i}$, as follows:

$$\Delta V_{k,i} = R_{i,k} \cdot \Delta V_k$$

$$R_{i,k} = \frac{SF_{i,k}^{\;2}}{\sum_{j=1}^{N} SF_{j,k}^{\;2}}; \sum_{i=1}^{N} R_{i,k} = 1$$

The reduction of the each control variable is as follows:

$$\Delta V_{k,i} = SF_{i,k} \cdot \Delta X_i$$

$$\Delta X_i = \frac{1}{SF_{i,k}} \cdot \Delta V_{k,i} \Rightarrow \Delta X_i = \frac{1}{SF_{i,k}} \cdot \frac{SF_{i,k}^{\;2}}{\sum_{j=1}^{N} SF_{j,k}^{\;2}} \Delta V_k$$

$$\Delta X_i = \frac{SF_{i,k}}{\sum_{j=1}^{N} SF_{j,k}^{\;2}} \Delta V_k$$

WLS Example

Assume a problem with just two control variables. The above equations become.

$$\Delta V_{k,1} = R_{1,k} \cdot \Delta V_k; \Delta V_{k,2} = R_{2,k} \cdot \Delta V_k$$

$$R_{1,k} = \frac{SF_{1,k}{}^2}{\left(SF_{2,k}{}^2 + SF_{1,k}{}^2\right)}; R_{2,k} = \frac{SF_{2,k}{}^2}{\left(SF_{2,k}{}^2 + SF_{1,k}{}^2\right)}$$

$$\Delta X_1 = \frac{1}{SF_{1,k}} \cdot \Delta V_{k,1} \Rightarrow \Delta X_1 = \frac{SF_{1,k}}{\left(SF_{2,k}{}^2 + SF_{1,k}{}^2\right)} \Delta V_k$$

$$\Delta X_2 = \frac{1}{SF_{2,k}} \cdot \Delta V_{k,2} \Rightarrow \Delta X_2 = \frac{SF_{2,k}}{\left(SF_{2,k}{}^2 + SF_{1,k}{}^2\right)} \Delta V_k$$

Let

$SF_{1,k}$ = 0.5; $SF_{2,k}$ = 0.2; ΔV= 10 MW, i.e., the overload is 10 MW. Let the nominated amount for control variable #1 be 100 MW and for control variable #2 be 50 MW.

$$R_{1,k} = \frac{0.5^2}{0.5^2 + 0.2^2} = \frac{0.25}{0.25 + 0.04} = \frac{0.25}{0.29}$$

$$R_{2,k} = \frac{0.2^2}{0.5^2 + 0.2^2} = \frac{0.04}{0.25 + 0.04} = \frac{0.04}{0.29}$$

Note that $R_{1,k}$ + $R_{2,k}$ = 1

$$\Delta V_{k,1} = \frac{0.25}{0.29} \cdot 10 ;\ \Delta V_{k,2} = \frac{0.04}{0.29} \cdot 10$$

$$\Delta X_1 = \frac{0.5}{0.29} \cdot 10 ;\ \Delta X_2 = \frac{0.2}{0.29} \cdot 10$$

Table 2 Summary of the WLS example

Control Variable #	***$SF_{i,k}$***	***$\Delta V_{k,i}$***	***ΔX_i***
1	0.5	$\frac{0.25}{0.29} \cdot 10$ = 8.62	$\frac{0.5}{0.29} \cdot 10$ = 17.24
2	0.2	$\frac{0.04}{0.29} \cdot 10$ = 1.38	$\frac{0.2}{0.29} \cdot 10$ = 6.90
Total Flow Reduction of Overload		10	

In the WLS formulation, the reduction on the flow on the constraint is pro-rated based on squares of the shift factors. Both the numerator and denominator are composed of shift factors squared.

The reduction in the actual control is pro-rated based on shift factor (not squared). The higher the shift factor value relative to others the more the control will be adjusted. Thus there is a ***sharing*** of reduction as compared to the Max CRR method in which the most effective control variable is reduced first.

4.2.4.4. Example with Results from WLS and Max CRR

If the example above was optimized using Max CRR (this is the optimization currently employed in the allocation process), X_1 will be reduced by 20 = 10/0.5, where 0.5 is the shift factor for X_1. This control variable has a larger shift factor than the other and this is why it is adjusted first to alleviate the constraint. If the second control variable was used, it would be reduced by 10/0.2 = 50. Table 3 below provides a comparison of the WLS and the Max CRR methodologies using the above example.

Table 4 provides another example where the shift factors are very close to each other. The shift factor for control variable 2 is changed from 0.2 to 0.49

Table 3 Example with WLS and Max CRR

			WLS Method			***Max CRR Method***		
Control Variable	$SF_{i,k}$	***Nominated Amount***	$\Delta V_{k,i}$	ΔX_i	***Cleared Amount***	$\Delta V_{k,i}$	ΔX_i	***Cleared Amount***
1	0.5	100	(0.25/0.29) 10 = 8.62	(0.5/0.29) 10 = 17.24	82.76	10	20	80
2	0.2	50	(0.04/0.29) 10 =1.38	(0.2/0.29) 10 = 6.90	43.10	0	0	50
Totals		150	10	24.14	125.86	10	20	130

Table 4 Example with WLS and Max CRR with Shift Factors Closer Together in Value

			WLS Method			***Max CRR Method***		
Control Variable	$SF_{i,k}$	***Nominated Amount***	$\Delta V_{k,i}$	ΔX_i	***Cleared Amount***	$\Delta V_{k,i}$	ΔX_i	***Cleared Amount***
1	0.5	100	(0.25/0.4901) 10 = 5.101	(0.5/0.4901) 10 = 10.202	89.798	10	20	80
2	0.49	50	(0.2401/0.4901) 10 =4.899	(0.49/0.4901) 10 = 9.998	40.002	0	0	50
Totals		150	10	20.2	129.8	10	20	140

Under both methods the overload is removed. However, in the WLS method, the control variables share in the reduction, whereas in the Max CRR method the control variable with the larger shift is reduced to alleviate the constraint. A very important result is that under both cases, 10 MW of overload was removed from the constraint. The amount of removal does not change with the change in the method. The real difference is in which control variables are used and in what amounts to remove the overload.

The results in Table 4 show a much more equal sharing in the reduction for the WLS as opposed to the Max CRR.

Also, if the shift factors were equal, the Max CRR method would pro-rate the reductions based on the nominated amount. This is not explicitly shown in the optimization formulation. In fact, since the Max CRR formulation is a linear program, equal shift factor would result in a degenerate solution case in which there is not a unique solution (an infinite number of combinations for reductions in control variable #1 and #2 would work). However, the pro-rationing is properly handled in the soft ware.

In the WLS, if the shift factors were equal we see the reduction would be equally shared between the two control variables even though the nominated amount for control variable #1 is twice as large as the nominated amount for control variable #2. In the WLS formulation the proper pro-rationing would be managed by determining the proxy weights based on the nominated amounts. However, this part of the formulation is not provided in this paper.

4.2.5. Move to single allocation tier in monthly CRR release

Based on comments that have been received from various CRR participants the CAISO understands that the current monthly CRR process can take a considerable amount of time and resources for entities to participate in the allocation and auction processes. One consistent comment that we have heard is that there is not enough time to review allocation results and prepare for the auction. The CRR team has reviewed the monthly timeline and with the existing process there is no slack in the schedule with the current timing for receiving outage data, the two allocation tiers and the one auction process. A possible option for relieving the monthly schedule somewhat would be to move to a single tier for the allocation process. This would provide about an additional week between Tier 1 of the monthly allocation and the auction. The CAISO is interested in hearing from CRR participants if this is something that would be of interest.

4.3. Non-Credit Business Process Issues

4.3.1. Sale of CRRs in the CRR auction

Currently a CRR holder that wants to liquidate a CRR holding cannot sell it directly, but must instead try to buy an opposite and offsetting CRR in the auction and, if successful, continue to hold both the original CRR and its opposite. Although this approach may accomplish the same result as selling the original in terms of the market CRR settlement, it is not equivalent from the perspective of credit requirements and more mundane considerations such as bookkeeping, etc. The ISO had originally intended to implement the capability of the CRR system to support sales of previously-acquired CRRs, but this feature could not be implemented at the start of the CRR market and was deferred. As with other CRR enhancements that are being proposed the implementation of this feature could be simplified and made less costly without the inclusion of the multi-point CRR. The ISO believes that this feature is desired by multiple CRR market participants. The ISO now proposes to move forward expeditiously to implement this feature.

4.3.2. Modeling approaches to reinforce CRR revenue adequacy through transmission outages consideration

CRRs have been revenue inadequate in the ISO markets for the month of April and May 2009. A notable characteristic of these months is that they are the time for completion of transmission maintenance work before the summer season begins. Since then, the ISO has limited the quantity of CRRs that are released in the monthly CRR process, and the revenue inadequacy has not been the concern that it was in these initial months. However, the CRR revenue adequacy has remained variable during the month, and there has not been a great level of comfort that any particular month would end in revenue adequacy. The concern for revenue adequacy will continue to be present as transmission maintenance activity resumes in the fall, and winter storms cause outages.

The ISO therefore intends to review and possibly reconsider the factors that determine the quantity of CRRs it releases to determine whether any changes are needed, in particular to the amount of network capacity that is made available for CRRs. The ISO will be considering, among other things, (1) what improvements can be made to the modeling of outages in the monthly CRR model and (2) possible reduction of the 75% capacity availability level in the annual CRR process. This is a topic that may take some time to resolve, because the ISO believes that at least 12 months of operational experience in the new market structure will be necessary before the ISO can establish more than interim values for the amount of CRRs to release in the monthly CRR process.

4.3.3. Tracking of Long Term CRRs in the CRR system

As per Tariff requirements, section 36.8.5, load migration is also reflected in Long-Term CRRs. LT CRRs have a life spanning nine years. Currently, due to system limitations LT CRRs are defined within the CRR system for a rolling two-year life. For instance, for LT 2009-2018 the CRR system has only records of CRRs for 2009 and 2010. By the start of next year, CRRs for 2009 will expire and then records for CRR 2011 will be created, and so on, until reaching 2018. Due to this shortcoming, CRR transfers to reflect load migration are only reflected on the currently existing two-year span of LT CRRs. With the current configuration, when reaching the start of a new year, LT CRRs will have their life extended one more year, but these newly created CRRs will not have reflected any load migration that have already affected LT CRRs up to that point on time. In this case, load migration is only reflected in the current two-year life of the CRRs. For this reason, an enhancement of the CRR system is needed to keep track of LT CRRs and systematically reflect load migration on them for their whole life span. The ISO's current assessment is that the proposed change affects only the internal processing of CRRs and remains within the established tariff and policy. If stakeholder comments are consistent with the ISO's current assessment regarding this process improvement, the ISO will proceed to make this refinement in its processes.