CALIFORNIA ISO

California Independent
System Operator

September 30, 2005

The Honorable Magalie Roman Salas
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Re: California Independent System Operator Corporation, Docket Nos. ER02-1656 -003, ER02-1656-004, and ER02-1656-015

Dear Secretary Salas:

Pursuant to the Further Order on the California Comprehensive Market Redesign Proposal, issued October 28, 2003,[1] in the above-docketed proceeding by the Federal Energy Regulatory Commission ("FERC" or "Commission") and consistent with the September 1, 2005 Notice Of Extension Of Time, the California Independent System Operator Corporation ("CAISO") is hereby submitting this information regarding its allocation of Congestion Revenue Rights ("CRRs"). Specifically, this filing includes: 1) detailed information on the development of the CRR allocation rules to date, including the whitepapers developed by CAISO illustrating the details of its proposal for discussion during its stakeholder meetings; 2) a discussion of the results of the CRR Study 2 conducted by LECG that provide insights on the expected CRR allocation; and 3) information concerning the CAISO's recent and upcoming CRR rules and software/system development, including the expected time frame for the illustrative and actual CRR allocation.

On July 22, 2003, the CAISO submitted for filing with the Commission its Amendment to the Comprehensive Market Design 2002 ("July 2003 Filing").[2] In the July 2003 Filing, the CAISO requested that the Commission grant conceptual approval in its entirety of the amended Comprehensive Market Design Proposal ("MRTU"). The MRTU filing included a proposal to replace the existing path-specific Firm Transmission Rights created for the CAISO's original zonal congestion management design with "source-to-sink" CRRs appropriate for a Locational Marginal Pricing ("LMP") congestion management design. As proposed by the CAISO, CRRs would allow market participants to hedge the risk

[1] *California Independent System Operator Corp.*, 105 FERC ¶ 61,140 (2003) ("October 2003 Order").

[2] *Id.*

of congestion charges associated with the LMP congestion management design the CAISO is developing. The July 2003 Filing also included a proposal to allocate CRRs to entities that serve load within the CAISO control area and provided the conceptual elements of such an allocation process.

In its October 2003 Order, the Commission supported the adoption of CRRs as a risk management tool for market participants as well as the CAISO's proposal to allocate CRRs to loads within the control area, and which, among other things, directed the CAISO to file "detailed information on the proposed first year allocation when it files its proposed tariff instituting the CRR allocation method" and directed the CAISO to "make an initial filing of this allocation information as soon as practicable but at least three months prior to its tariff filing."[3] On August 22, 2005, the CAISO requested an extension of time for making this filing to September 30, 2005, which the Commission granted in its September 1, 2005 Notice of Extension of Time.

A. Development of CAISO Proposal for CRR Allocation Rules.

Since the July 2003 Filing, the CAISO, along with stakeholders, and most recently with significant assistance by LECG, has continued to develop its CRR allocation methodology. Recognizing the significance and importance the allocation of CRRs plays in the California energy markets under MRTU, CAISO has gone to significant lengths to closely examine the alternative methodologies for equitably allocating CRRs. The CAISO greatly appreciates the degree of stakeholder involvement and participation in this process and believes that it is now very close to finalizing a set of allocation rules that will yield an allocation of CRRs in the first and subsequent years of MRTU operations that will provide market participants with an equitable and reasonably adequate hedge against the costs of congestion incurred under LMP-based energy spot markets. The CAISO's latest CRR allocation proposal is described in detail in the whitepapers the CAISO has developed to aid it in developing the CRR allocation rules with its stakeholders. Attachments A and B contain the whitepapers that describe the CRR allocation rules: 1) to LSEs serving load internal to the CAISO control area; 2) to LSEs serving load outside the CAISO control area; and 3) to sponsors of merchant transmission.

From the start, as reflected in its July 2003 Filing, the CAISO envisioned releasing CRRs to LSEs through an allocation process and to a wider group of entities through an auction process.[4] At first, however, it was not evident to the CAISO what methodology would yield a just and reasonable allocation for all eligible entities. It is only through its extensive stakeholder process and its continued evaluation of alternative methods for releasing CRRs that the CAISO could develop a methodology that fits all the necessary criteria to yield such a result.

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3 *Id*. at P 172.

4 *Id.* at PP164-165.

Shortly after its July 2003 Filing, the CAISO conducted CRR Study 1 and most recently it has concluded CRR Study 2, in an effort to obtain a better understand of the CRR coverage that may be afforded to LSEs based on certain assumptions regarding the nature and characteristics of the transmission system, available resources, known constraints, and demand on the grid.[5] These results have been helpful in aiding the CAISO and its stakeholders to better tailor the CRR allocation rules towards an allocation that is both equitable and feasible as reflected in its current proposal provided in Attachments A and B.

In an effort to further educate itself and its stakeholders on the tradeoffs of alternative CRR methodologies, the CAISO has engaged LECG to assist it through this process. Through a series of presentations and whitepapers, and through its continuous presence at stakeholder meetings held on May 19, June 22, July 14, August 18, and August 31, 2005, LECG has enabled the CAISO and its stakeholders to achieve a better understanding of the tradeoffs in developing its allocation rules. LECG has been particularly instrumental in conveying to the CAISO and its stakeholders some of the lessons learned from the allocation processes adopted by the eastern and mid-western Independent System Operators/Regional Transmission Organizations. In addition, LECG performed the analysis for the CAISO's CRR Study 2 and prepared a full report describing their detailed analysis of the CRR Study 2 results, described below, which has enabled the CAISO and its stakeholders to better evaluate the design choices needed for completing the CRR allocation rules.

Throughout this process the CAISO has been responsive to requests by stakeholders, the Market Surveillance Committee ("MSC") and its Board of Governors by considering the adoption of alternative methods for releasing CRRs. For example, in response to requests by some stakeholders during the August 31, 2005 stakeholder meetings that the CAISO consider releasing CRRs entirely through an auction rather than allocation, the CASIO issued a Request for Stakeholder Comments on Specific Questions on September 6, 2005.[6] Soon after, in response to the comments from stakeholders supporting the allocation methodology, the CAISO resumed the development of the CRR allocation rules. On September 27, the CAISO posted another request for comments concerning an issue raised by the CAISO Board of Governors, requesting stakeholders to comment on the merits of adopting a greatly simplified allocation approach instead of the proposal described in Attachment D. The CAISO hopes to receive comments on this proposal during its October 5, 2005 stakeholder meetings, but is in the interim continuing to refine its CRR allocation proposal and drafting enabling tariff language that reflects its current proposal.

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5 The results of CRR Study 2 are discussed below and the CRR Study 2 Report and Addendum are attached in Attachments E and F respectively. The results of CRR Study 1 can be found at http://www.caiso.com/docs/2004/01/29/2004012910343827511.html.

6 *See* http://www.caiso.com/docs/2005/09/06/2005090611283821197.pdf.

The CAISO recognizes that such requests for comments and solicitation of further direction from its stakeholders has instilled a sense of uncertainty in certain stakeholders regarding the CAISO's level of confidence and commitment to its current CRR allocation rules draft proposal. The CAISO, however, views such stakeholder inquiries as a necessary and productive part of the rules development process, particularly since it recognizes how significant the release of CRRs is to its stakeholders. Further, such inquiries have not delayed the CAISO in pursuing the completion of its CRR allocation proposal. As reflected in the September 27 whitepaper contained in Attachment A, the CAISO is continuing to address and find solutions for many of the issues raised earlier this summer.

B. LECG CRR Study 2 Results.

The primary objectives of CRR Study 2 were to: 1) develop hypothetical allocations of CRRs based on six alternative scenarios and several additional sensitivity analyses; and 2) estimate the financial values of these hypothetical allocations based on an entire year of hourly simulated LMPs resulting from LMP Modeling Study 3B.[7] The results of CRR Study 2 have guided the CAISO in its development of the most recent proposal for allocation of CRRs to LSEs serving internal load. For example, CRR Study 2 explicitly compared the effect of allocating CRRs to LSEs based on the three large Load Aggregation Points (LAPs) proposed in the July 2003 Filing, versus the alternative of allocating based on 23 smaller LAPs, both in terms of the MW quantities of CRRs allocated and the financial values of the resulting allocations. LECG's detailed review of the MRTU market design, which was released publicly on February 23, 2005 and was filed as an attachment to the CAISO's May 13, 2005 MRTU filing, expressed a theoretical concern that the use of three large LAPs would adversely affect the ability of the CAISO to release an efficient level of CRRs. The results of CRR Study 2 assisted the CAISO in concluding that the impact on CRRs of the three large LAPs was not significant and did not outweigh the drawbacks of settling energy purchases at the more disaggregated level in California.

A more detailed discussion of CRR Study 2 is provided by LECG in its CRR Study 2, Evaluation of Alternative CRR Allocation Rules ("LECG CRR Study 2 Report"), Attachment E hereto. Below is a summary of the conclusions discussed with stakeholders during the August 31, 2005 stakeholder meetings, and discussed in greater detail in the LECG CRR Study 2 Report:

- The CRR allocation for CRRs defined as obligations resulted in an allocation of CRRs that pay out virtually all congestion rents collected by the CAISO to CRR holders based on the congestion patterns and prices in LMP Study 3B.

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[7] *See* http://www.caiso.com/docs/2002/08/23/200208231358035858.html.

- When the CRR allocation process was applied to CRRs defined as options, the resulting CRR allocation left 10-12% of the congestion rents collected by the CAISO unassigned based on the LMP Study 3B simulation of congestion patterns and prices.

- All of the CRR allocations analyzed in CRR Study 2 were close to revenue adequate on an annual basis when valued based on LMP Study 3B congestion charges, *i.e.,* the congestion charges collected by the CAISO from settlements in the LMP market would be nearly sufficient to fund payments to CRR holders.

- Many of the CRRs sinking at LAPs that were awarded in the base case scenarios did not satisfy the simultaneous feasibility test, because the simultaneous feasibility test in the base case was applied at the subzone level while the award of CRRs was at the LAP level.

- Overall, the CRR study results confirm the potential for the base case allocation methodology to award infeasible CRRs as discussed in the MRTU Report (February 2005 LECG Report), although the financial impact of the infeasibility is small if evaluated at LMP Study 3B prices. The financial cost could be much higher if evaluated using a different pattern of congestion prices than simulated in LMP Study 3B.

- The award of infeasible CRRs in the annual and monthly allocation process would have had additional adverse impacts in combination with annual and monthly auctions.

- Applying the simultaneous feasibility test at the LAP level (Sensitivity 5) had relatively little impact on the percentage of the congestion rents paid out to holders of CRRs (payout ratio) calculated using LMP Study 3B prices and reduced the number of CRRs awarded through the allocation process by about 6%, relative to the base case or Sensitivity 7.

- A disadvantage of the Sensitivity 7 approach as applied in CRR Study 2, however, is that it appears in practice based on the CRR Study 2 outcomes to result in the award of far fewer CRRs feasible to the LAP as a whole than does the Sensitivity 5 allocation methodology.

- Review of LSE specific proration patterns revealed material differences across LSEs in both the proration ratio and the CRR payout per megawatt of load.

- It appears that in some instances that particular features of the allocation rules contributed to the differences in proration outcomes across LSEs.

- The CRR Study 2 analyzes alternative methods of defining and awarding CRRs given that LSEs purchase power at LAP prices. If the MRTU design that settles all LSE power purchases at aggregated LAP prices were to be modified such that LSEs purchased power at LMP prices calculated for a lower level of geographic aggregation than the LAP, then it would also be desirable to adopt a less aggregated basis for nominating and awarding CRRs that is consistent with the pricing system.

The CAISO notes that the CRR Study 2 results are highly dependent on the set of assumptions, described in further detail in LECG CRR Study 2 Report and in LMP Modeling Study 3B. In addition, CRR Study 2 was not based on precisely the same set of allocation rules reflected in the CAISO's September 27 CRR whitepaper in Attachment A. Consequently, these results are only illustrative of the ultimate degree of CRR pay-out, the potential hedge the released CRRs would provide, and the degree of revenue adequacy that would be achieved through the actual allocation. The CAISO with the assistance of LECG, utilized the CRR Study 2 results to design the current proposal in a manner that will improve upon the main drawbacks of the allocation methodology adopted for the study. For example, the use of multiple tiers in the allocation process, which will include an opportunity for LSEs to obtain the results of each tier before submitting their CRR nominations for the next tier, will enable LSEs to obtain their entire allocation entitlements more fully, with less differences among LSEs in the extent to which their entitlements are fulfilled.

As described below, during 2006 the CAISO will be able to conduct more realistic studies that better reflect the expected outcome of its actual allocation of CRRs, but only after certain significant milestones are achieved in the CRR rules and software/systems development process. As such, the CAISO anticipates that upon obtaining additional CRR study results, and perhaps even after the actual allocation is conducted, certain aspects of its allocation rules may require further fine-tuning and it will make any necessary filings with FERC to institute those changes. Nevertheless, the CAISO will endeavor to provide as much information as soon as possible to stakeholders, who are necessarily interested in having as much information as possible as soon as possible.

C. Recent and Upcoming CRR Rules and Software/Systems Development.

While the CAISO and its stakeholders have already engaged in considerable activity for the development of the rules and procedures that will govern the release of CRRs, certain milestones must be achieved before the CAISO can finalize its rules development and the actual release of CRRs. At this time, based on the results of CRR Study 2 and the significant stakeholder discussions that the CAISO has engaged in, the CAISO is confident that its current proposal will yield a just and reasonable release of CRRs. Subject to additional stakeholder discussions to be held on October 5 and 6, and approval by its Board of Governors on October 18-19, the CAISO anticipates that on November 30, 2005, it will file with FERC detailed enabling tariff language that is very close to the current CRR allocation proposal as contained in whitepapers in Attachments A and B.

The CAISO notes that the success of its CRR rules development and the actual allocation of CRRs is dependent on achieving the milestones below. Pivotal to this process is its ability to obtain Board-approval of its MRTU design, including the CRR rules, as well as its ability to accommodate any changes to its design in its software/systems development and implementation as described below. The illustrative CRR allocation anticipated in May of 2006 – which is intended to be a complete run-through with stakeholders of all steps in the entire proposed allocation process – will be instrumental in providing market participants greater knowledge of the allocation process and the nominations that will yield a CRR allocation that meets their business needs when the actual allocation is conducted prior to MRTU start-up. In order for the CAISO to be prepared to conduct its illustrative CRR allocation based on the same CRR allocation rules that will be in effect for the actual allocation prior to MRTU start-up, all systems have to be fully integrated with the rest of the MRTU market functionality on-site. At this time, the CAISO is confident that it will achieve these software/systems milestones timely.

Also pivotal to this process, is the CAISO's ability to obtain full FERC-approval of the CRR rules that will be in place when its actual CRR allocation is conducted. It is the CAISO's hope to complete the FERC-approval process by the time it conducts its mock CRR allocation in July of 2006.

1. CRR Rules development:

a. **September 27** – CAISO released the second draft of its proposed rules for allocating the CRRs to internal LSEs.

b. **September 30** - CAISO shall release draft tariff language to reflect its current proposed CRR rules and allocation methodology.

c. **October 5-6** - CAISO intends to finalize managements proposed allocation rules following the stakeholder meetings.

d. **October 18-19** - CAISO shall present to and seek approval from its Board of Governors for all of its MRTU design, including its proposal for CRR rules.

e. **October 24-28 -** CAISO shall review the proposed tariff language with stakeholders in preparation of the November 30 filing of the MRTU tariff language.

f. **October 31 –** CAISO shall present to and seek approval from its Board of Governors to file the MRTU tariff, including its CRR rules.

g. **November 30** – CAISO shall file its MRTU tariff as approved by its Board of Governors.

2. Software/Systems Development:

a. Pre-Factory Testing of the CRR software is scheduled to terminate on October, 2005.

b. Factory Acceptance testing is scheduled to conclude in November, 2005.

c. November consists of site acceptance testing and expects to terminate that process at the end of December.

d. January 2006 begin on site integration of all MRTU systems and CRR has to be part of that.

3. CRR Illustrative and Actual Allocations

a. **May to July 2006** – CRR Study 3 – full illustrative allocation based on CRR allocation methodology approved by FERC with filing of expected allocation of CRRs with FERC within a reasonable time following the completion of the study.

b. **September to December 2006** – Actual CRR allocation with filing of actual allocation with a reasonable time following the completion of the actual allocation.

Respectfully submitted,

/s/ *Anna Mckenna*__________

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CERTIFICATE OF SERVICE

I hereby certify that I have this day served a copy of this document upon all parties listed on the official service list compiled by the Secretary in the above-captioned proceedings, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010). Dated this 30th day of September in the year 2005 at Folsom in the State of California.

/s/ Anna Mckenna
Anna Mckenna

Attachment A

Market Redesign Technology Upgrade Project (MRTU)
CAISO Proposal

Allocation of CRRs to LSEs Serving Load Within the CAISO Control Area

Table of Contents

1 Introduction

The proposal contained in this document represents the CAISO's synthesis of several rounds of public discussion, written comments from stakeholders, examination of rules and procedures adopted by other ISOs, and assessment of the results of CRR Study 2, to craft a proposal that the CAISO believes strikes a reasonable, equitable and workable balance of the objectives of CRR allocation and the concerns expressed by stakeholders. In the course of the process to develop this proposal, a few important facts and observations became apparent.

First, CRRs cannot provide a perfect, risk free hedge against the congestion costs associated with the limitations of the existing transmission system. At best the CAISO can return to consumers through CRRs nearly – but not exactly – all of the congestion charges it collects, with the remainder being redistributed through a simple secondary mechanism such as using the end-of-year Balancing Account surplus to reduce access charges. The CAISO believes the present proposal will achieve this objective with minimal – but not zero – risk of revenue inadequacy of the CRRs it releases.

Second, there is no perfectly equitable way to allocate CRRs to the eligible entities, in part because, in view of the first observation, there is no one definition of equity on which all parties will agree. That is, given the fact that some exposure to congestion costs will remain after the CRRs are allocated, there is no way to ensure ex ante that all consumers and all LSEs will be hedged to the same degree. The CAISO believes the present proposal comes as close as possible to achieving equity, in the sense that these rules and procedures will not unduly and systematically advantage or disadvantage any particular class of consumers or LSEs.

Third, these rules and procedures are fairly complex and will require all participants as well as the CAISO to dedicate considerable time and effort to performing them on a continuing basis.

Fourth, the complexity seems to arise from trying to achieve a particular aspect of equity, that is, from the attempt to enable each LSE – and in turn the consumers each LSE serves – to obtain through the CRR allocation process the most effective hedge possible against its exposure to congestion charges. In pursuit of this objective, the rules and procedures require “validated” or “verified” sources that link a LSE’s allocated CRRs to the supply locations that will be used in calculating its congestion charges, but only for a portion of each LSE’s maximum eligibility so that each LSE may have free choice of source locations for another portion. For the same reason, the process is structured in a series of tiers such that LSEs obtain the results of one tier before submitting their requests for the next tier. These and other complexities are attempts to “tune” each LSE’s allocated CRRs to provide the best possible hedge.

1.1 Request for Another Round of Written Comments

The CAISO now requests that parties come to the October 5 meeting prepared to discuss the present proposal and, following that meeting, submit written comments to the CAISO no later than close of business on Monday, October 10. The October 10 date is necessary to enable the CAISO to prepare a written summary of stakeholder comments and provide this to its Governing Board in the package of Board documents for the October 19 meeting. The CAISO is also requesting written comments on all other topics covered in the current sequence of stakeholder meetings, also by October 10, and will provide a more detailed request on the other MRTU topics to market participants in a separate market notice. To facilitate parties’ preparation of their comments and the CAISO’s summary for the Board, later this week the CAISO will provide a template for parties to use.

In these new comments, the CAISO requests that parties indicate support or neutrality on the issues, in addition to identifying items they oppose. The CAISO wants to provide its Board and ultimately FERC with as complete a summary of stakeholder positions as possible, and to avoid the situation of having only the views of a vocal minority to present to the Board and the FERC to consider in their deliberations on how best to address the numerous policy issues discussed with the stakeholders during 2005.

1.2 Some Key Elements of This Proposal

There are several policy and design issues that have been discussed in the last several rounds of meetings and comments, on which the present proposal lays out the CAISO positions. It is worth noting these at a high level before getting into the details of the proposal.

1. The question of allocation of CRRs versus full auction. In response to this question, which was posed by the CAISO in advance of stakeholders submitting their September 8 comments, a predominant – though not universal – preference was expressed for staying with the allocation approach. As a result the CAISO remains committed to developing a workable and equitable allocation methodology that is supported by stakeholders.
2. A related matter of principle is whether CRR allocation should reflect parties’ exposure to congestion costs or should only reflect their support for the embedded costs of the grid. The latter approach would be simpler to implement because it could be satisfied simply by crediting congestion charge revenues back to demand (load and exports) on a per-MWh

basis, or through a full auction approach in which the auction revenues are paid to the PTOs to reduce the TAC and WAC. Comments by stakeholders indicated a predominant preference for CRR allocation that reflects their exposure to congestion costs under LMP. While this could be accomplished through a full auction process in combination with an LSE specific allocation of "auction revenue rights" (ARRs), such an approach would not achieve the process simplification that could be possible with a flat-rate credit of congestion charges or by using the revenues from a full auction process to reduce access charges. The CAISO therefore proposes to conduct a CRR allocation process that is designed to allocate CRRs to each LSE in a manner that reflects as closely as possible each LSE's congestion exposure.

3. The question of CAISO "verification" of nominated CRR sources.[1] Among the stakeholders there are differences of opinion regarding two approaches to the matter of CAISO verification of eligible sources for LSE CRR nomination. (A) The CAISO proposal is to conduct verification of sources the first year only – for both the annual and the monthly processes. After the first year CAISO source verification would cease and instead the principle of "grandfathering" would apply. That is, LSEs would be able to request renewal of CRRs allocated to them in the prior period, and the CAISO would award these renewal requests with priority over requests for new CRRs. To be clear, the CAISO intends grandfathering to apply only to CRRs that were allocated to the LSE in the prior period; it would not apply to CRRs obtained through the auction or through secondary transfers from another LSE. (B) It appears that several parties do not support grandfathering and want the CAISO to perform source verification on an indefinitely continuing basis.

   Based on a reading of the comments, the concerns of the parties advocating (B) may be mitigated significantly if the first-year allocation in which sources are verified by CAISO is viewed by all parties as fair and consistent with their hedging needs. That is, if all parties receive an equitable first-year allocation, they will all benefit from the assurance of continuity made possible by the grandfathering feature. Therefore the importance of designing an appropriate first-year allocation cannot be over-emphasized.

   Among the parties who oppose grandfathering there seem to be two main concerns. First, there is a concern that some LSEs will hold onto valuable CRRs even when they no longer serve load from those CRR sources, thereby limiting the ability of other LSEs to obtain a fair share of valuable CRRs through the allocation process. The second concern is that the key concept that makes grandfathering work under the CAISO's proposal is the fact that grandfathered CRRs are allocated first, before requests for new CRRs, and this could put LSEs gaining load at a disadvantage.

   The CAISO recognizes these concerns, but believes that the overall balance and equity of the proposal are better served by incorporating provisions to mitigate the concerns rather than by eliminating the grandfathering feature. In this regard the CAISO believes that the primary objective is to ensure that customers who change LSEs are not disadvantaged with respect to CRR coverage compared to customers who do not change. The provisions described in the section on Retail Access are designed for this purpose.

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[1] The CAISO now proposes to use the term "verification" to refer to the process whereby the CAISO reviews CRR sources nominated for allocation by eligible parties to ensure that the party is eligible to be allocated CRRs from these particular source points, as described later in this paper. The CAISO will no longer use the term "validation" to refer to this process, so as to avoid creating any confusion between this CRR-related process and the various validation procedures that will be performed in the CAISO markets under MRTU.

There is, in addition, a more compelling reason not to perform ongoing verification of the sources LSEs nominated for CRR allocation. The LECG consultants, who performed CRR Study 2, wrote the CRR Study 3 Report and assisted the CAISO in developing its CRR allocation proposal, as well as the CAISO's Market Surveillance Committee, have all raised strong concerns about forward-looking verification of CRR sources for allocation eligibility. Their concerns center around the distortion of incentives for both LSEs and suppliers that is created when contracting parties are aware that their contracts can be used to obtain free allocations of CRRs. Evidence from other ISO's, particularly PJM, has been cited to show that this concern is not just theoretical but has occurred in practice. More explanation on this point is offered in the discussion of the "historical reference period" later in this document.

4. There is also disagreement among parties regarding how CRR eligibility of LSEs should be affected when some load migrates under direct access. The main alternatives at issue are: (A) the LSE that loses load must have a reduction in the CRRs it can "grandfather" in subsequent periods; versus (B) the LSE that loses load does not have its "grandfatherable" CRRs reduced as long as its total quantity is within its MW eligibility. The CAISO proposes to adopt option (A) and views it as a necessary feature for achieving the objective of enabling customers who change LSEs to maintain CRR coverage.

5. Iterations with participants in each allocation process. This CAISO proposal divides each allocation process into stages and tiers (described below) where each stage or tier has its own SFT, and participants receive the results of the latest stage or tier prior to submitting their nominations for the next one. This is different from how CRR Study 2 was conducted, but is an important feature for maximizing the release of CRRs (subject to simultaneous feasibility of course) and maintaining equity when it is necessary to prorate CRR awards, while maximizing participant choice. Readers will note, however, that the present proposal incorporates some changes to the tier structure that was proposed in the previous white paper on this topic.

6. Net revenues from marginal losses. On September 15 the CAISO issued a new proposal on how to credit net loss revenues back to demand. This new proposal keeps the net loss revenues separate from the CRR balancing account and credits the funds back to demand on a flat per-MWh hour basis on each settlement statement. This means that revenue adequacy of CRRs will not be supported by the net loss charges.

7. In another white paper issued on September 15 the CAISO reaffirmed its position that there should be only three large LAPs which coincide with the IOU transmission territories, with no provision for opt out by wholesale buyers as FERC's July 1 MRTU order suggested. The only change to our July 2003 proposal contemplated at present is that all Participating Loads will be scheduled and settled at the node rather than buying power at the LAP. Thus PLs will use nodes for all purposes in the spot markets, and will not use LAPs at all. (The CAISO also notes that there are circumstances in which the loads of Metered Subsystems (MSS) are settled at their locational prices rather than at the three large LAPS.)

8. Another theme discussed extensively in the stakeholder meetings has been simplicity. It should be noted, however, that the dominant opinion among stakeholders seems to be to prefer more accurate tuning of the allocation to reflect LSEs' exposure to congestion charges, even if that means a more complex process. The CAISO has therefore developed its proposal to strive for simplicity in a manner that does not compromise the accuracy of CRR allocation. At the same time, readers are urged to keep in mind the questions raised at the beginning of this document and to recognize that the CAISO Board has explicitly asked for input on a more extensive simplification of the allocation rules than the current proposal provides for.

The simplicity theme has emerged in the following ways.

(a) With respect to the tradeoff between the number of tiers (each tier including a run of the SFT) and the time granularity of CRRs in the annual process (i.e., a one-year product, or four 3-month seasonal products, or 12 one-month products). Moreover, the question of the annual structure itself can be viewed as a tradeoff between simplicity and precision, i.e., fine-tuning the annual CRR allocation to meet needs that vary over the year, versus the complexity of the annual process when each tier consists of four (seasonal) or 12 (monthly) completely distinct sets of CRR requests and SFT runs. As described below, the CAISO proposes an annual structure having four seasons, and a tier structure that minimizes the number of tiers and stages while allowing for accuracy in the allocation process.

(b) With respect to CAISO verification of sources, ongoing verification for every year and month in perpetuity would mean a more complex process than using grandfathering after year one. The CAISO therefore continues to propose the grandfathering approach which, with appropriate safeguards for continued CRR coverage of customers who switch LSEs, would provide a significant simplification of the CRR allocation process.

2 Issue Statement

The problem is to develop a set of CRR Allocation Rules that will apply to Load Serving Entities (LSEs) on behalf of customers they serve within the CAISO control area. Previous white papers on this subject and discussions with stakeholders over the last few months referred to a basic underlying principle of CRR allocation:

> Parties who support the embedded costs of the ISO transmission grid are entitled to an allocation of CRRs in accordance with the nature and extent of their support for these costs.

In addition a number of objectives of CRR allocation were articulated, with the recognition that there would need to be some trade-offs in balancing these objectives:

1. (a) Where CRR entitlement is based on use of the grid to serve load, CRR allocation should be reasonably consistent with each entity's actual or expected use of the ISO grid.

   (b) Where CRR entitlement is based on investment in new transmission that is not recovered through access charges, CRR allocation should be consistent with the transmission sponsor's net addition of capacity to the ISO grid. This objective is addressed in the CAISO's proposal for allocating CRRs to sponsors of merchant transmission projects, and is not discussed further in this document.

2. CRR allocation should lead to CRR revenue adequacy. In practice this will be assured through application of a simultaneous feasibility test (SFT) as the central mechanism for determining which CRRs can be released.

3. CRR allocation should reasonably be based on market participant choice.

4. CRR allocation should promote maximal allocation of the congestion rents collected by the ISO to parties receiving the CRR allocation.

5. Any reductions in parties' requested CRR allocations should be performed in an equitable fashion, consistent with the priorities associated with their respective CRR entitlements and, only secondarily, reflective of their relative effectiveness in relieving transmission constraints.

6. CRR allocation rules should strive for simplicity, for example, with regard to the activities that must be performed by market participants and the CAISO in each annual and monthly CRR allocation process to develop and validate CRR requests.

These objectives have been discussed with stakeholders throughout this process, and the stakeholders are generally supportive of these objectives.

In addition to these objectives, the CAISO has noted the need to consider how CRR allocation rules could affect the incentives for investment in new transmission and generation infrastructure, to ensure that the CRR rules are consistent with these broader objectives. The issue, then, is to develop CRR Allocation Rules in accordance with the basic principle that achieve an appropriate balance of the stated objectives.

3 Summary of CAISO Proposal

Section 2.1 below summarizes the structure of the CRR allocation and auction process, and is intended primarily as background. Then the subsequent two sections provide the main substance of this proposal, dealing respectively with the specification of sources for CRR requests under the assumption of a given customer base to be served by each LSE (section 2.2), and the Retail Choice rules that will apply when customers migrate from one LSE to another (section 2.3).

3.1 Structure of the CRR Allocation and Auction Process

The CAISO will conduct two CRR release processes – annual and monthly – each of which will release CRRs applicable to two Time of Use (TOU) periods, the conventional 6-by-16-hour Peak Period and the Off-peak Period comprised of all other hours of the week. The July 2003 filing provided that the annual release process would release two sets of CRRs each defined for a 12-month/TOU period, and the monthly release process would release two sets of CRRs each defined for a one-month/TOU period. In CRR study 2, the “annual” allocation was in reality a “monthly” allocation, with each LSE allocated 12 distinct monthly sets of CRRs having one-month duration, based on 12 distinct sets of CRR nominations with 12 distinct nomination caps. The submitted comments generally preferred that the “annual” allocation be structured as 12 one-month CRRs and did not support an “annual” structure of 12-month CRRs defined for the whole year. Several parties expressed a willingness to support a seasonal CRR structure as an intermediate concept, recognizing the reduced implementation costs of such an approach relative to 12 one-month CRRs, and the greater accuracy relative to a 12-month CRR instrument.

Based on these factors, the CAISO now proposes an annual CRR structure that consists of eight sets of CRRs representing four seasons (defined to be consistent with WECC practice) and thw two on-peak and off-peak TOU periods. Each CRR release process will consist of two major elements, a CRR Allocation Process and a CRR Auction. Participation in the allocation process will be limited to those entities eligible for an allocation of CRRs. Participation in the auction process will be open to all parties qualified with respect to creditworthiness requirements. Within each CRR release process (i.e., annual and monthly), the allocation process will be conducted and completed prior to the auction process. This white paper does not provide any further discussion of the auction process, since its primary focus is on specifying allocation rules. Because the CRR allocation process is founded on a principle of eligibility, it is necessary to define the parameters of that eligibility, specifically the maximum quantities of CRRs to which each eligible party is entitled, and the allowable sources and sinks they may specify for the CRRs they wish to receive. With regard to maximum quantities, the CAISO proposes to retain the proposal stated in the July 2003 filing, modified to be consistent with the seasonal structure of the annual CRR release. Each LSE's annual upper bound, i.e., the maximum MW CRR quantity it can request for allocation in the annual allocation process, will be calculated separately for each season and TOU period and will equal 75 percent of the 99.5 percentile point on its historical load duration curves for that season and TOU period. These calculations will also be performed separately for each LAP in which the LSE serves load.[2] The annual allocation process will therefore require an entire year's historical hourly load data, from which will be calculated a set of eight seasonal/TOU historical load duration curves for each LAP in which the LSE serves load.

The monthly allocation process will use forecasted load rather than historical load, and will set the LSE's monthly upper bound to be equal to the 99.5 percentile point on the applicable monthly/TOU forecasted load duration curve, and its eligibility for monthly CRRs will equal its monthly upper bound minus its allocation of annual CRRs for that month.

With regard to allowable sinks, LSEs serving load within the CAISO control area will be settled at the applicable Load Aggregation Point (LAP) in the CAISO spot markets, and therefore the LAP would be the appropriate sink for allocated CRRs.[3] In case the LSE serves load in more than one LAP, there would be independent CRR allocations to that LSE for each LAP, each with its own MW upper bound calculated as described above based on load duration curves for each LAP. With these parameters of the CRR allocation structure specified, the major open question at this time is the specification of eligible sources for LSE CRR requests, which is the primary focus of the present white paper.

The annual/seasonal CRR allocation process will make 75 percent of the grid's transfer capacity available in the network model used in the Simultaneous Feasibility Test (SFT). The annual/seasonal allocation process will use an "all lines in service" assumption regarding the availability of grid facilities.[4] The monthly CRR allocation process, conducted prior to the start of each Trading Month, will allow LSEs to request CRRs for up to 100 percent of their eligibility for the Month/Time-Of-Use period minus their awarded annual CRRs, and will make 100 percent of the grid's transfer capacity available in the SFT. The network model for the monthly CRR allocation process SFT will, however, account for planned transmission outages and derates.

Multi-point CRRs. Note that the CAISO still anticipates having the "network service" CRR (NS-CRR) functionality that was described in the July 2003 Comprehensive Market Redesign filing.

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[2] The hourly load data used to calculate the load duration curves and hence the 99.5 percentile upper bounds are assumed to be reduced by the amount of the LSE's load that is served under transmission ownership rights (TOR), existing transmission contracts (ETC) and converted rights (CVR).

[3] Following the release in February 2005 of the LECG Report on the MRTU market design, the CAISO discussed with stakeholders the fact that by aggregating load settlement to the three large LAPs (based on the IOU service territories) the application of the SFT at the LAP level may constrain the release of CRRs to an unacceptable degree. FERC's July 1, 2005 order on MRTU also noted this concern and directed the CAISO to consider more granular load settlement and CRR definition. The CRR Study 2 Report prepared by LECG and issued on August 24 provided some empirical evidence on this matter, but after considering that evidence the CAISO believes that its July 2003 proposal to use three IOU-based LAPs is still the most appropriate method for spot market settlement of internal loads. Nevertheless the proposal discussed here would be workable even if more granular LAPs are adopted.

[4] The CAISO may make an exception to the "all lines in service" assumption in situations where there is known to be a transmission outage or derate that could significantly affect CRR revenue adequacy during the relevant period.

The CAISO now proposes to rename this feature, however, to call it "multi-point CRRs" ("MPT-CRR") to avoid any potential confusion with other more conventional uses of the term "network service" in the electric utility industry. In any of the steps of the process described below the LSE may utilize the MPT-CRR feature, as long as such use is consistent with the other parameters of each step.

It is assumed throughout this white paper that all CRR release processes appropriately account for Transmission Ownership Rights (TOR), Existing Transmission Contracts (ETC), Converted Rights (CVR) and any CRRs that are allocated to sponsors of Merchant Transmission projects. These matters are not the focus of the present white paper and are not discussed further here. The matter of CRRs for LSEs serving load outside the CAISO control area is also not addressed here. Separate CAISO white papers are available on these topics.

3.2 Specification of Source Locations for LSE CRR Requests

3.2.1 Introduction

At the July stakeholder meeting, the group discussed four high-level issues that need to be addressed to define the nomination rules for CRR sources.

1. The extent to which there will be restrictions on the CRR sources that LSEs will be eligible to nominate, and how these restrictions will be defined and applied.
2. What mechanism will be available for LSEs to obtain CRRs on a long-term basis?
3. Whether and how tiers and stages will be used to allocate CRRs, and how the nomination rules will differ among the tiers or stages.
4. How the CRR nomination rules will account for shifts in retail load among LSEs.

This section assumes that each LSE's customer base is specified and focuses only on issues 1, 2 and 3. The question of what do to with respect to CRRs when customers switch LSEs is the subject of the next section.

Based on recent discussions with stakeholders the CAISO has designed the rules described here with several considerations in mind.

- First, it is essential that the CRR allocation process not give rise to incentives that undermine economic efficiency or reliability.
- Second, it is desirable to have a mechanism that provides some continuity in CRR awards from one period to the next, to provide a high degree of certainty that CRRs a LSE receives in one year will be awarded again the next year if requested by that LSE. This consideration is important to support multi-year bilateral arrangements between LSEs and suppliers, as well as generation investments by LSEs. Accomplishing this in practice suggests allocation rules that enable an LSE to "grandfather" (i.e., renew with some priority) at least a portion of the CRRs that it was awarded in the previous year.

  The concept of grandfathering is applied in the CAISO proposal in a manner that also helps to simplify the mechanics of the CRR allocation process by eliminating the need for verification of a LSE's request to renew CRRs it was previously awarded.

  Applying the grandfathering concept in the first year of the CRR allocation, when there are no previously awarded CRRs to renew, requires identifying a reference pattern of supply sources that the LSE used to serve its load. Such a reference pattern may be based on owned or contracted physical resources, bilateral energy delivery to trading hubs, or even pro rata shares of the supply resources that served CAISO system load. Below the CAISO offers a proposal for how to deal with this aspect of the allocation.

- Third, somewhat in contrast to the previous point, CRR allocations should not be so locked in through a grandfathering mechanism as to prevent LSEs from obtaining CRRs from new supply sources, or to withhold CRR protection for customers who switch their LSE. Thus the allocation rules must provide room for LSEs to request CRRs that they did not receive in a previous allocation process, and have some confidence that they will be able to receive these CRRs.
- Fourth, the rules must be non-discriminatory, particularly between incumbent LSEs and new LSEs, and between LSEs who lose customers and those who gain customers.

3.2.2 The Proposal

As noted above, in a system of allocation rules that includes the concept of grandfathering, it is necessary to handle the first year somewhat differently from subsequent years. In the proposal described below the “end state” or subsequent-to-first-year allocation processes, both annual and monthly, are structured in three tiers where the first tier is for CRRs that were awarded in the previous year and are requested for renewal by the LSE, and the subsequent tiers are for LSEs to request CRRs that they do not currently hold. Thus the second and third tiers are intended to enable LSEs to obtain CRRs from new generation sources and to account for load growth. By sequencing the re-allocation of grandfathered CRRs ahead of the allocation of new CRR requests, the process maximizes the likelihood that all grandfathered CRRs will remain simultaneously feasible from year to year.

Under the proposed grandfathering process, the LSE’s portfolio of “grandfatherable” CRRs can evolve over time in response to changing needs, or can remain constant over long period of time. The requirement for acquiring the grandfathering priority is only that the LSE received the CRR in the most recent year or month; it is not required to have received the CRR in the initial year CRR allocation process. In the end state process, a particular CRR sourced at point A would not have the grandfather priority the first time it is requested, but once it is awarded the LSE can then request it as a grandfathered CRR the next time around. Thus, an LSE that plans to construct generation at a location that is not currently impacted by congestion but that might become congested in the future could request a CRR from that source even prior to building the new generation. Once the LSE is allocated a CRR from that source, that CRR nomination could be grandfathered in future CRR allocations.

Another characteristic of this proposal is that CAISO verification of the sources requested by LSEs occurs in the first year annual and monthly allocations only. In the end state, with the grandfathering provisions, source verification is no longer required. The grandfatherable rights are associated with specific sources, i.e., the ones for which CRRs were allocated in the prior period. If the LSE wants to get CRRs from new sources in a subsequent year, it may do so but will not get the grandfather priority in the allocation of the new sources.

In each tier of the various allocation processes the CAISO will run a SFT to allocate a certain share of each LSEs’ maximum allocation. Between tiers (SFT runs) the CAISO will provide the results to LSEs to enable them to consider these results in deciding what additional CRRs to request in the next tier. (In the MISO’s allocation process, for example, LSEs are allowed three days between tiers to submit their requests for the next tier.) By running separate, sequential SFTs for each tier, the tier structure enables LSEs to maximize their chances of receiving the CRRs they value most.

The following sub-sections describe further details of the tiered structure and other differences between the first-year annual and monthly processes versus the subsequent-year or “end-state” annual and monthly processes. The following will apply separately to each season/TOU period for the annual process, each Month/TOU combination for the monthly process, and each LAP in which a LSE serves load. Also, after each complete allocation process the CAISO will run a CRR auction.

First Year Annual and Monthly Allocation Processes

In the first-year annual allocation CRR source nominations for Tiers 1 and 2 would require CAISO verification, whereas nominations for Tier 3 would be open to LSE choice. As described in further detail below, the CAISO is proposing that Tier 1 would be up to 50 percent of the LSE’s total annual eligibility and tier 2 would cover up to 75% of an LSEs total annual eligibility. These tier percentages mean that verification will be required for up to 75 percent of an LSE’s CRR nominations in the annual CRR allocation process. Since the annual allocation will provide at most 75 percent of the LSE’s total allocated CRR holdings for any given month, the 75 percent limit in Tiers 1 and 2 of the annual process translates to 56.25 percent of the LSE’s annual allocation limit that will be verified for the annual process. The motivation for requiring a substantial degree of verification derives from discussions at several of the stakeholder meetings, namely, that there is less risk for LSEs of insufficient hedging if they choose CRR patterns that reflect their expected use of the grid to serve their load. Moreover, limiting the extent of LSE choice for this relatively large Tier 1 helps prevent potentially severe prorationing of awarded CRRs that could occur if LSEs exercise choice by competing for what they expect to be the most valuable CRRs.

The verification process would involve demonstration that the LSE had an entitlement to take energy to serve its load from the nominated sources during a historical reference period. Verified sources could include generation owned by the LSE or under contract, as well as trading hubs (which will correspond to today’s congestion zones) used for delivery of bilateral energy contracts.[5] For the purpose of source verification short-term energy contracts of at least one-month duration will be acceptable.

An additional rule in the annual allocation process will be to limit the CRRs requested from a particular generation source to 75 percent of the P-max of the generator, even if that generator is owned or fully contracted to the requesting LSE. The reason for this is that the combination of nominating CRRs up to 100 percent of generator capacity but only making 75 percent of the transmission system available could cause generation pocket constraints to be binding in the annual allocation, even though these constraints may not bind when the full network capacity is available. Once one of these constraints becomes binding in the SFT all CRR requests that affect it would be prorated. This may be a particular problem with CRR nominations sourced at trading hubs, because nominations that cause a constraint to bind from a single small generator in tier 1 could cause every nomination from a trading hub that includes that generator to be infeasible in tiers 2 and 3. The opposite effect could also occur, that is, CRRs awarded in tiers 1 and 2 and sourced at a trading hub could exhaust the capacity of a line on which a particular generator has a high shift factor and prevent the LSE who relies on that generator from getting its full complement of CRRs.

[5] In addition there may be some situations for holders of Existing Transmission Contract (ETC) rights where the contractual rights to transmission service do not extend all the way to the load location. In such cases the ETC holder would need CRRs whose source is the terminus of the ETC rights and whose sink in the relevant load location.

The first-year monthly process would be essentially the same as the annual process, except for (1) basing the total monthly eligibility on forecast load rather than historical load, as noted earlier; (2) having two tiers rather than three; (3) adjusted percentages involved in "truing-up" each LSE's CRR quantity to 100 percent of its full monthly eligibility; (4) increasing grid facility and generator P-max values to 100 percent; and (5) incorporating planned transmission outages and derates into the network model for the SFT.

Additional Details of the First Year Allocation Process

This section provides greater detail of the first-year allocation process, building on the concepts discussed above.

First Year Annual Allocation

The annual CRR release will be structured as a set of four seasonal CRR allocations. Thus the LSE Upper Bounds will be calculated for each season and TOU period. The following points describe the features of the proposed first-year annual allocation process, as applied to each season/TOU period and each LAP in which the LSE serves load.

The CAISO proposes a three-tier process, with tier percentages equal to 50%, 25%, and 25%. The first tier is intended to be large enough to cover most of the verified sources that LSEs wish to nominate, including generation owned or under contract to the LSEs as well as bilateral energy contracts of at least one month duration that may specify delivery at a trading hub. The percentage is chosen with the objective of maximizing the likelihood that LSEs will receive their verified nominations in full with little or no prorationing, thus limiting the potential for asymmetric CRR allocations among the LSEs in Tier 1 arising from a need to prorate nominations. The relatively small tiers 2 and 3 allow LSEs to adjust their CRR holdings in small increments as the 75% of system capacity allotted to the annual process becomes more fully accounted for by released CRRs and some constraints begin to bind. Breaking up the remaining allocation into two distinct tiers also operates to reduce the potential impact of the CRR proration rule. As noted earlier, each tier would involve a run of the SFT followed by provision of the results to the LSEs as input for formulating their nominations for the next tier.

An important element of the CAISO CRR allocation methodology is the "historical period" for verification of CRR sources. The historical period is a year in the recent past, as recent as possible consistent with LSEs not having strategically modified their supply procurement practices in anticipation of CRR allocations. It is therefore proposed that the historical period be 9/1/04 to 8/31/05. The verification rules described below would apply to the LSE's supply portfolio on a season-by-season basis for the annual allocation and on a month-by-month basis for the monthly allocation. The verification for a particular seasonal period would be based on the LSE's supply portfolio on the 15th of the 2nd month in the seasonal period, and the verification for a monthly CRR period would be based on the LSE's supply portfolio on the 15th of the corresponding month in the historical period.

The proposed upper bounds for each tier of the first-year annual allocation (for each season/TOU and each LAP in which the LSE serves load) would be as follows:

- LSE Tier 1 Upper Bound = 50% * 75% * season/TOU/LAP load metric
- LSE Tier 2 Upper Bound = 75 percent * 75% * load metric minus Tier 1 allocations
- LSE Tier 3 Upper Bound = 100 percent * 75% * load metric minus Tier 1 & 2 allocations

Eligible sources in Tier 1 would include the following. All categories of sources will be given equal weight in the SFT for Tier 1.

- Eligible Sources Within the CAISO:
  - Up to 75% of generator Pmax *LSE ownership share of an internal generating unit owned during the historical period.[6] LSE must provide proof of its ownership share. (Category I/O)
  - Up to the contract quantity of capacity (MW) for any internal generator whose energy has been purchased by the LSE for the historical period under a contract with a term of one month or more, not to exceed 75% of generator Pmax. The LSE must provide information substantiating the existence of the contract. (Category I/C)
  - Up to 75% of average hourly quantity contracted for physical delivery at a trading hub during historical period under a contract with a term of one month or more (SP-15 or NP-15). The LSE must provide information substantiating the existence of the contract. (Category TH)
  - For the special case of ETC holders noted above, up to 75% of the share of the ETC holder's load that is served under an ETC that does not provide transmission service all the way to the ETC holder's load location. (Category ETC)
- Eligible Sources External to the CAISO:
  - Up to 75% of generator Pmax *LSE ownership share of any generating unit outside the CAISO control area owned by an LSE for the historical period, for which there was firm transmission to the border of the CAISO control area for the historical period. In this case the source point for the CRR nomination would be the relevant intertie scheduling point. (E/O)
  - Up to the contract quantity of capacity (MW) for any generator outside the CAISO control area whose energy was purchased by the LSE for the historical period under a contract with a term of one month or more and for which there was firm transmission to the border of the CAISO control area for the same period, not to exceed 75% of generator Pmax. In this case the source point for the CRR nomination would be the relevant intertie scheduling point. (E/C)
  - Up to the LSE's share of residual import capability at each CAISO intertie in the annual allocation. All LSEs would receive shares of the residual import capability of all interties regardless of the actual locations of their loads. This mechanism allows all LSEs to obtain shares of CRRs sourced at the intertie scheduling points even if they don't have verified import sources in the first-year allocation process. The residual import capability for an intertie will be defined as 75% of the rated import capability for the intertie, minus 75% of the TOR and ETC rights originating at the intertie scheduling point, and minus the total source eligibility determined for the intertie for the season/TOU in the previous two paragraphs, based on LSE generation ownership and contracts (E/O, E/C). A percentage of the residual import capability will be allocated to LSEs in proportion to their loads. LSEs are then eligible to nominate CRRs up to this quantity. (E/R)
- All tier 1 nominations will sink at the LAP.
- The SFT for tier 1 will be applied at the LAP level, i.e., to CRRs will be defined to sink at the LAP along the lines of Sensitivity 5 in CRR Study 2.

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[6] The historical period concept is described more fully a little later in this section.

- Details of Tier 2: Up to 75% of annual allocation.
  - Each LSE's verified sources will be comprised of the same sources as in Tier 1.
  - All tier 2 nominations will sink at the LAP.
  - The SFT for tier 2 will be applied at the LAP level, i.e., to CRRs defined to sink at the LAP.
- Details of Tier 3: Up to 100% of annual allocation.
  - Propose that there would be no restrictions on eligible sources, and no verification of sources in tier 3.
  - In Tier 3 the LSE can choose to nominate CRRs that sink at either the LAP or a sub-LAPs, where the definitions of the sub-LAPs will be specified on the basis of a future CRR study but are expected to be roughly similar to the sub-LAPs used in CRR Study 2.

    CRRs awarded to sub-LAPs will settle at sub-LAP prices. Tier 3 takes an approach similar to that of Sensitivity 7 in CRR Study 2, except that in this proposal the LSE will nominate sub-LAP sinks rather than having the CAISO disaggregate LSE nominations specified to the LAP as was done in CRR Study 2.

    Tier 3 will allow LSEs to obtain partial hedges for the portion of their load that is not hedged by CRRs sinking at the LAP. Some additional CRRs may be feasible to sub-LAPs that are not feasible to the LAP.
- The historical period will be from September 1, 2004 through August 31, 2005, which ends at the time of this proposal so as not to create incentives for parties to try to shape their generation contracting during the historical period to affect their CRR eligibility. Eligible sources for any given month of CRRs to be allocated will be derived from the supply relationships in effect at the mid-point of the corresponding month of the historical period.

Monthly Allocation

The monthly process will be essentially the same as the annual process, except for the smaller number of tiers, adjusted percentages involved in "truing-up" each LSE's CRR quantity to 100 percent of its full monthly eligibility, increasing grid facility and generator P-max values to 100 percent, and incorporating planned transmission outages and derates into the network model for the SFT. With a two-tier monthly process, the first tier would account for 50% of the LSE's incremental monthly eligibility and would need to be sourced from verified sources. The second tier would account for the remainder of the monthly eligibility and would not restrict the choice of sources. Combining the verification tiers from the annual and monthly process, the result is that up to 68.5% of the LSE's total awards for any given month would be from verified sources, assuming that the LSE nominated the maximum quantities in the validated tiers and all of these nominations were awarded.

End-state Annual and Monthly Allocation Processes

After the first year, in the end-state allocation processes there will be no source verification by the CAISO. There will be three tiers in both the annual process and the monthly process, where each tier involves a distinct SFT run followed by an opportunity for LSEs to review their results in formulating their requests for the next tier. Tier 1 of both the annual and the monthly processes allocates only grandfathered CRRs that the LSEs want to renew. The second tier provides an opportunity for LSEs that gained load through retail access migration to obtain new

CRRs with some priority over new CRR requests, as described further below. The third tier then allows all to request CRRs that they did not hold in the current year and to nominate up to their upper bound for that allocation process. [7] The tiered structure enables LSEs to request their most desired CRRs first when the likelihood of receiving their full nomination is relatively high, and to see the results before submitting their requests for the next tier. Beyond the first tier of the annual and monthly process there is no requirement that source nominations be from the grandfathered CRRs.

For the tiers of the annual process the LSE requests would have to observe the following limits. These limits are based on the assumption that the annual process allocates 100 percent of the LSE's annual upper bound for each season/TOU period, calculated as described earlier based on the set of eight seasonal/TOU load duration curves.

- Tier 1 Upper Bound = total quantity of grandfatherable CRRs held by the LSE. The quantity of grandfatherable CRRs = min[(CRRs held in the previous period minus any reduction for loss of load due to retail access[8]), (LSE's annual upper bound)].
- Tier 2 Upper Bound = greater of zero or (50 percent of annual upper bound minus Tier 1 allocations).
- Tier 3 Upper Bound = greater of zero or (100 percent of annual upper bound minus Tiers 1 and 2 allocations).

For example, suppose the LSE's annual upper bound is 100 MW, and in the first year it received 60 MW of CRRs in the annual allocation process. In the second year this LSE wants to renew all 60 of its first-year annual CRRs and receives all of them in Tier 1 of the second-year annual allocation. Assuming that the LSE's annual upper bound is still 100 MW in the second year, this cannot nominate additional CRRs in Tier 2 because its Tier 1 allocation already exceeded 50 percent of its annual upper bound. In Tier 3 the LSE can nominate an additional 40 MW of CRRs to complete its 100 MW eligibility.

For the end-state monthly process, there would also be three tiers, structured in the same manner as the three-tiered annual process. To be clear, when we refer to grandfathering previously awarded CRRs in the monthly allocation process, we mean CRRs awarded for the same month in the previous year, not CRRs awarded for the previous month. Because a primary purpose of the monthly "true-up" CRR allocation is to enable LSEs to shape their CRR holdings to reflect changing needs over the annual cycle, the appropriate reference for grandfathering is the same month of the previous year.

3.3 Accommodating Retail Choice

Migration of retail choice customers between LSEs needs to be accommodated in the CRR process in three ways: (1) adjustments to the prospective annual allocation, (2) adjustments to the prospective monthly allocation, and (3) mid-period adjustments relative to the annual and monthly cycles. The mid-period adjustments are of two types: adjustments with respect to annual CRRs based on the point in the annual cycle when the load migration occurs, and adjustments with respect to monthly CRRs based on the point within the monthly cycle when the load migration occurs. For the annual and monthly prospective adjustments ((1) and (2)), the

[7] To be clear, the CAISO does intend to limit CRR source locations (and also sink locations in the auction processes) to those network nodes or locations that are used for scheduling in the Day Ahead market.

[8] Adjustments to grandfatherable CRRs for loss of load due to retail access migration are discussed in the next section.

approach proposed here would reduce the quantity of an LSE's CRR holdings eligible for the grandfathering priority in proportion to the share of its load that migrated away to other LSEs. For mid-period adjustments the CAISO proposes two options for consideration: (Option A) transfers of CRR holdings through the CAISO's secondary registration system (SRS); and (Option B) financial settlements between the two LSEs. In this discussion the assumption is that total load in the system is essentially fixed so that we can focus on changes to each LSE's total eligibility due only to customers switching between LSEs.

Prospective Annual Allocation Process

The rules discussed here apply only to the end-state annual allocation process and not to the first-year process. In the annual allocation the CAISO proposes to reduce an LSE's grandfatherable CRR source quantities in the next annual allocation in proportion to the net load lost through retail choice migration since the last annual allocation. The reduction will be applied as a constant percentage to all of theCRR sources that were awarded in the prior annual allocation to the LSE losing load.

In the next annual process, the Tier 1 SFT will include all LSE nominations to renew their current, grandfatherable annual CRR holdings (up to the reduced maximum quantities for LSEs losing load) plus CAISO "reservations" for the annual CRRs that were part of the current year holdings of LSEs losing load but due to the load migration are no longer grandfatherable by those LSEs for the next year. That is, reservations will be entered as CRR obligation requests corresponding MW-for-MW to all reductions in LSE grandfatherable CRRs due to lost load, i.e., "as if" another LSE were now requesting the same CRRs that were reduced from the original grandfatherable annual CRR portfolios of LSEs losing load. If pro-rationing is required in Tier 1, it will be applied equally to CRRs requested for renewal and the CRR reservations representing the migrated load. These CRR reservations are used only for the purpose of equitably prorating grandfathered CRRs if necessary, as a means to ensure that sufficient transmission capacity is reserved in Tier 1 to open up capacity in Tier 2 to enable LSEs gaining load to obtain new CRRs for the load they gain from LSEs losing load. Thus, once Tier 1 is completed these CRR reservations will be erased for the running of Tiers 2 and 3.

For example, suppose that in the current year LSE-A was eligible for 100 MW of annual CRRs and actually received 75 MW. During the year 30 MW of its load migrates to other LSEs and it gains 10 MW of load from another set of LSEs, so that its eligibility for annual CRRs is reduced to 80 MW. Since it has lost a net of 20% of its load relative to the prior allocation period the quantity of annual CRRs it may now request to renew for the next annual cycle is also reduced by 20% to 60 MW. That is, its grandfatherable CRRs are reduced by 20 percent or 15 MW, and the reduction is spread at a uniform 20 percent rate over all the sources LSE-A holds. Then suppose that in the next year's Tier 1 annual allocation, LSE-A requests only 53 MW of its 60 MW of grandfatherable CRRs. The Tier 1 SFT will include the 53 MW requested by LSE-A plus the 15 MW it had to give up because of losing load, for a total of 68 MW (in addition to the requests of the other LSEs). If prorationing is required in Tier 1, all 68 MW of grandfathered CRRs and CRR reservations will be subject to proration. When Tier 1 is completed, whatever portion of the 15 MW reservation that was not subjected to proration is essentially erased, so that only the awarded share of LSE-A's 53 MW request carry over as awarded CRRs into Tier 2.

In Tier 2 LSE-B, the LSEs that gained the load that migrated from LSE-A, would not be required to request the grandfathered CRRs reduced from LSE-A's portfolio, but would be free to choose its preferred CRRs in the later tiers. However, rather than raising the overall CRR nomination cap for the LSEs with net gains in load, there would be a separate nomination cap for the gain in load. Thus, if an LSE gained 10MW of load, it would have a separate Tier 2 nomination for 5 MW of CRRs and another 5 MW CRR nomination cap in the Tier 3. LSEs gaining load would therefore have a preferential chance to acquire CRRs using the transfer capability freed up by the release of CRRs by the LSE that lost load, but would not be required to nominate the same CRRs given up by the LSE losing load. The fact that CRRs representing LSE-A's loss of grandfatherable CRRs were included in the Tier 1 process essentially reserves capacity on the network to accommodate the increase in LSE-B's requests, but does not restrict LSE-B's choices in Tiers 2 and 3. In the next annual allocation process the CRRs awarded to LSE-B in the current Tier 2 and 3 allocations would be grandfatherable in Tier 1. This process of reducing LSE-A's grandfatherable allocation limit and using the reduction to make room for LSE-B's requests for new CRRs will be a far more manageable process to implement than trying to track transferred holdings of CRRs in fractional MW amounts from one LSE to another over a sequence of time periods. This approach also serves to make any transfer capability freed up by release of grandfathered CRRs or other changes in LSE nominations available to all LSEs who have grandfathered CRRs covering less than 50 percent of their load.

Prospective Monthly Allocation Process

In most cases customers will migrate from one LSE to another somewhere in the middle of the annual CRR allocation cycle. Between annual cycles, load migration will be reflected through a combination of changes in the prospective monthly allocated quantities, plus a financial payment described in the next section to transfer to the new LSE the remaining value of CRRs valid for the period in which the customer migration occurred.

For LSE-A who loses load there would be a reduction in grandfatherable monthly CRRs analogous to that described for the annual process. To be clear, this reduction will be applied in a MW quantity that reflects only the share of monthly CRRs in LSE-A's total CRR holdings, and is calculated relative to the CRRs awarded for the same month of the previous year. This adjustment in prospective monthly CRR eligibility would not attempt to reflect any needed adjustment in LSE-A's current holding of annual CRRs, which would be addressed through a mid-period adjustment. For LSE-B who gains load, its monthly CRR nomination upper bound would be increased accordingly and, analogous to the treatment of LSE-A described above, this increase would reflect only the share of CRRs released through the monthly process.

Mid-period Adjustments

During the discussion at the August 18 meeting it was suggested that the mid-month adjustment (i.e., transfer of the value of LSE-A's monthly CRRs to LSE-B for the remainder of month in which the load migrates) would in most cases be small enough to be ignored, which would allow for a simpler adjustment process for retail access. Having heard no objection to this view, the CAISO therefore proposes not to require any mid-month transfer of CRR holdings or equivalent financial payments between LSEs with respect to their holdings of monthly CRRs.

With respect to holdings of annual CRRs, however, the CAISO believes that the associated value should not be ignored, and therefore will require an appropriate transfer to take place. In addition the CAISO will allow, but not require, parties to utilize its Secondary Registration System (SRS) for effecting this transfer. The SRS provides an effective, straightforward mechanism for implementing the principle stated in the CAISO's July 2003 filing that CRRs will "follow the load" when retail customers migrate from LSE-A to LSE-B.

The present proposal is intended to be analogous to and consistent with the adjustments described above to the two LSEs' CRR entitlements in the prospective annual and monthly allocation processes. If LSE-A loses five percent of its load through migration to LSE-B at a particular point during the annual CRR cycle, it must transfer five percent of the remaining value of its allocated annual CRR holdings to LSE-B. To be precise, the remaining value of its annual CRR holdings is equal to the hourly CRR payment stream starting on the date the customer migration became effective and ending on the date the annual CRRs expire. This transfer of value can occur through direct financial payments between the relevant parties, outside of the CAISO settlement system. Alternatively, parties can utilize the CAISO's SRS to register a transfer of a share of LSE-A's CRR holdings, which would need to be spread as a uniform percentage over all of LSE-A's sources associated with the same LAP in which the migrating load is located, to LSE-B. The transfer would be for the remainder of the current annual CRR cycle and must include both peak and off-peak CRRs. To be accepted by the SRS the transfer must be entered by both parties into the SRS to take effect on the same date as the load transfer takes effect. As a result of entering the transfer into the SRS, the CAISO's settlement system will route the hourly settlement for the transferred CRRs to LSE-B instead of LSE-A.

If the parties opt for a direct financial settlement rather than a transfer of CRR holdings from one LSE to another, that settlement should be equal in value to the revenue stream that would have accrued to the corresponding transfer of CRRs through the CAISO's SRS. In an earlier draft of this proposal the CAISO suggested that the financial settlement could be based on the auction prices associated with the relevant CRR holdings in the most recent applicable CAISO auction process. The CAISO has now concluded that this calculation would not be appropriate, particularly when MRTU is first implemented, because there is no way to assess how deep the auction processes will be and how accurately the resulting auction prices will reflect the value of the CRR revenue stream.

Adjustments for Load Growth

This section deals specifically with a LSE's load growth that is not the result of retail access load migration. That is, LSE gained load without any other LSEs losing any customers. Load growth will be reflected in the forecasted load duration curves used to calculate each LSEs MW upper bound for CRR allocation. When the next period's MW upper bound increases due to load growth, the LSE will be able to request additional CRRs beyond the quantities it held in the prior period in the later tiers of the allocation process.

Suppose for example that LSE-C gains 12 MW of load within the same LAP in which it has been serving load and for which it has obtained CRRs. In Tier 2 of the annual allocation process it could request 9 MW of new CRRs. However the permissible grouping of these new CRRs over Tiers 2 and 3 would depend on the quantity of grandfathered CRRs LSE-C renewed in Tier 1. Suppose LSE-C was previously eligible for 100 MW of annual CRRs and held 60 MW of CRRs from the prior annual allocation process. Suppose also that LSE-C requested to renew all 60 MW of its grandfatherable CRRs in Tier 1 of the next allocation process and received all of these. LSE-C's total annual eligibility in the new allocation process would be 109 MW, but because it received more than 50 percent of this amount in Tier 1 it would not be eligible to request new CRRs in Tier 2. In Tier 3, however it could request up to 49 MW of new CRRs.

Sales of Allocated CRRs by LSEs

The CAISO's July 2003 filed proposal stated that allocated CRRs would actually be the property of the customers rather than the LSEs, i.e., that the LSEs would be viewed as custodians of these CRRs on behalf of customers, and as a result it would not be appropriate for LSEs to sell their allocated CRRs either in the CAISO's auction processes or in the secondary market. The CAISO now believes that this restriction is not necessary, given the proposed rules for adjusting each LSE's allocation eligibility, supplemented by financial settlements between LSEs when customers migrate from one LSE to another. The CAISO believes that the proposal described in this white paper adequately protects the interests of customers without restricting LSEs from selling allocated CRRs. The CAISO therefore proposes to remove this restriction in the interest of facilitating greater liquidity in the CRR auctions and secondary market.

One potential problem with allowing such sales arises in connection with migration of load from LSE-A to LSE-B. Specifically, if LSE-A sells its allocated CRRs, it may be unable to transfer the required quantities of CRRs to LSE-B when customers migrate to LSE-B. This would occur only if LSE-A sold so many of its allocated CRRs that its remaining CRR holdings are less than the quantities it is required to transfer, at least for some of its allocated sources. In this case LSE-A would be required to make a financial payment to LSE-B equal to the value of the CRRs that it no longer had in its possession to transfer, as a supplement to the required CRRs it still held and was able to transfer. LSE-A would obviously be unable to effect this portion of its required payment through the CAISO's SRS because it no longer held the CRRs it needed to transfer.

Although the CAISO proposes to eliminate the rule that prohibits LSEs from selling allocated CRRs, the software functionality to accommodate sales of CRRs by auction participants may not be available in Release 1 of MRTU. This functionality does exist within the vendor's software system and could be available at a later date, but the current scope of work for the CRR project does not include this feature because the CAISO expected to retain the prohibition on sales of allocated CRRs. Parties will still be able to sell CRRs through bilateral transactions that they record in the SRS. In addition they can accomplish essentially the same thing as a sale in the auction by bidding to buy a CRR in the opposite direction of the one they want to sell. Thus if LSE-1 wants to sell a CRR from source X to sink Y, the equivalent transaction would be to bid to buy a CRR from source Y to sink X. As a result of this purchase LSE-1 would hold both an X-Y and a Y-X CRR The values of these two CRRs would net exactly to zero, leaving LSE-1 in the same position financially as if it had sold its X-Y CRR. The CAISO therefore believes that it should not be a significant deficiency not to have the functionality for parties to sell CRRs in the auction in Release 1.

4 Rationale for CAISO Proposal

4.1 Alternatives Considered

Some of the alternatives considered by the CAISO involved the following variations to the elements of this proposal.

- **Require verification of sources in all periods rather than just for the first year.**

The CAISO prefers to stop performing verification after the first year in order to simplify the process, and to prevent the perverse incentives that arise when preferential CRR allocation is linked to new contracts. We recognize that some parties prefer the CAISO to continue with source verification on a continuing basis, but we believe that the drawbacks of such an approach are severe and, moreover, that the concerns expressed can be addressed in ways that do not create perverse incentives, specifically focusing on an acceptable and equitable first-year allocation, as well as effective rules to move CRR coverage with the customer when the customer switches LSEs.

- **Do not require any verification of sources, and allow LSEs complete choice.**

As described earlier, the CAISO does not support this approach, at least not initially upon MRTU start-up, because of the potential for severe prorationing of CRRs if parties try to compete for the most valuable CRRs.

- **Do not utilize grandfathering; i.e., do not provide a priority in subsequent periods to CRR requests that are renewals of current holdings.**

The CAISO recognizes that some parties oppose grandfathering, and understands this opposition to be based on a concern that grandfathering will favor incumbent LSEs over LSEs who are acquiring customers from the incumbent LSEs. The CAISO recognizes this concern, and believes that the tiered structure, which restricts participation in the early tiers by LSEs who have grandfathered CRRs, combined with the reduction in grandfatherable CRRs when customers migrate, will sufficiently protect the interests of customers who participate in retail choice.

4.2 Evaluation Criteria

The primary evaluation criteria are, of course, the degree to which the proposal achieves the objectives stated earlier in this document. In addition the CAISO considered the following criteria in developing this proposal.

- **Simplicity:** This proposal allows market participants and the CAISO to avoid, after the first year's allocation, the need for verification of sources. The grandfathering provisions markedly simplify the allocation process and support the goal (#6) that CRR allocation rules should strive for simplicity with regard to the activities that must be performed by market participants and the CAISO.
- **Transparency:** In this proposal, allocation requests are limited by a calculation based on each LSE's historical load duration curve (for annual requests) and forecasted load (for monthly requests). These parameters establish a transparent upper bound for CRR requests that is rooted in the goal (#1) that CRR allocation should be reasonably consistent with each entity's actual or expected use of the ISO grid.
- **Consistency with comprehensive market design:** Under this proposal, consistent with the MRTU design feature that LSE loads are to be settled at the applicable Load Aggregation Point (LAP) in the CAISO spot markets, allocated CRRs are sinked at the LAP level as well.
- **Market efficiency:** This proposal requires the verification of sources in the first year, which supports the goal (#4) that CRR allocation should promote the maximum distribution of congestion rents collected by the ISO. The option for using trading hubs as sources and the ability to request multi-point CRRs also supports the goal (#3) for CRR allocation to be reasonably based on market participant choice.
- **Precedence:** Many of the provisions in the proposal are established practices within eastern ISOs, as demonstrated in previous presentations to stakeholders.

Attachment B

California Independent System Operator

Market Redesign Technology Upgrade Project (MRTU)

<u>Excerpts from</u>

Summary of CAISO Proposals to Resolve Policy Issues Discussed in the 2005 Stakeholder Process

September 15, 2005

California ISO

Market Redesign and Technology Upgrade (MRTU)

Summary of CAISO Proposals to Resolve Policy Issues Discussed in the 2005 Stakeholder Process

1. Introduction

This document provides a summary of the CAISO's final proposals on most of the MRTU policy issues that have been discussed in the stakeholder process that commenced in March 2005 and has continued to the present time. The issues included in this document are those for which the CAISO has determined that the proposals it presented at the August 16-18 and August 30 – September 1 stakeholder meetings are final and do not require revision prior to submitting them to the CAISO governing Board on October 19 and, if they are approved, incorporating them into the MRTU tariff. This determination has been made in consideration of the comments submitted by stakeholders, and with the recognition that some elements are not unanimously supported by the stakeholder community. The CAISO believes, however, that the proposals presented here strike the best balance between the various concerns expressed by stakeholders, subject to the need to ensure that the comprehensive MRTU design is internally consistent from a whole system perspective, can be implemented in February 2007, and achieves the objectives of the CAISO's market redesign effort.[1]

Readers will note, of course, that the CAISO's proposals on some issues were not in final form by the conclusion of the September 1 meeting. Therefore there are two sets of topics that have been discussed in the 2005 stakeholder process but are not addressed in this document. The first set of such topics are addressed in separate white papers being released concurrently with this document. The CAISO decided to release separate papers on these topics because the latest proposals do contain substantial advances or revisions to what was discussed at the last round of meetings. Thus readers will see separate papers on the following topics:

1. Resource Adequacy Must Offer Obligation (RA-MOO)
2. Allocation of CRRs for LSEs Serving Load Within the CAISO Control Area
3. Open Issues Related to Existing Transmission Contracts (ETCs)
4. Treatment of Transmission Ownership Rights (TORs)

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[1] With the initiation of the MRTU market redesign effort at the beginning of 2002, the CAISO identified several critical objectives reflecting the need to correct fundamental flaws in California's electricity markets related to the zonal market design and the collapse of the California Power Exchange. These objectives, which continue to be the primary focus of the MRTU effort, are to: (1) perform effective congestion management in the CAISO forward markets (day-ahead and hour-ahead) by enforcing all transmission constraints so as to establish feasible forward schedules; (2) create a day-ahead energy market; (3) automate real-time dispatch so as to balance the system and manage congestion in an optimal manner with minimal need for manual intervention; and (4) ensure consistency across market time frames (day-ahead through real-time) in the allocation of transmission resources to grid users and in the pricing of transmission service and energy. Collectively these objectives comprise the over-arching goal of aligning the scheduling and operating incentives inherent in market prices with the requirements of reliable system operation.

5. Inter-SC Trades of Ancillary Services
6. Integration of the Participating Intermittent Resource Program (PIRP) into MRTU
7. Granularity of Load Aggregation Points (LAPs)
8. Credit of Net Marginal Loss Revenues.

The second set of topics discussed in the 2005 stakeholder process that are not addressed in this document are those topics included in the CAISO's May 13, 2005 conceptual filing and in view of FERC's July 1, 2005 order may be viewed as concluded. Readers will note, of course, that a few elements of the July 1 order are still before FERC for rehearing or clarification, and that the May 13 filing explicitly left some design details open for resolution through the 2005 stakeholder process. The CAISO has tried to identify these elements clearly as they intersect the topics contained in this document or the companion white papers. But for the most part the CAISO views the three major elements of the May 13 filing – clearing demand bids at the LAP, the design of the Hour Ahead Scheduling Process (HASP), and the structure of market power mitigation – as concluded by the July 1 order and does not discuss them in the documents being released at this time.

In summary, this document and the eight additional white papers identified above represent the entire set of proposals CAISO management intends to submit to its Board on October 19. As noted above, the present summary document does not contain new proposals or changes to the CAISO proposals presented in the last two rounds of meetings. In some cases, however, the CAISO has added some fresh material where needed to clarify or support the rationale for the earlier proposals, or to respond to specific concerns that stakeholders have raised, and in these cases the present document identifies the new material.

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3. Transmission Rights Issues

3.1 CRR Allocation for Load Within the CAISO Control Area

This topic is addressed in a separate CAISO White Paper being released concurrently with the present document.

3.2 CRR Allocation for Load Outside the CAISO Control Area

3.2.1 The Issue

The issue is whether to allocate CRRs to LSEs on behalf of load outside the CAISO control area in a manner analogous to LSEs serving load inside the control area.

3.2.2 CAISO Proposal

The CAISO proposes to offer to LSEs with external load – upon demonstration of a legitimate need, described further below – the opportunity to request CRRs through the same allocation process the CAISO performs for LSEs with internal load, in exchange for pre-paying the access charge for the period for which the requested CRR is valid. LSEs will thus be able to request annual on-peak or off-peak CRRs through the annual allocation process, and monthly on-peak or off-peak CRRs through the monthly allocation process, in one-MW increments, in exchange for pre-paying one MWh access charge times the number of hours in the relevant period, for each MW CRR requested.[2]

Payment of the annual (monthly) access charge for one MW entitles the entity to request one MW CRR in the CAISO's annual (monthly) CRR allocation process.[3] Because the CRR allocation process enforces a simultaneous feasibility test (SFT) there is some chance that the entity will be allocated fewer than the full amount of requested CRRs for which it pre-paid. In this case the CAISO proposes to refund to that LSE, at the end of the year (month) to which the CRRs apply, that portion of the amount paid for the unawarded CRRs that was not used up by the LSE in access charges incurred over the course of the period (see example later in this document).

In determining a party's "legitimate need" to participate in this allocation process, the CAISO will consider generation facilities within the CAISO control area that are owned or under contract to the LSE serving external load.

The CAISO will apply a MW upper bound to the amount of CRRs a LSE with external load can request in this process, analogous to the MW upper bound that will apply to LSEs with internal load. That is, the LSE with external load will have to provide data to the CAISO from which can be calculated that LSE's hourly use of the CAISO grid to export power. The data will have to cover a full year if the LSE wants to participate in the annual allocation process. If the LSE only wants to participate in a monthly allocation process, the LSE may submit historical data for the same month in the previous year.

3.2.3 Discussion of Stakeholder Comments and CAISO Responses

LSEs that serve load outside the CAISO control area have argued that they should be allocated CRRs in a manner analogous to LSEs serving load inside the control area. They argue that, like the LSEs with internal load, they also support the embedded costs of the CAISO grid through payment of access charges and will be exposed to LMP-based congestion charges for using the grid when MRTU is implemented. Some of these parties refer to a FERC ruling on ISO-NE to support their argument.

Other parties argue that LSEs with external load are differently situated to LSEs with internal load – specifically they have the ability to choose whether or not to use the CAISO grid to serve their load – and therefore should not be entitled to CRR allocation.

The CAISO's proposal is based primarily on the rationale that external loads and internal loads are differently situated with respect to their need to rely on the CAISO grid and, as a result, the certainty of their future payment of CAISO access and congestion charges is very different.

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2 Based on the CAISO's current Wheeling Access Charges (WAC), the per MW cost for a full year (both on-peak and off-peak hours) will be in the range of $22,000, based on an average WAC of approximately $2.50/MWh. The CAISO will release distinct CRRs for on-peak and off-peak hours based on the usual 6 x 16 definition of the on-peak hours of the week. The cost for on-peak hours only would be roughly $12,500 per MW per year, and the cost for off-peak hours roughly $9,500 per MW per year. The CAISO notes that the cost of a full year's access charge cannot be known exactly at the beginning of the year because the access charge may need to be adjusted and revised during the year to ensure accurate and complete recovery of the Participating Transmission Owners' revenue requirements over the year. Therefore at the end of the year the CAISO may need to charge or refund to the LSE who participates in this offering any discrepancy between the actual full year's access charge and the per MW prepayment amount.

3 For details on this process refer to the CAISO's proposed CRR allocation rules for LSEs serving load within the CAISO control area, a complete description of which is contained in another CAISO White Paper being released concurrently with this one.

Additionally, the CAISO's proposal is consistent with provisions approved by FERC for PJM, ISO-NE and MISO.

Allocation of CRRs by the CAISO provides two important benefits to eligible parties. First, unlike obtaining CRRs through an auction process where parties buy CRRs at auction-clearing prices, entities eligible for CRR allocation will receive CRRs at no additional cost. Second, the CAISO will conduct a CRR allocation process for eligible parties prior to each CRR auction process, so that parties eligible for CRR allocation get the first opportunity to obtain the CRRs they desire, ahead of those parties who must rely on the auction to obtain their desired CRRs. Because of this sequencing of allocation and auction, the availability of CRRs to auction participants will be limited by the fact that the CRR allocation process occurs first. For both these reasons, eligibility for allocation of CRRs will be highly desirable and must be defined carefully and based on sound principles.

The fundamental principle underlying eligibility for CRR allocation, as stated in the CAISO's white paper, is:

> Parties who support the embedded costs of the CAISO transmission grid are entitled to an allocation of CRRs in accordance with the nature and extent of their support for these costs.

It is important to clarify a few points about this principle. First, support for the embedded costs of the grid is mainly through one of two ways: (1) as a Load Serving Entity (LSE) that pays the access charge (TAC or WAC) for each MWh of power withdrawn from the grid; or (2) as a Merchant Transmission sponsor that finances the construction or upgrade of grid facilities that are turned over to CAISO operational control and whose investment costs are not recovered through the access charge or another regulatory mechanism. Allocation of CRRs to Merchant Transmission sponsors is addressed in another CAISO white paper being released concurrently with this one and is not discussed further here.

Second, with regard to LSEs the crucial question for eligibility is the extent to which they will continue to pay access charges during the time period for which allocated CRRs would be defined, not whether they have paid access charges in the past. The presumption is that for past access charge payments they have already received transmission service and no future entitlement is appropriate. Hence the linkage between paying access charges and entitlement to CRR allocation is a forward-looking principle.

Third, also with regard to LSEs, another key distinction is whether or not they are required, due to their physical or electrical location with respect to the CAISO control area, to utilize the CAISO grid to serve their load. LSEs who serve load inside the CAISO control area cannot avoid using the CAISO grid, hence cannot avoid the payment of access and congestion charges.[4] In contrast, LSEs who can avoid using the CAISO grid can avoid both access charges and congestion charges. Although this distinction may not be explicit in the principle stated above, it is implicit because it is a characteristic of the "nature and extent" of a LSE's support for the embedded costs of the grid. An example will help clarify this point.

Consider a LSE whose load is outside the CAISO control area and who owns and operates a generating plant inside the CAISO control area. Under today's market design, which requires that each SC submit balanced forward schedules, this LSE would have to balance a schedule

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4 There is an exception to this statement for Metered Subsystems (MSS) with supply resources located within their MSS electrical boundary. These entities can elect net settlement in the CAISO markets, which means that the CAISO settlement is based on their net withdrawal from the CAISO grid at the electrical boundary of the MSS. For MSS electing net settlement, their maximum eligibility for CRRs is based on these net withdrawals from the CAISO grid – which reflect their exposure to CAISO congestion charges – rather than on their gross load.

for its generator against an equal withdrawal and would thus incur access and congestion charges. Today the only way for the LSE to avoid paying the access charge for an energy withdrawal to balance its generator would be to skip the Day Ahead and Hour Ahead markets and bid that generator into today's Real Time market. Under MRTU, however, this LSE could simply self-schedule its generator or offer it into the CAISO's Day Ahead energy market, which is part of the MRTU Integrated Forward Market, without having to schedule any withdrawal at all. Thus this LSE could operate its generator and get paid in the CAISO energy market, while serving its load from other sources that do not utilize the CAISO grid, thus completely avoiding any access or congestion charges.

Based on the discussion above, given the flexibility external loads have with respect to their use of the CAISO grid and the resulting uncertainty of the linkage between their receipt of CRRs and their payment of CAISO access charges, the CAISO has concluded that prepayment of access charges for the CRR period is an appropriate requirement for these LSEs to be able to request CRRs in the allocation process, ahead of those parties who must rely on the auction to obtain their desired CRRs at auction prices.

Moreover, the CAISO has determined that the present proposal is consistent with provisions approved by FERC for PJM, ISO-NE and MISO, including in particular ISO-NE's compliance with the FERC order noted above. NYISO does not offer such a product for external loads; they only allow LSEs with external load to participate in the auction to obtain CRRs.

In an earlier section this document stated that in cases where the LSE does not receive all the CRRs it provides prepayment for and requests in the allocation process, the CAISO would "refund to that LSE, at the end of the year or month to which the CRRs apply, that portion of the amount paid for the unawarded CRRs that was not used up by the LSE in access charges incurred over the course of the period." The following example should help clarify how this would work.

Suppose a LSE requests 70 annual peak period CRRs in the annual allocation process, makes the up-front payment for 70 MW, and then as a result of the SFT receives only 40 MW of CRRs. The payment for 30 MW of CRRs is potentially refundable to the LSE at the end of the year, depending on the peak period access charges the LSE incurs. To determine the amount of the refund, the amount of access charges in excess of 40 MW that the LSE incurs in each peak hour of the year will be charged against the refundable amount. Access charges in amounts up to 40 MW per hour will be covered by the 40 MW worth of pre-payment for the 40 MW of CRRs the LSE received, which is not refundable. The only other adjustment required, which was noted in an earlier footnote, would be due to changes in the access charge that occur during the relevant CRR period, that could cause a discrepancy between the per-MW prepayment and the actual total per-MW access charge over the period. When there are mid-period changes to access charges, the CAISO will make end-of period settlement adjustments for discrepancies between the pre-payment amounts and the actual access charges, with respect to both the awarded CRRs and the refundable amounts.

3.3 CRR Allocation for Sponsors of Merchant Transmission Projects

3.3.1 Statement of the Issue

Currently the costs for building new upgrades or additions to the CAISO Controlled Grid, either by the PTOs or by merchant transmission entities, are recovered by either (1) rolling into PTO access charges, (2) receipt of FTRs, or (3) reimbursement over a period of time for the full amount of investment. After MRTU implementation, the CAISO intends to make available CRRs to developers of new transmission facilities that do not have alternative methods for recovery of their upfront network upgrade costs. The issues under consideration here involve the principles for allocation of CRRs to entities who build new or upgrade existing ISO grid facilities and the CAISO's methodology for determining the amount and spatial configuration of CRRs to be allocated to these entities, including those entities who have already constructed new facilities and seek to convert their FTRs to CRRs.

3.3.2 CAISO Proposal

The CAISO proposes to allocate this type of Merchant Transmission (MT) CRRs for the incremental amount of transfer capability when the new facilities are put under CAISO operational control and energized. Thus, the entitlement of CRRs would be based upon the impact on the total capacity of the CAISO grid.

The CAISO proposes these MT CRRs would remain in effect for the life of the facilities or 30 years, whichever is less, but this structure could be reviewed if the upgraded path utilized were de-rated on a long-term basis. The CAISO proposes the MT developer may choose the nominated MT CRRs to be either Options or Obligations. However, the CAISO proposes that merchant transmission sponsors must accept counter-flow CRRs to mitigate the reduced feasibility of CRRs previously awarded to other entities, so that these previously awarded CRRs would remain protected throughout their remaining term.

The CAISO also has outlined a proposed methodology for determining the incremental amount of transfer capability that would be the basis for the amount of MT CRRs to be allocated. This methodology is based largely on PJM's process for allocating Auction Revenue Rights.

The CAISO recognizes that MT CRRs potentially offer important incentives for transmission expansion, and the CAISO is receptive to further stakeholder input that would improve this framework for these allocation rules. The CAISO's Market Surveillance Committee (MSC) also is reviewing this issue and will be able to offer further analysis to shape this proposal and frame a better understanding for all market participants.

While this proposal has been discussed with some stakeholders to some degree, the CAISO is not confident that it has fully vetted all the issues and concerns regarding CRRs for MTs. While it is committed to having MT CRR provisions at the start of MRTU in February 2007, the CAISO believes it is not imperative that the CAISO hurry resolution of these issues prior to the November 30, 2005 filing of the MRTU Tariff. Rather, with respect to this specific aspect of CRRs, the CAISO believes it is possible to include general tariff language related to the availability of MT CRRs in the planned November 30th tariff filing, without foreclosing a wide range of parameters for MT CRR allocation rules or impacting the MRTU implementation schedule. In the meantime, and subsequent to the November 30th filing, CAISO will continue to work towards resolution of the issues with its stakeholders.

Therefore, the CAISO proposes to continue to engage with stakeholders in further review of this MT CRR proposal after the September 20-22 MRTU stakeholder meeting and even after the November tariff filing to better define the principles for allocating MT CRRs. The CAISO notes that the timing of this process does not impede or in any way affect the CAISO's ability to file complete CRR allocation rules for LSEs in the November 30 tariff filing.

3.3.3 Discussion of Stakeholder Comments

The following comments were offered recently to the CAISO regarding this proposal:

Calpine supports merchant transmission developers having a choice between the current monetary reimbursement mechanism or the allocation of CRRs. In response, the CAISO has previously stated its intention to phase out the monetary credit-back mechanism with MRTU implementation, but this position could be reviewed in the context of the timing for the MT CRR allocation.

FPL and Jim Kritickson have separately posed specific questions related to MT CRRs that have been posted to the CAISO website, and the CAISO intends to post a response to each question within the next week. FPL also has raised concerns about the treatment of merchant transmission projects currently in operation, and the transition of their awarded FTRs to CRRs. The CAISO will explore ways to respond to these concerns within the context of an on-going stakeholder process.

SCE raises concern that the 30-year award of CRRs could impact other CRRs awarded to LSEs through load growth or other changes after the initial determination to merchant transmission developers. SCE also points out that queuing MT upgrades based on their operating date differs from the CAISOs generator interconnection process that is based on receipt of a valid interconnection request. These are valid issues that the CAISO and stakeholder should consider further.

Finally, SCE favors deferral of this MT proposal until after the planned November 30 FERC filing to allow more extensive stakeholder review. The CAISO largely agrees but emphasizes its intention to work quickly with stakeholders before and after the November filing date.

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Attachment C

Market Redesign and Technology Update (MRTU)

CAISO Brief White Paper

CRR Allocation Rules for LSEs Serving Internal Load

Request for Stakeholder Comments on Specific Questions

NOTE: Comments are due to the CAISO by close of business on Thursday September 8. Send comments to: dwithrow@caiso.com

Based on discussions with stakeholders at the recent August 31 meeting, as well as some of the written comments submitted on September 2, the CAISO is asking parties to address the specific questions below when they submit their more expansive written comments on September 8. Your responses to these questions will be important to help the CAISO finalize its proposal for allocating CRRs to LSEs serving internal loads. In assessing the alternatives for developing a final proposal on this topic, the CAISO will weigh the following criteria (not necessarily in order of importance):

- Feasibility to implement in MRTU Release 1 (February 2007)
- Effects on reliable grid operation and performance of the MRTU market design
- Preferences expressed by stakeholders
- Complexity to perform the required activities on an ongoing basis
- Potential for market manipulation or inefficient arbitrage
- Transparency, and
- Degree to which the proposal achieves the objectives originally stated in the CRR white papers released earlier this year.

In your comments please indicate your preferences regarding the alternatives identified, as well as the reasons for your preferences, referring wherever possible to specific business practices and needs of the entity you represent.

Context

All of the following options and variations assume that the CAISO would still allocate CRRs to converted rights and would model TORs and ETCs in the Simultaneous Feasibility Test (SFT) in a manner that is consistent with their treatment in settlement. Assume also that the SFT would reflect the CRRs allocated to any sponsors of merchant transmission projects eligible for CRR allocation. Assume further that both the annual and monthly CRR release processes would be conducted, with 75 percent of network capacity available in the annual process and 100 percent of network capacity, adjusted for planned outages, available in the monthly processes.

Question 1: “Allocation Plus Partial Auction” or “Full Auction”

Based on discussions with stakeholders the CAISO believes it is important to solicit parties’ current views on a question fundamental to CRR release that was assumed to have been closed prior to the CAISO's July 2003 comprehensive market redesign filing. This is probably the highest-level, most fundamental question raised in this brief white paper. The question is:

- Should we continue developing the CAISO allocation rules proposal, with consideration of the many design features laid out in the August 24 white paper (Option A, which may be referred to as the "Allocation Plus Partial Auction" approach)? or
- Should we depart from this approach and not conduct an allocation process at all, but release all CRRs through an auction process (Option B, or the "Full Auction" option)?

In raising Option B we recognize that the disposal of auction revenues under Option B is an important question. A little further below it is identified as a second-level choice.

In considering this question parties should bear in mind some of the points raised during the recent public meetings.

In 2003 when this question was first discussed the CAISO and stakeholders predominantly (though not universally) preferred the allocation approach as the way to achieve greater simplicity as well as greater certainty for the CRR recipients. This conclusion was based on the presumption that a full auction process would need to be preceded by an allocation process for Auction Revenue Rights (ARRs), and that such a process would be as detailed and complicated as an allocation process for CRRs. Therefore the full auction process was thought to resemble the allocation process, but with an extra step – i.e., the auction itself – which would lengthen and complicate the entire process and would also increase the uncertainty for LSEs regarding whether they would obtain their desired CRRs. In reconsidering the full auction approach now, the CAISO suggests that perhaps a complicated allocation of ARRs would not be necessary, and that CRR auction revenues could be channeled back to customers in a much simpler manner.

Over the past few months, the CAISO with the assistance of Susan Pope and Scott Harvey of LECG has explored with stakeholders the alternative approaches to CRR allocation adopted by the other ISOs. In this process we have considered such design questions as validation of CRR sources, renewal or "grandfathering" of previously released CRRs with high priority, and the use of stages and tiers in the allocation process to maximize CRR release, enhance individual LSE choice, and ensure equity when proration is necessary. Unfortunately no single approach of another ISO is clearly the best; rather, each of the other ISOs adopted the approach that best fit its specific needs and circumstances.

Finally, during the latest round of meetings several of the parties expressed interest in finding a much simple approach, and some expressed a preference for abandoning complex allocation schemes altogether. Therefore the CAISO believes it is appropriate to ask all parties to express their views on this fundamental question.

Question 2: Distribution of Auction Revenues Under a Full Auction

Under Option (B) the primary second-level choice is how to distribute the auction revenues. The main choices are:

(Option B-1) Pay all auction revenues into the Participating Transmission Owner (PTO) Transmission Revenue Requirement (TRR) accounts, which then flows back to customers by reducing access charges (TAC and WAC).

(Option B-2) Develop rules for allocation of Auction Revenue Rights (ARR) directly to LSEs serving internal loads, much in the same manner as we would allocate CRRs.

As noted above Option B-2 could easily be as complicated as the Option A approach we have been taking to date, since all of the objectives and considerations we have raised in connection with CRR allocation would be applicable to ARR allocation as well. The CAISO therefore asks parties to give serious consideration to Option B-1 as a way to simplify the entire process. Any suggestions for alternatives to B-1 and B-2 would be welcome as well.

Question 3: Granularity of CRRs Under the 3-LAP Spot Market Settlement

Parties should consider this question primarily in the context of CRR allocation (Option A), and in view of the findings discussed in the recent Final CRR Study 2 Report. Assume in answering this question that we retain the 3-LAP system for market settlement proposed in the July 2003 filing (i.e., LAPs that coincide with the transmission territories of PG&E, SCE and SDG&E). The question of whether to increase the granularity of the spot market settlement by introducing more LAPs is raised as a separate question further below.

With respect to Option A the following sub-options are possible:

(Option A-1) Enforce the SFT at the LAP level (Sensitivity 5 approach).

(Option A-2) Enforce the SFT at the sub-LAP level and settle the resulting CRRs at sub-LAP prices (Sensitivity 7 approach).

(Option A-3) A mixed approach in conjunction with tiers in the allocation process, e.g., use the Sensitivity 5 (A-1) approach for tiers 1-2 and Sensitivity 7 (A-2) approach for tiers 3-4.

(Option A-4) Enforce the SFT at the sub-LAP level and release CRRs that are defined to and settled at the LAPs (the “base case” approach in CRR Study 2).

Note that under all options the CRR nominations submitted by the LSEs would be to the three LAPs, even under options where CRRs are defined and allocated to the sub-LAP level.

The CAISO views (A-1) and (A-2) as the leading candidates, whereas (A-3) is less desirable because of the additional complexity it introduces, and (A-4) is less desirable because it violates the SFT and results in CRR revenue inadequacy, even when all transmission facilities are fully in service. (Note that A-1, A-2 and A-3 could be revenue inadequate when transmission outages or derates cause grid capacity in the markets to be reduced compared to conditions in the SFT, but will be revenue adequate when grid conditions in the markets are the same as in the SFT.) The CAISO asks parties to consider these factors in their comments.

Question 4: Structure of the Annual CRR Product

Another choice to be made, independent of the above considerations, is the structure of the CRRs released in the annual process. At one extreme is a single set of CRRs that have 12-months duration; at the other extreme is 12 sets of CRRs each having 1-month duration. In between would be seasonal CRRs, which could mean two seasons (summer and winter) or four. For example four seasons might consist of Spring (March and April), Summer (May through September), Fall (October and November), and Winter (December, January, and February), whereas two seasons might consist of Summer (May through September) and Winter (the rest of the months). Of course each would have distinct peak and off-peak CRRs.

A related question is whether the monthly “true-up” CRR releases should actually take place on a monthly basis, one month at a time, or should be done less frequently – e.g., once every 3 months for a 3-month period – to reduce the overall amount of time the parties and the CAISO have to spend on this process.

Question 5: Granularity of LAPs for Spot Market Settlement

Another choice to be made, also independent of the above considerations, is whether to retain the 3-large-LAP design for scheduling and settlement in the CAISO spot markets, or to increase the granularity of the LAPs used in the spot markets. FERC addressed this topic in its October

2003 order on the MRTU comprehensive design proposal and again in its July 2005 order. The CAISO currently has a rehearing request pending at FERC on aspects of the July 2005 order. Apart from these regulatory matters, the CAISO would like to hear from parties how they view the substance of this issue at this time.

As background for considering how to respond to this question, the CAISO reminds parties of the reasons why the CAISO originally proposed, in the July 2003 filing, to schedule and settle internal loads using the 3-large-LAP design and not to allow any opt-out provisions. The main argument for insulating customers from the locational price impacts of LMP was the observation that these price impacts would derive primarily from the physical properties of a transmission system that was built under the prior regulatory framework. The prior framework was based on geographically uniform retail pricing across each IOU's transmission service territory, and did not contemplate competition in the generation sector nor the unbundling of the transmission from the generation sector that was at the center of electric restructuring in the 1990s. Under the former framework the investment decisions of the major IOUs typically considered tradeoffs between generation and transmission in determining the most cost-effective way to meet their load-serving obligations reliably. With integrated utilities and geographically uniform pricing the customers located in constrained "load pockets" did not face any cost consequences, but with electric restructuring and locational pricing these customers would face higher costs simply as a result of the shift in market structure. The CAISO reasoned therefore that wholesale prices within each of the major IOU transmission territories should be uniform, at least until the point that transmission upgrades substantially eliminated the load pockets created under the former regulatory framework.

In addition the CAISO pointed out that locationally granular pricing for most customers was of secondary importance in implementing LMP. The primary benefits of the LMP design would be realized by applying the full network model in the day ahead and real time markets to ensure feasible schedules, and nodal pricing for supply resources to align scheduling and operating incentives with reliable grid operation. Experience with demand response programs elsewhere and associated research have shown that time-varying prices for customers result in greater response than locationally-varying prices. At the same time, to promote demand response from the limited set of customers who could respond (i.e., "participating loads") the July 2003 filing proposed to pay the LMPs for dispatchable real-time load reduction in response to a CAISO dispatch instruction.

With regard to the ability of customers to opt out of the 3-large-LAP scheme, the July 2003 filing noted that extensive opting out by customers in areas where LMPs were on average lower than the LAP prices would defeat the purpose of large-area price aggregation by causing the LAP prices to increase over time. The CAISO therefore proposed not to allow opting out. At the time of the July 2003 filing the CAISO believed that the provisions described above were generally – though not necessarily universally – supported by stakeholders.

Finally, in LECG's February 2005 report on the comprehensive MRTU design, the authors pointed out that the 3-large-LAP approach could have detrimental impacts on the release of CRRs. The CAISO acknowledged the validity of this observation, discussed the problem with stakeholders at the public meetings beginning in March, and agreed to conduct sensitivity analyses in CRR Study 2 to shed some light on the magnitude of the problem. The results of these analyses are discussed in LECG's Final CRR Study 2 Report.

The design options identified under Question 3 above indicate possible ways of addressing the effect on CRR release of using the three large LAPs for scheduling and settlement in the CAISO spot markets. The CAISO notes that some of these design options (A-2, A-3, A-4) contemplate releasing CRRs that are defined with greater granularity on the sink side than the three LAPs, thus preserving the 3-large-LAP approach for the spot markets. The CAISO believes that this device offers a reasonable way to address the potential CRR problem without modifying the filed approach for spot market settlement. Thus if we consider impact on CRRs to be the most important reason for going to greater granularity in the spot markets, the CAISO suggests that such a change may not really be needed based on CRR considerations alone.

The CAISO therefore asks parties to consider the factors discussed above and to comment on whether they believe there is a need for greater granularity of load scheduling and settlement in the spot markets, and if so, on the reasons why greater granularity is needed. If CRR impacts are the primary need, why are the options identified under Question 3 not sufficient to address these impacts? Alternatively, if parties support retaining the 3-large-LAP approach for the spot markets, please explain the reasons for such support.

Attachment D

Market Redesign and Technology Update Project (MRTU)

CRR Allocation Rules

An Issue for Stakeholder Comment Raised by the CAISO Board of Governors

Introduction

In a white paper being released concurrently with this document, the CAISO offers its proposed rules and procedures for allocating Congestion Revenue Rights (CRRs) to load serving entities (LSEs) who serve customers within the CAISO control area. The proposal contained in that white paper represents the CAISO's synthesis of several rounds of public discussion, written comments from stakeholders, examination of rules and procedures adopted by other ISOs, and assessment of the results of CRR Study 2, to craft a proposal that the CAISO believes strikes a reasonable, equitable and workable balance of the objectives of CRR allocation and the concerns expressed by stakeholders. In the course of the process to develop this proposal, a few important facts and observations became apparent.

First, CRRs cannot provide a perfect, risk free hedge against the congestion costs associated with the limitations of the existing transmission system. At best the CAISO can return to consumers through CRRs nearly – but not exactly – all of the congestion charges it collects, with the remainder being redistributed through a simple secondary mechanism such as using the end-of-year Balancing Account surplus to reduce access charges. The CAISO believes that its proposal will achieve this objective with minimal – but not zero – risk of revenue inadequacy of the CRRs it releases.

Second, there is no perfectly equitable way to allocate CRRs to the eligible entities, in part because, in view of the first observation, there is no one definition of equity on which all parties will agree. That is, given the fact that some exposure to congestion costs will remain after the CRRs are allocated, there is no way to ensure ex ante that all consumers and all LSEs will be hedged to the same degree. The CAISO believes that its proposal comes as close as possible to achieving equity, in the sense that the proposed rules and procedures will not unduly and systematically advantage or disadvantage any particular class of consumers or LSEs.

Third, the proposed rules and procedures for allocating CRRs are fairly complex and will require all participants as well as the CAISO to dedicate considerable time and effort to performing them on a continuing basis.

Fourth, the complexity seems to arise from trying to achieve a particular aspect of equity, that is, from the attempt to enable each LSE – and in turn the consumers each LSE serves – to obtain through the CRR allocation process the most effective hedge possible against its exposure to congestion charges. In pursuit of this objective, the rules and procedures require "validated" or "verified" sources that link a LSE's allocated CRRs to the supply locations that will be used in calculating its congestion charges, but only for a portion of each LSE's maximum eligibility so that each LSE may have free choice of source locations for another portion. For the same reason, the process is structured in a series of tiers such that LSEs obtain the results of one tier before submitting their requests for the next tier. These and other complexities are attempts to "tune" each LSE's allocated CRRs to provide the best possible hedge. Unfortunately, there is no way to be sure, ex ante, that going through this complex process will yield results that are enough of an improvement over a much simpler approach – such as pro rata allocation of a set of "system" CRRs – to justify the costs associated with such complexity.

The Board's Request for Stakeholder Comments

The fourth observation raises an issue on which the CAISO now requests comments from the stakeholders. As many readers of this document are aware, there was considerable discussion of CRR allocation rules at the combined meeting of the CAISO Board of Governors and the Market Surveillance Committee on September 22. At that meeting the Board directed CAISO staff to initiate discussion among the stakeholders of the following question:

> Do the benefits of the complex CRR allocation rules and procedures the CAISO is now proposing outweigh the costs – to the market participants as well as the CAISO – of implementing these rules and procedures and performing them on an ongoing basis?

To focus this question more precisely, consider two alternatives.

[A] Allocate CRRs according to the rules and procedures described in the CAISO's proposal, as described fully in the accompanying white paper.

[B] Allocate to each LSE a pro rata share of a set of "system CRRs" defined, for example, by the power flows in a peak-load hour with all major transmission and generation facilities in service. Allocate these to LSEs in proportion to their load defined – as it is in the CAISO proposal – by the 99.5 percentile point on each LSE's load duration curve. Assume the other parameters of the CRR structure remain the same; e.g., there would still be on-peak and off-peak CRRs, and they could be issued for annual, seasonal or monthly periods, and released in an annual process and a monthly true-up process. Subsequent to each allocation process there would still be an auction, as in the CAISO's proposal. The key difference with option [B] is that allocation of CRRs for each season or month and TOU period would be a single step, a pro rata allocation of a share of system CRRs, rather than a multi-tier process with verification, grandfathering, and a series of iterations between the CAISO and the participants corresponding to distinct runs of the Simultaneous Feasibility Test.

To continue the theme discussed by the Board and the MSC on September 22, the CAISO provides – but with a strong note of caution – some empirical results on the relative magnitudes of the costs of congestion and transmission losses based on LMP Study 3B, which was used to perform the financial impact analysis portion of CRR Study 2. Using the hourly LMPs from LMP Study 3B, the total annual cost of congestion was $151 million, while the total of marginal loss charges was $406 million. If we assume that marginal loss charges are roughly twice as large as the actual cost of losses to the system, then roughly $203 million would be credited to demand as a flat per-MWh rate in accordance with the proposal in the CAISO's September 15 White Paper on this topic.

As the CAISO and its consultants (LECG) have emphasized more than once, it would be risky to attach too much credence to a single year's LMP results because the LMPs and hence the congestion and losses costs in a different year can be very different. The CAISO therefore offers these numbers as one piece of empirical data, but cautions that we should not draw any conclusions from them even about the relative orders of magnitude of the costs of congestion and losses.

Unfortunately the CAISO does not have more reliable numbers to provide at this time. It is unfortunate because such numbers, if accurate and credible, would help provide some useful perspective on the question the Board has posed. That is, the question of whether parties believe that the benefits associated with a more carefully tuned process for allocating CRRs, specifically the CAISO's current proposal (referred to as option [A] above) would be worth the cost of implementing it and performing it on an ongoing basis, i.e., the question of whether parties believe such a process would sufficiently improve the outcomes for participants in comparison with option [B].

Alternatively, if there is doubt as to whether [A] would win the cost/benefit assessment over [B], parties should comment on how they view option [B] as an alternative. To be clear, option [B] does not propose to eliminate CRR allocation and replace it with a full auction process. Parties responded to this question, which the CAISO posed in a brief paper issued on September 6, with a resounding no; that is, most – though not all – parties expressed strong preferences for an allocation process. The CAISO is not asking this question again now. Rather, the question to respond to at this time is whether to adopt a much simpler allocation process, one that is based on pro rata shares of system CRRs, and then following each allocation with an auction in which parties may – but are not required to – trade to obtain different sets of CRRs.

The CAISO requests that parties come to the October 5 meeting prepared to discuss the questions discussed above, and following that meeting submit written comments to the CAISO no later than close of business on Monday, October 10. The October 10 date is necessary to enable the CAISO to prepare a written summary of stakeholder comments and provide this to its Governing Board in the package of Board documents for the October 19 meeting. In a market notice to be issued later this week, the CAISO will provide a template for stakeholders to use in providing a more comprehensive set of comments on October 10, in addition to responding to the question posed in this document.

Attachment E

California Independent System Operator

CRR Study 2
Evaluation of Alternative CRR Allocation Rules

Prepared by
Scott M. Harvey and Susan L. Pope

LECG

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Appendices

CRR Study 2
Evaluation of Alternative CRR Allocation Rules

Scott M. Harvey and Susan L. Pope[1]
August 24, 2005

EXECUTIVE SUMMARY

The California ISO's CRR Study 2 was designed, in collaboration with the CAISO's market participants and other stakeholders, to simulate the possible outcomes of a CAISO-administered process for allocating Congestion Revenue Rights (CRRs) to load-serving entities (LSEs) who serve electricity customers within the CAISO control area. The simulated outcomes encompass a range of potential CRR allocation rules formulated as distinct scenarios and sensitivity analyses.

This CRR Study 2 Report presents and discusses the results of CRR Study 2. In order to assess the potential impacts of the alternative allocation rules, the report calculates two sets of metrics for each CRR Study 2 scenario and sensitivity analysis. The first set of metrics describes the degree to which individual LSEs were allocated the full megawatt quantity of CRRs that they requested. The second set of metrics presents the CRR allocation results in financial terms, by calculating the financial value of the allocated CRRs from CAISO estimates of a full year of Locational Marginal Prices (LMPs). The CAISO estimated the LMPs in a simulation that reflects congestion patterns that could occur in the CAISO's redesigned power markets when they begin operating in February 2007.

The CRR Study 2 analysis provides the basis for seven observations relevant to choices among alternative rules for allocating CRRs.

- First, the CRR allocation process for LSE CRRs defined as obligations employed in CRR Study 2 results in the assignment of CRRs that pay out virtually all congestion rents collected by the CAISO to CRR holders based on the congestion patterns and prices in LMP Study 3b. For either the base case or Sensitivity 7,[2] the value of the awarded CRRs accounted for 105% or more of the total congestion rents in Scenario I and 102% or more in Scenario IV. The 5-6% revenue inadequacy of the allocated CRRs is attributable to transmission outages during the historical March 2003 that are reflected in LMP Study 3b rather than to the application of the simultaneous

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[1] Scott Harvey is a director with LECG. Susan Pope is a principal with LECG. Dmitri Perekhodstev, Daniel Basoli and Joel Niamien provided research assistance in the preparation of this report.

[2] Section VI of this report contains a summary description of each of the scenarios and sensitivity cases analyzed in CRR Study 2. In the base case, all CRRs are nominated and settled with sinks at the LAP prices but the simultaneous feasibility test is applied at the sub-zone level. In Sensitivity 7, CRRs were nominated at the LAP level, but the simultaneously feasibility test and settlements are applied to sinks defined at the sub-zone level. In Scenarios I and IV of both the base case and the sensitivity cases, all LSE CRRs and ETC reservations were allocated as obligations. For the purpose of applying the simultaneous feasibility test, the SCE LAP was broken down into five subzones (listed in Table 26 below), while the PG&E LAP was broken down into 17 subzones (listed in Table 30 below). The SDG&E LAP was not further broken down into subzones.

feasibility test at the subzonal level. Excluding the simulated March results, the base case payout ratio was slightly less than 94%.

The lowest monthly value of the base case payout ratio was a little over 73% in the simulated April. Overall there were two months with payout ratios less than 80% and four months with payout ratios less than 90%. There were also five months with payout ratios above one, and all of these payout ratios in excess of 1 appear to reflect the impact of transmission outages, rather than the effects of the base case methodology for applying the simultaneous feasibility test. Thus, the CRR allocation rules used in CRR Study 2 resulted in an allocation of CRRs that assigned a high proportion of the congestion rents collected by the CAISO to LSEs, enabling them to be hedged against congestion to the extent permitted by the transfer capability of the transmission system. Different congestion patterns than those present in LMP Study 3b, however, could result in a higher or lower level of hedging.

The months with low payout ratios in CRR Study 2 are low demand months and the low payout ratios may be a result of LSE CRR nominations that were constrained under the CRR Study 2 methodology by the relatively low monthly peak loads in these months. This suggests that somewhat higher payout ratios could likely have been achieved by modifying the CRR allocation rules to permit use of higher caps on CRR nominations in the low demand months. Allocation of more CRRs in the low demand months would not have led to revenue inadequacy in these months but, given the substantial level of CRR revenue inadequacy due to transmission outages in March of the simulated year would have reduced the offset for these outage shortfalls over the year as a whole in CRR Study 2. It needs to be kept in mind, however, that transfer capability not used to support the allocation of an annual or monthly CRRs would have been made available for sale in the annual and monthly auctions, so limits on the allocation of CRRs do not necessarily avoid transmission outage-related shortfalls.

- Second, when the CRR allocation process was applied to CRRs defined as options, the resulting CRR allocation left 10-12% of the congestion rents collected by the CAISO unassigned based on the LMP Study 3b simulation of congestion patterns and prices. Thus, less of the congestion rents collected by the ISO are allocated through the award of CRRs defined as options than as obligations. This outcome and supplementary analyses indicate that the award of CRR obligations provides counterflow in the CRR allocation simultaneous feasibility test that enables the award of additional CRRs and significantly increases the total payout of congestion rents. This finding suggests that it would be preferable from the standpoint of fully utilizing the transmission system to support the allocation of CRRs to award CRRs defined as obligations.

- Third, one of the primary questions that CRR Study 2 was designed to examine was the impact of these alternative methods for applying the simultaneous feasibility test and awarding CRRs (the base case methodology which awards infeasible CRRs, Sensitivity 5, which awards CRRs that are feasible to the LAP as whole, and Sensitivity 7, which awards feasible CRRs to subzones) on the revenue adequacy of the awarded CRRs. All of the CRR allocations analyzed in CRR Study 2 were close to revenue adequate when valued based on LMP Study 3b congestion charges , i.e., the congestion charges collected by the CAISO from settlements in the LMP market would be nearly sufficient to fund the payments owed to CRR holders. The revenue adequacy of the awarded CRRs was also analyzed from the standpoint of simultaneous feasibility, independent of the simulated LMP prices. This analysis found that many of the CRRs sinking at LAPs that were awarded in the base case scenarios did not satisfy the simultaneous feasibility test, particularly those sinking at the SCE LAP, because the simultaneous feasibility test in the base case is applied at the subzone level while the award of CRRs is at the LAP level. These infeasible CRRs could have given rise to material congestion rent shortfalls in a study with different congestion patterns than those simulated in the LMP Study 3b.

The LMP Study 3b simulated prices are one possible outcome, but the financial magnitude of the differences across these CRR allocation approaches could be larger for different congestion patterns than portrayed in LMP Study 3b or for different CRR nominations than those made in CRR Study 2. A disadvantage of the base case CRR allocation methodology is that although the resulting revenue inadequacy was small in this study, it could be larger with different congestion patterns or if the allocation were followed by an auction. Moreover, to the extent that infeasible CRRs are allocated under the base case methodology, it would not be straightforward for LSEs to hedge themselves against the uplift charges that could result from different congestion patterns than those found in LMP Study 3b in combination with these infeasible CRRs.

The award of infeasible CRRs in the annual and monthly allocation process would have ripple effects on the annual and monthly auctions. If the CAISO modeled the allocated CRRs as sinking at the LAP in the auction simultaneous feasibility test, then the auctions would start with infeasibilities. This would likely have the result that counterflow CRRs would be purchased in the auction to restore feasibility, resulting in negative auction revenues for allocation to LSEs. Under such an approach there would be a potential for auction outcomes in which the CAISO purchased counterflow CRRs at prices in excess of the value of those CRRs to LSEs, resulting in large charges. We therefore do not recommend this approach. The alternative approach would be to model the allocated CRRs as sinking at subzones in the auction simultaneous feasibility test, consistent with the application of the simultaneous feasibility test in the base case CRR allocation. This approach could, however, result in CRRs being sold in the auction that exacerbate infeasibilities created in the CRR allocation process. We also would not recommend this approach.

Overall, the CRR study results confirm the potential for the base case allocation methodology to award infeasible CRRs as discussed in the MRTU Report,[3] although the financial impact of the infeasibility is small at LMP Study 3b prices the financial

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[3] Scott Harvey, William Hogan and Susan Pope, "Comments on the California ISO MRTU LMP Market Design," February 23, 2005, pp. 96-97.

cost could be much higher if evaluated using a different pattern of congestion prices that simulated in LMP Study 3b. Moreover, the revenue adequacy would also be greater in the actual market process in which the CRR allocations are followed by auctions, presenting the CAISO, its market participants and regulators with unattractive choices for combining the infeasible CRR awards with an auction process. For these reasons we recommend against allocating CRRs using the basecase methodology and that the simultaneous feasibility test, CRR awards and CRR settlements be consistent as under the Sensitivity 5 or Sensitivity 7 methodologies.

- Fourth, another primary question addressed by CRR Study 2 was to evaluate the degree to which the base case, Sensitivity 5 and Sensitivity 7 allocation methodologies award CRRs that adequately hedge LSEs against congestion, by fully allocating the congestion rents collected by the CAISO. Applying the simultaneous feasibility test at the LAP level (Sensitivity 5) had relatively little impact on the percentage of the congestion rents paid out to holders of CRRs (payout ratio) calculated using LMP Study 3b prices but reduced the number of CRRs awarded through the allocation process by about 6%, relative to the base case or Sensitivity 7. The overall difference was larger or smaller in individual months. The magnitude of the difference between the Sensitivity 7 and Sensitivity 5 outcomes in CRR Study 2 is neither so large as to provide a strong basis for awarding CRRs to hedge congestion to particular subzones nor so small as to provide a strong basis for simplifying the allocation process by allocating CRRs only to the LAP as a whole.[4]

  The CRR Study 2 CRR nominations and the LMP Study 3b LMP simulation results imply that although the base case methodology sometimes results in the award of infeasible CRRs, the revenue adequacy impact was small in dollar terms. Conversely, the results also imply that although the Sensitivity 5 methodology reduces the number of CRRs that can be awarded to sink at the LAP, the reduction was relatively small, particularly in dollar terms. It also appears that the relative level of awards under Sensitivities 5 and 7 may have been significantly impacted by the nomination of particular CRRs providing counterflow, and if those specific CRRs were not nominated in the actual allocation process, the relative level of CRR awards between Sensitivities 5 and 7 would have been affected.

  The Sensitivity 5 methodology resulted in the award of more CRRs that are feasible to the LAP as a whole than would the other methodologies as they were applied in CRR Study 2. A noteworthy finding is that although the base case subzonal CRR awards can in some instances be combined into far fewer CRRs feasible to the LAP as a whole than the number of CRRs that are awarded in Sensitivity 5, the proportion of the base case CRR awards that were actually infeasible is much smaller than suggested by the subzonal awards. The reasons for this contrasting pattern involve the proration rule and objective function for the base case CRR awards. If the CRR

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[4] To be clear, these comments concern only the level of aggregation in CRR awards; the question as to the level of aggregation in determining load prices is a separate issue addressed below.

allocation is followed by a CRR auction with a simultaneous feasibility test that models the allocated CRRs as sinking in subzones consistent with the base case methodology, then there is a potential for much greater infeasibility and revenue inadequacy than observed in CRR Study 2.

The Sensitivity 7 approach that awards both CRRs that are feasible to the LAP and additional CRRs feasible to particular subzones has the advantage that LSEs can observe the subzone within the LAP to which they are not hedged through their CRR allocation and purchase additional CRRs sinking in those subzones in the auction or enter into hedging contracts with generators located in those subzones. A disadvantage of the Sensitivity 7 approach as applied in CRR Study 2, however, is that it appears in practice based on the CRR Study 2 outcomes to result in the award of far fewer CRRs feasible to the LAP as a whole than does the Sensitivity 5 allocation methodology. Moreover, the proration rule and objective function can result in anomalous allocations across LSEs at the subzone level. This would be particularly likely if multiple nomination priority levels were evaluated in a single simultaneous feasibility test as in CRR Study 2.

The Sensitivity 5 methodology has the potential disadvantage that it could potentially fail to allocate CRRs fully utilizing many interfaces, underallocating the hedging capability of the transmission system. As observed above, the financial significance of the underallocation was relatively small when evaluated using LMP Study 3 prices and congestion patterns but could be larger for different prices and congestion patterns. This potential limitation only concerns the allocation of CRR values, however, as LSEs would be able to purchase CRRs across these underallocated interfaces in the annual and monthly auctions for the purpose of hedging their cost of meeting load.

Another finding is that the particular methodology used to implement Sensitivity 7 in CRR Study 2 caused the CRR allocation process to award far fewer CRRs feasible to the entire LAP than was actually feasible. If the CAISO adopts the Sensitivity 7 approach to CRR allocation in which CRRs are awarded to subzones, it should change the way the allocation is implemented so that the methodology allocates a larger proportion of CRRs that are feasible to the entire LAP. This could be achieved through changes in the objective function which attach a priority to awarding CRRs that were feasible to the entire LAP, relative to awarding CRRs feasible only to a few subzones. Such a change would likely entail non-trivial changes in the auction software which could have other unexpected effects and impact implementation schedules.

An alternative method of implementing the Sensitivity 7 approach while maximizing the award of CRRs feasible to the LAP as a whole and avoiding changes in software functionality would be to sequence the use of the Sensitivities 5 and 7 objective functions across nomination priorities to produce a CRR allocation that combines CRRs feasible to the LAP as a whole with extra CRRs feasible only to some subzones within the LAP. For example, the Sensitivity 5 approach of applying the simultaneous feasibility test to CRRs sinking at the LAP as a whole could be applied to priority 1, 2 and 3 nominations, achieving the high level of feasible CRR awards to the LAP that appears possible with the Sensitivity 5 methodology. LSEs could then be permitted to submit priority 4 CRR requests that would specify subzones to which additional CRRs would be accepted from each nominated source. This approach would in effect award as many CRRs sinking at the LAP as a whole as possible, and then award additional CRRs sinking in particular subzones. This approach would also avoid complicating the auction process as the CRRs outstanding prior to the auction would be feasible.

- Fifth, review of LSE specific proration patterns revealed material differences across LSEs in both the proration ratio and the CRR payout per megawatt of load. The purpose of calculating these metrics is not to evaluate the equity of the specific CRR allocation determined in CRR Study 2. The CRRs allocated in CRR Study 2 were impacted by the CRR nominations of the LSEs and different nomination patterns could result in different allocations. In practice, many of the differences across LSEs in the proration rates and CRR payout were readily discernable to be a result of the choices market participants made in requesting CRRs rather than a result of anomalous allocation or proration rules. CRR Study 2 is therefore concerned with evaluating whether specific features of the allocation and proration rules may have contributed to differences across LSEs in the proration ratio or CRR payout that were unrelated or only tangentially related to the CRR nomination choices of the LSEs .

  It appears that in some instances particular features of the allocation rules contributed to the differences in proration outcomes across LSEs:

  (a) First, some differences are directly or indirectly a result of allowing CRR source nominations up to 100% of unit pmax in the annual CRR allocation while only making 75% of the transfer capability of the transmission system available to support CRR awards in this allocation. This mismatch had a number of direct and indirect effects on differences in CRR awards, as discussed more fully in Section VIII.D below. The import of this observation is not that these nomination requirements impacted particular LSEs favorably or unfavorably, because the nomination requirements could impact completely different LSEs in the actual allocation. Instead, the point is that the differences between the source nomination cap and the proportion of transmission system transfer capability available to support CRR awards can interact to produce unexpected differences in CRR proration and awards across LSEs.

  (b) Some differences in the observed proration rates and CRR payout are directly or indirectly a result of the study methodology which required LSEs to submit CRR requests for all four priority levels before knowing the CRR allocation outcomes from the higher priority nominations. Providing LSEs with their high priority CRR awards before the LSEs are required to submit their lower priority CRR nominations may therefore contribute to fewer unexpected differences in CRR proration and awards across LSEs, although such a sequential allocation process would impose costs on both LSEs and the CAISO on the revenue adequacy of the awarded CRRs.

(c) The proration rule of maximizing the awarded CRRs has the potential to contribute to anomalous differences in CRR awards across LSEs. The impact of this proration rule in producing anomalous allocation outcomes across LSEs was limited by the use of multiple priority levels in CRR Study 2 and this aspect of the proration rules was not identified as contributing to any of the anomalous allocations investigated. Given the limited time for review of differences in individual LSE CRR awards, this finding is based on incomplete analysis.

(d) The design alternative of allowing LSEs to nominate CRRs source from trading hubs, as well as from physical generators and tie lines, was evaluated in Scenarios IV, V and VI and it does not appear to materially impact either the revenue adequacy of the awarded CRRs nor the proportion of congestion rents assigned to LSEs through the allocation process. Permitting market participants to purchase CRRs sourced and sinking at trading hubs in CAISO coordinated CRR auctions is a desirable market design element, although this does not require that trading hubs be allowed as CRR sources in the CRR allocation. CRR nominations from trading hubs can contribute to unexpected proration and allocation patterns in conjunction with the 100% of Pmax cap on CRR nominations from generators in the annual allocation and in conjunction with proration rules that maximize the awarded CRRs, which would need to be taken into account by LSEs nominating CRRs sourced at trading hubs and may influence the details of the CRR allocation process relating to nomination caps and proration rules.

- Sixth, the CRR Study 2 analysis evaluates alternative methods of defining and awarding CRRs given the assumption that LSEs purchase power at LAP prices. If the MRTU design that settles all LSE power purchases at aggregated LAP prices were to be modified such that LSEs purchased power at LMP prices calculated for a lower level of geographic aggregation than the LAP, then it would also be desirable to adopt a less aggregated basis for nominating and awarding CRRs that matches the pricing system. That is, it would be workable to award CRRs sinking at either the LAP level or the subzone level (and settling at the corresponding LAP or subzone prices) while settling load purchases in the day-ahead market at the LAP level. If on the other hand, the load settlement system is unbundled to charge LSEs for power based on subzone prices, then it would not be workable to award CRRs settling at a more aggregated, e.g., LAP level CRR awards should be unbundled to at least the level of disaggregation of load pricing.

I. INTRODUCTION

This report analyzes and discusses the financial impact of alternative CRR allocation rules, based on CRR allocations calculated by the CAISO for the CRR Study 2 scenarios and LMP prices simulated by the CAISO in LMP Study 3b.

The report also describes the CRR allocations calculated by the CAISO for CRR Study 2. To protect the confidential business information of the participants in this study, the report either describes these allocations on an aggregated basis, or presents individual LSE results in a manner that does not enable readers to associate specific results with specific study participants. As requested by market participants in discussions of the draft report, coded identifiers have been added to Tables 49 through 54 and each LSE will be informed by the CAISO of the coded identifiers applicable to their CRR requests. In the near future the CAISO will provide all study participants with additional information on their specific allocation results. The results of LMP Study 3b will be made public by the CAISO in a separate report.

LECG (Scott Harvey and Susan Pope) have had three roles in developing the analyses described in this report. First, we have worked with the CAISO to develop a number of metrics that permit market participants to meaningfully compare and analyze the results of alternative CRR allocation rules. Second, we have calculated these metrics for the CRR awards calculated by the CAISO based on market participant CRR requests for the six CRR allocation scenarios specified by CAISO market participants. To apply the metrics, we valued the CRRs awarded in each allocation scenario using the LMP prices calculated by the CAISO in LMP Study 3b.[5] Third, we have undertaken a number sensitivity analyses of the impact of alternative CRR allocation procedures or processes and of potential changes in the pattern of CRR requests that we believe are important for market participant understanding of the range of potential outcomes from an actual CRR allocation.

This report begins with introductory explanations of the nature of CRRs (Section II), the purposes served by CRRs in LMP markets (Section III), and the proposed CAISO CRR allocation process (Section IV), before turning to a discussion of the metrics (Section V) and the results for the scenarios and sensitivity cases (Section VIII). Section VI briefly describes the scenarios and sensitivity cases upon which CRR Study 2 is based and Section VII describes the use of the LMP Study 3b data in LMP Study 2.

II. WHAT ARE CRRS?

In LMP markets such as those coordinated by PJM or NYISO and, under development by the CAISO, traditional firm (or "physical") transmission rights have been replaced by source-to-sink financial transmission rights or CRRs.[6] The ownership of CRRs hedges market participants

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5 We have not reviewed the validity of the models or results for either the CRR Study 2 allocations or the LMP Study 3b, except as noted below.

6 The concept of financial transmission rights was originally developed by William Hogan and it was first implemented in PJM on April 1, 1998. Source-to-sink financial transmission rights are referred to as FTRs in PJM, New England and the Midwest, TCCs in NYISO, and as CRRs in the FERC NOPR for a standard market design. In developing its LMP market design the CAISO uses the term CRRs to distinguish the new LMP based

against LMP-based congestion charges incurred in the day-ahead market. If the sources and sinks for a market participant's CRR holdings exactly match the generation the market participant uses to meet its load, then the market participant will be financially indifferent to the level and pattern of congestion in the day-ahead market. Specifically, a CRR from location A to location B entitles the holder to be paid the difference between the congestion component of the LMP price at B and the congestion component of the LMP price at A.[7] This is identical to the formula used to calculate congestion charges so if a market participant injects and withdraws power at the source and sink of its CRR in the amount of its CRR, it would incur no congestion charges. Significantly, these payments to CRR holders are intended to be funded by the congestion charges collected by the CAISO in settling the day-ahead market, not by uplift charges paid by market participants or from CRR auction revenues.

The owner of a CRR (obligation) pays or is paid the hourly cost of congestion ($/MWh) between specified locations on the transmission system in every hour. Thus (ignoring losses), the owner of a CRR sourced at A and sinking at B receives a payment of Pb-Pa. If the CRR owner's net injections and withdrawals scheduled in the day-ahead market at locations A and B match the CRR MW quantity of its CRRs from A to B, then the CRR holder would pay Pb-Pa for transmission use and receive Pb-Pa for its CRRs, so the CRR holder would incur no net cost for transmission congestion. A CRR is thus financially equivalent to a firm transmission right (i.e., the holder is able to inject power at A and withdraw power at B without paying for congestion) and provides the financial equivalent of firm transmission service if the transmission usage the CRR holder schedules in the day-ahead market exactly matches its financial rights.

Under the currently proposed market design the sinks and sources for CRRs may be single network nodes or sets of nodes, such as trading hubs or load aggregation zones (LAPs).

Like traditional firm transmission rights, the award of financial transmission rights such as CRRs is, at least in the original formulation, limited by the transfer capability of the transmission system.[8] The reason for this link between the award of CRRs and the transfer capability of the transmission system is that payments to CRR holders must be funded. The source of these payments is not CRR auction revenues or a socialized uplift but is the congestion rents collected by the ISO when employing LMP pricing. When there is congestion under an LMP pricing system, there will be differences between locational prices across the grid that will cause the ISO to collect congestion rents. This must be the case under an LMP pricing system because the existence of congestion necessarily implies that some generator is paid a lower price

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financial instruments from the "Firm Transmission Rights" or "FTRs" that exist within the current zonal market design.

7 CAISO LMP prices will reflect differences in both congestion and losses so CRRs will be settled based on the difference in the congestion components of the LMP prices. In LMP pricing systems that do not include the cost of losses the difference in the congestion components of the LMP prices is equal to the difference in prices so CRRs can be settled in such systems based on the difference in LMP prices between the source and sink.

8 PJM and the NYISO strictly applied the revenue adequacy theorem to the award of CRRs in their original tariff filings. More recently, FERC has departed from this principle in the context of awarding FTRs to existing transmission customers and has ordered both PJM and the MISO to award CRRs for existing transmission rights (ETCs in California terminology) that are infeasible, with the cost of the payments to the holders of these CRRs borne by other transmission customers. See 108 FERC ¶61,163, August 6, 2004, #80-94. 107 FERC ¶61, 223, May 28, 2004, #48.

for its power than the price at which that power will be sold to load located within a constrained region. It is these congestion rents that fund payments to CRR holders. The congestion rents collected by the system operator will be limited, however, by the physical transfer capability of the transmission system, so this physical transfer capability of the transmission system also limits the CRR payments that can be funded from these congestion rents. The property of revenue adequacy for a set of financial transmission rights means that the congestion rents the ISO collects in charges for congestion under LMP pricing will be sufficient for the ISO to fund payments to financial rights holders, *regardless of the actual usage of the grid*.

Revenue adequacy is an important characteristic of financial rights systems and is governed by several revenue adequacy theorems. The most basic of these revenue adequacy theorems is William Hogan's 1992 proof that a set of CRR obligations[9] is revenue adequate if the set of injections and withdrawals corresponding to the CRRs is simultaneously feasible in a contingency constrained dispatch of the same grid that is used to settle the CRRs.[10] *Any* simultaneously feasible set of net injections and loads can describe a set of revenue-adequate CRRs, and that set of CRRs will remain revenue-adequate for that grid (transmission facilities and contingency set) *even if actual grid use differs from the set of injections and loads matching the CRRs*. The power of the revenue adequacy theorem is that a set of CRRs satisfying the simultaneous feasibility criteria will be revenue adequate not only when grid use (injections and withdrawals) matches CRR sources and sinks but even when grid use is entirely different from the sources and sinks of the awarded CRRs, as long as the transmission grid that was the basis for the simultaneous feasibility test remains fully available.

In New York and, until recently, in PJM, the award of financial transmission rights (TCCs in NYISO, FTRs in PJM) is governed by a simultaneous feasibility condition, which attempts to ensure that the congestion charges collected by the ISO in the day-ahead market are sufficient to fund payments to CRR holders. The simultaneous feasibility condition is that the awarded CRRs must be simultaneously feasible in a contingency constrained economic dispatch of the transmission system used to schedule the day-ahead market. If this condition is satisfied, then the revenue adequacy theorem assures that if the same transmission grid is available in the day-ahead market as that which was used to test the feasibility of the awarded CRRs and the day-ahead market is cleared at least cost based on LMP prices, then the congestion rents collected in settling the day-ahead market[11] will be sufficient to fully fund the required payments to CRR holders, even if day-ahead schedules are completely different from the CRRs held by market participants.

CRRs are not necessarily revenue adequate if the grid model used to test simultaneous feasibility is different from the grid model used to settle the CRRs. LMP-based congestion rent collections may be insufficient to fully fund the required payments to CRR holders if elements of

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9 CRR obligations entitle the holder to payments if the price differential is positive, but require payments if the price difference is negative.

10 See William W. Hogan, "Contract Networks for Electric Power Transmission," Journal of Regulatory Economics, Vol. 4 #3, September 1992 pp. 211-242.

11 These congestion rents are produced by the difference between the prices paid to generators and paid by loads. They are calculated by multiplying the net injections at each location on the CAISO grid by the congestion component of the LMP price at that location.

the transmission grid that were modeled as in service in the simultaneous feasibility test used to award CRRs are modeled as out of service in the market in which the CRRs are settled, as a result of either maintenance or forced outages.[12] In essence, the payments due to CRR holders are hedged by the transfer capacity of the transmission system, and if the transfer capability of the transmission system is reduced, the hedge provided by the transmission system is no longer necessarily sufficient to cover these payments.

Conversely, if transmission lines modeled as out of service in the CRR allocation and auction process are available in the day-ahead market, then there is a potential for the collection of a congestion rent surplus in settling the day-ahead market.[13]

William Hogan's original revenue adequacy theorem applied to CRRs defined as obligations, which is one of two types of CRRs. A CRR obligation entitles the holder to a payment when the difference in LMP price between the sink and the source of the CRR is positive, but also requires a payment by the holder if the difference is negative. A CRR obligation can nevertheless be a perfect congestion hedge in the circumstance in which a CRR obligation entails a payment by the CRR holder, as the transaction hedged by that CRR would receive an offsetting congestion payment for providing counterflow (under LMP, a transmission schedule from a high priced location to a low priced location is paid for the counterflow rather than being charged for congestion). The potential for a CRR to entail payments rather than the receipt of revenues means that CRR obligations can be risky, however, if they are held for arbitrage, rather than to hedge a real transaction. Financial rights in PJM and New York were initially defined solely as point-to-point obligations.[14]

An important feature of CRR obligations is that they are transitive. Thus, any CRR obligation from A to B can be partitioned into two CRRs sinking and sourcing at a common third location. For example, an A to B CRR obligation could be partitioned into two CRRs, one from A to the Hub and the second from the Hub to B, which would receive the same total payments as the A-B CRR, since $(P_{HUB} - P_A) + (P_B - P_{HUB}) = P_B - P_A$. Furthermore, any CRR from A to C can be reconfigured into an A to B CRR by purchasing a C to B CRR, since $(P_C - P_A) + (P_B - P_C) = P_B - P_A$.

It is also possible to define CRRs as options. CRRs defined as options entitle the holder to the difference in locational prices between the CRR source and sink if the difference is positive, but do not require payment when it is negative. The transitivity property noted above does not extend to CRRs defined as options, however. The principal difficulty in implementing a system including CRR options has been the complexity of implementing a revenue adequacy test for CRR options. A set of CRR options is revenue adequate if the set of injections and

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12 Revenue inadequacy may also occur due to other changes in grid availability in the day-ahead market, relative to that modeled in the simultaneous feasibility test for CRRs. These include differences in unscheduled grid use (loop flow), PAR settings, and transmission limits.

13 It is also possible in some circumstances for the return to service of a line modeled as out of service in the preceding auction or allocation to give rise to a congestion rent shortfall but this is an unusual circumstance.

14 This choice was motivated in part by the ease of applying the simultaneous feasibility test to obligations using existing software algorithms. The simultaneous feasibility test for obligations is simply a contingency-constrained dispatch, a familiar industry problem that many vendors had software to solve.

withdrawals corresponding to the CRR options is simultaneously feasible in a contingency constrained dispatch for all possible exercise levels and combinations of exercise levels for every CRR defined as an option.[15] While this test cannot be literally applied for the award of a significant number of options, software developers have developed approximations that appear to be workable and in 2003 PJM began running auctions in which FTR options as well as obligations have been sold.

All LMP based markets must account in one manner or another for the possibility of congestion rent short-falls (or surpluses) arising from transmission outages, but different markets have adopted different procedures. In the NYISO, the OATT provides that TCCs will be fully funded; that is, the TCC holder always pays or is paid the full difference between the congestion components of the LMP prices at the point of receipt and delivery. If the congestion rent collections in the day-ahead market are not sufficient to fund these payments to TCC holders, the New York transmission owners make up the congestion rent short-fall and recover these payments in their transmission access charges, which recover the embedded costs of the transmission system. Similarly, any congestion rent surplus in the day-ahead market is credited against the access charge. Since TCC auction revenues are also credited against the access charge, the increase in TCC auction prices attributable to full funding flows into the same account as the payments that make possible the full funding.

In PJM and the MISO, the OATT provides that payments to FTR holders will be prorated if congestion rent collections are insufficient to fully fund payments to FTR holders. Shortfalls in congestion rent collections during proration hours are made up with surpluses collected in other hours of the month or prior months to the extent possible.

III. WHAT IS THE PURPOSE OF CRRS?

Before discussing CRR allocation, it is important to be clear about the purposes served by CRRs. CRRs serve three functions in LMP markets. First, they provide a mechanism for the ISO or RTO to dispose of the congestion rents collected through LMP congestion pricing. Second, they provide a form of congestion hedge that permits market participants to hedge the LMP-based congestion charges associated with long-term power contracts. Third, they can be used to support an equitable cost allocation by ensuring that the market participants that pay the embedded cost of the transmission system receive the economic value of the transmission system. Importantly, they are designed to achieve these purposes without creating incentives for market participants to withdraw from the ISOs economic dispatch and without undermining open access to the transmission system.

Consider the first purpose of CRRs, that of distributing the congestion rents collected by the ISO. Under LMP pricing, all energy is purchased by loads at the market clearing price at the withdrawal location and all energy is sold by suppliers at the market clearing price at the point of injection. At times when there is transmission congestion, LMP pricing will cause the payments

15 Scott M. Harvey, William W. Hogan, and Susan L. Pope, "Transmission Capacity Reservations and Transmission Congestion Contracts" (hereafter Harvey-Hogan-Pope 1996) June 6, 1996 (revised March 8, 1997), pp. 41-44. William Hogan, "Financial Transmission Right Formulations," March 31, 2000.

by load to exceed payments to generators. Because the CAISO is not entitled to keep this difference, the congestion rents need to be returned in some manner to market participants.

There are many ways other than the funding of CRRs through which congestion rents could be returned to market participants. The second purpose served by CRRs, however, which is to provide a mechanism for market participants to hedge the congestion charges associated with long-term power contracts, cannot readily be achieved through other means. LMP pricing provides a market mechanism for allocating the short-term use of the transmission grid but it does not by itself provide a framework for market participants to enter into long-term price hedging contracts. The price of transmission use can be very volatile under LMP and actual redispatch costs are not known under LMP until generators provide their bids for redispatch and transmission schedules are determined. This uncertainty of congestion charges under a market-based congestion pricing system creates a potential demand for congestion hedges to enable entities entering into long-term contracts or load serving obligations to lock in their congestion costs.

Financial transmission rights such as CRRs were developed to address the limitations of a pure-spot pricing system for energy and transmission. Financial transmission rights enable market participants to obtain long-term transmission price certainty, like that obtained with traditional firm transmission rights. By enabling market participants to "lock-in" a price for transmission, they support long-term bilateral contracts in the energy market.[16]

The third purpose served by financial transmission rights is to support an equitable allocation of the benefits provided by the transmission system. LMP pricing by itself does not provide any financial benefits to the transmission customers responsible for paying the embedded cost of the transmission system, but LMP pricing causes the system operator to collect congestion rents when the transmission system is constrained. CRRs provide a mechanism for assigning the economic value of the transmission system (the congestion rents) to the customers responsible for paying its embedded costs.[17]

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[16] Since financial rights are a risk management mechanism, their existence provides no short-term welfare benefits in models in which there is no risk aversion; see Paul L. Joskow and Jean Tirole, "Transmission Rights and Market Power on Electric Power Networks," *Rand Journal of Economics*, Vol. 31, #3, Autumn 2000 (hereafter Joskow-Tirole 2000). Similarly, financial rights provide no long-term welfare benefits in models in which the transmission grid is fixed or investments are funded through a regulatory process, as there is no need to define efficient property rights for transmission expansion. Financial hedges analogous to CRRs could potentially be obtained in conventional insurance markets, but insurance markets are generally not used to hedge against sustained long-term changes in market conditions such as those that would produce long-term changes in congestion levels. CRRs are an attractive form of risk management because if they are defined in accordance with Hogan's revenue adequacy theorem, the entity that collects the congestion rents is hedged in paying CRR holders against changes in energy prices and market conditions by the transfer capability of transmission system.

[17] This avoidance of cost shifting also does not directly provide welfare benefits, but the practical reality is that transmission customers will not willingly participate in a system under which they continue to pay the embedded costs of past transmission investments but the benefits of these investments (the congestion rents) are shared with other market participants. Conversely, if both embedded costs and benefits are to be shared, then transmission customers of low-cost systems will be unwilling to participate in sharing the higher costs of others. Thus, in practice, an important advantage of defining financial transmission rights and allocating these rights (or

A central characteristic of financial transmission rights such as CRRs is that they accomplish these three purposes without undermining open access or the incentive of generators to respond to dispatch instructions and LMP prices. Moreover, if the financial rights are defined in accordance with the revenue adequacy theorem discussed below, they will not impose financial risks on the ISO issuing the financial transmission rights.

CRRs differ from traditional firm transmission rights (sometimes called "physical rights") in two respects that define the meaning of a "financial" right and enable the rights to support open access in combination with security-constrained least-cost dispatch of the transmission system. The first difference relative to traditional firm transmission rights is that market participants do not have to hold CRRs in order to schedule use of the transmission system. Second, market participants holding CRRs are paid the market value of their CRRs even if their transmission usage does not match their CRR holdings. Because the payment of transmission congestion rents to CRR holders is independent of their transmission use, CRRs are financial instruments.

The financial structure of CRRs is central to their purpose. It is because transmission customers do not have to hold a CRR in order to utilize the transmission system under LMP pricing that the system operator is able to redispatch all generation in real time based on offer prices to meet load at least cost (i.e., to coordinate a competitive market) while maintaining reliable operation. This would be impossible if a generator had to acquire a firm transmission right before being redispatched. Separation of the system of financial transmission rights from the physical dispatch also means that an entity holding CRRs cannot withhold use of the transmission system by failing to schedule transactions to use its entitlement, as would be possible with physical rights.[18]

In addition, because CRRs are financial, they avoid use-it-or-lose-it incentives associated with firm transmission rights. If a generator held a firm transmission right from A to B that had no value unless it was used, the generator's incentive to respond to dispatch instructions and spot pricing would be undermined by its incentive to realize the value of its transmission right. Absent ownership of any form of transmission rights, a generator with incremental costs that exceed the LMP price at its location would have an incentive to respond to dispatch instructions and the LMP price by reducing output and buying power to cover any forward sales whenever the LMP price at its location was lower than its incremental generating costs. Such behavior would be consistent with both least-cost dispatch and reliable grid operation, and is essential to achieving the efficiency and reliability benefits of implementing LMP pricing and least-cost dispatch. If a generator held a firm transmission right from A to B, however, it would forgo the value of the right if it did not generate power at A to match its input right. Thus, the effective price facing the generator would be the price at B, the sink of its firm transmission right, rather than the LMP price at its location. The generator therefore would have a financial incentive not to respond to dispatch instructions to reduce output as long as the LMP price at the sink of its physical right exceeded its incremental costs. Thus, the generator, in responding to the financial

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their economic values through auction revenue rights) to reflect the current entitlement to usage of the transmission grid is that it permits pareto optimal changes in transmission usage without cost shifting.

18 An entity holding CRRs could financially benefit from withholding generation to raise the value of its CRRs, but it cannot withhold use of the transmission system.

incentives provided by the transmission rights, would operate uneconomically and, by being unwilling to respond to dispatch instructions, potentially undermine the ISO's ability to maintain reliability.

Financial transmission rights are consistent with coordination of transmission grid use by multiple entities (i.e., open access) because CRR owners receive the economic value of their transmission rights regardless of how their generation is dispatched. If the generator in the example had a CRR from A to B, it would be paid the value of its CRR even if it did not generate power, so its output decision would be affected only by the spot price at its location compared to its incremental generating costs, not by its ownership of CRRs.

IV. CRR ALLOCATION AND THE CRR STUDY 2

Under the MRTU, the primary mechanisms for the allocation of CRRs by the CAISO will be an annual and monthly allocation of CRRs to LSEs. In addition, auctions for CRRs with a term ranging from one month to one year will be held on an annual basis, and a monthly reconfiguration auction will be held each month. Moreover, existing transmission contracts (ETC) pre-dating the formation of the CAISO are eligible for conversion to CRRs and in many cases have been converted. The CRR auction revenues are paid to the entities selling CRRs in the auction. Any residual auction revenues will be allocated to the transmission owners for crediting against transmission access charges.[19]

CRR Study 2 is intended to examine the impact of a variety of alternative rules for the CRR allocation process.[20] The study takes as a starting point the MRTU description[21] of the CRR allocation process, adds details where needed, and then examines the impact on the hypothetical CRR allocation of a few important variables that are varied across scenarios or sensitivity analyses.

For the MRTU, the CAISO has proposed to offer CRRs of two term lengths, annual and monthly, with distinct CRRs issued for the on-peak and off-peak periods. Thus, CRR Study 2 includes allocations of both on-peak and off-peak CRRs and LSEs were asked to submit different requests for the on-peak and off-peak periods. Moreover, each LSE may have had different maximum MW annual allocations for on-peak and off-peak hours.[22] Entities eligible for a CRR allocation have submitted their nominations by specifying source, sink, MW quantity and time of use. The MW quantities were capped by an upper bound determined by the 0.5 percent

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19 The revenue adequacy theorem also governs auction revenues. If the CRRs that were allocated prior to the auction are simultaneously feasible on the auction grid and if the CRRs outstanding at the end of the auction are simultaneously feasible on the auction grid, then the auction will be revenue adequate.

20 The methodology of CRR Study 2, including the specification of a number of scenarios and sensitivity analyses, was developed collaboratively by the CAISO and the stakeholders during 2004. This methodology is described in two documents available from the CAISO web site at http://www.caiso.com/docs/2004/07/20/2004072015390211394.pdf; http://www.caiso.com/docs/09003a6080/35/55/09003a60803555f6.pdf

21 This description is contained in the CAISO's July 17, 2003 Amended Comprehensive Market Redesign Proposal, Attachment A, paragraphs 76-97 (hereafter CMD).

22 California ISO, CMD Transmittal Letter, July 22, 2003 (hereafter CMD Transmittal), p. 78.

exceedence level of the monthly on-peak or off-peak load duration curve of the eligible entity.[23] For CRR Study 2, non-ETC LSEs were allowed to nominate a quantity of CRRs that was less than their load-based upper bound.

For the purpose of CRR Study 2, all CRRs have a one-month term. The annual CRR requests made for CRR Study 2 consisted of 24 separate sets of requests (monthly, on- and off-peak) and annual CRR awards consisted of awards of on-peak and off-peak monthly CRRs for each month of the allocation year. Under the MRTU, the ISO proposed to release a fixed percentage of the transmission capacity as annual CRRs for a particular operating year, after accounting for the impact of ETCs on the available capacity of the grid. The CAISO has proposed to use 75 percent of transmission system capacity to support annual CRRs, and 25 percent of capacity to support CRRs allocated on a monthly basis. These percentages were used in CRR Study 2, although the CAISO has stated that the percentages could be adjusted based on the outcome of the study. Consistent with the MRTU proposal, CRR Study 2 includes a monthly allocation, and monthly CRR requests, as well as an annual allocation and annual CRR requests.

Under the MRTU, the ISO proposes that CRR source locations may be a single injection node, an inter-tie point or a CAISO-defined trading hub, including the load aggregation points used for pricing wholesale power purchases. The source requirements for CRRs requested by LSEs in CRR Study 2 were restricted to the LSE's historical energy source locations; this definition was interpreted to include trading hubs for some scenarios. Consistent with the MRTU, the LAPs are generally used as CRR sinks for CRRs allocated to LSEs in CRR Study 2, but not for the CRRs used to reserve capacity for loads served by ETCs. CRRs allocated to LSEs in the study have a sink location corresponding to one of three standard LAPs: PG&E, SCE and SDG&E, except in Sensitivity 7, in which the sink locations are defined at the sub-zonal level. The CAISO used seasonal load distribution factors for on-peak and off-peak periods to assign load to nodes within these LAPs for purposes of the CRR Study 2 simultaneous feasibility test.[24]

In addition to CRRs with a pre-determined source specified by the requestor the CAISO also plans to offer Network Service CRRs (NS-CRRs) to provide each LSE with "an optimal congestion hedge at least cost."[25] To obtain a NS-CRR, an LSE will specify a set of injection nodes or inter-ties and assign nodal quantity bids or priorities to indicate its preferred distribution of CRRs over these nodes, as well as acceptable adjustments in case the preferred distribution is not feasible. The CRR allocation procedures will provide the preferred distribution, if possible, or can optimize the distribution. Once a NS-CRR is issued the distribution factors for the injection nodes are fixed. NS-CRRs subsequently may be unbundled into single injection node CRRs, consistent with the distribution factors defining the NS-CRR. NS-CRRs were not included in CRR Study 2 because the software enhancements required to model them had not been completed.

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23 California ISO, CRR Study 2, Final Scenario Assumptions, (hereafter CRR Study 2), p. 21.

24 CRR Study 2, p.5.

25 CMD # 88. The CAISO will be the first ISO to use a process like NS-CRRs to allocate financial transmission rights.

Under the MRTU, CRR obligations would be allocated to all native load within the CAISO control area that pays the embedded costs of the transmission grid. LSEs would be recipients of CRRs on behalf of the loads that they serve. The CMD states that the allocation to loads would be based on the historic level of load, the geographic distribution of load, and the anticipated distribution of a load's supply resources. For CRR Study 2, the CAISO guidelines state that "a consistent pattern should exist between the CRR source-sink request and the actual or historic supply sources that the requestor uses to serve load."[26] Pumped load was asked to use an average water year to determine the allocation cap. In CRR Study 2, the ISO undertook very limited validation of each LSE's right to nominate CRRs from requested generator sources.

CRR Study 2 modeled LSE CRR requests as obligations in most scenarios and as options in others. The results thus can be used to examine the implications of allocating LSEs options instead of obligations, which will be related to the importance of counterflow from non-ETC CRRs to the feasibility of other parties' CRR requests.

The CRR Study 2 modeling includes non-converted ETCs in the simultaneous feasibility test by representing CRRs in the model that have specific ETC load locations as their sinks. This modeling serves to reserve the transfer capability needed to meet obligations to ETC customers. These CRRs are represented in the simultaneous feasibility test used to allocate CRRs, but are not allocated to the ETC customer. The CRR Study 2 scenario specification explores the impact of modeling ETCs as options in some scenarios and as obligations in others.[27]

In CRR Study 2, ETC schedules were requested from the scheduling coordinator for each ETC schedule. The CAISO required ETC holders to provide a description of their normal use of the grid under their ETC rights, with specific quantities of generation and load at each location. This information is presumably reflected in the CAISO ETC reservations in CRR Study 2. CRR Study 2 evaluated the feasibility of ETCs, Converted Rights and LSE CRR requests simultaneously, with higher weights assigned to ETCs and converted rights.

CRR Study 2 is intended to provide data to help inform policy choices concerning the eligibility of entities that serve load outside of the CAISO control area to be allocated CRRs. The CAISO has stated that CRRs would not be allocated to parties historically engaging in short-term wheeling transactions that do not serve native loads internal to the CAISO control area (except for the case of ETCs, which are long-term contracts). However, the eligibility of entities that serve load outside of the CAISO control area and have contributed to the embedded cost of the CAISO control area is being considered.[28] CRR Study 2 accounts for external loads served

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[26] CRR Study 2, p. 10.

[27] The conceptual issues to consider in deciding whether to model ETCs as options or obligations are: first, if power only flows under the ETC when the ETC is in the direction of congestion, but the direction of congestion varies within the allocation period, then the simultaneous feasibility test needs to model the ETCs as options in reserving capacity to support the ETCs; and, second, if power always flows under the ETC regardless of the direction of congestion, then it would be appropriate to model the ETCs as obligations if the ETC holder's schedules are assumed to use its ETC rights to obtain this transmission service. Alternatively, if an ETC holder would be permitted to schedule transactions using its ETC rights in the direction of congestion and to schedule counterflow transactions in the market without buying additional transmission service, then the ETC rights would need to be modeled as options.

[28] CRR Study 2, p. 8.

under ETCs (existing transmission rights that have not been converted to CRRs) as well as under CVRs (existing transmission rights that have been converted to CRRs) and TORs (transmission ownership rights in transmission that is electrically within the CAISO control area but not under the direct control of the CAISO).[29]

Under the MRTU, it has been proposed that there would be no reduction in the quantity of CRRs allocated to an LSE due to the LSE's ownership of local generation.[30] That is, the load-based cap on LSE CRR nominations would not be net of local generation unless a lower level of CRRs were requested by the LSE in question for "whatever" reason. This approach was adopted in CRR Study 2. This is significant and a consequence of the aggregation level of the LAP pricing zones. When aggregate load zones covering large electrical areas are used for load pricing, an LSE can thus request CRRs from generation located electrically close to load in order to hedge itself against congestion charges arising from the LAP pricing system. It would therefore not be appropriate under the proposed LAP pricing system to reduce the CRRs allocated to an LSE based on its local generation since even an LSE with generation at the same location as its load could need CRRs from its generation to its load in order to be hedged for changes in congestion charges.[31]

Under CRR Study 2, consistent with the approach proposed in the MRTU filings, CRRs have been allocated to LSEs based on the priority level of their rights. The three broad priority levels are: (1) Unconverted ETC Rights; (2) Converted Rights (ETCs that convert to CRRs and new PTOs); and (3) LSEs (including metered subsystems and municipal utilities). In addition, a four-level priority approach has been applied to LSEs, in which the upper bound of each LSE's nomination quantity (in megawatts) has been divided by four. Along with each CRR request, the LSE has provided a tag with a sub-priority from 1 to 4, with 1 being the highest sub-priority. The total nominations for each sub-priority ranking may not exceed the sub-priority megawatt upper bound.

CRR Study 2 evaluated the feasibility of ETCs, Converted Rights and LSE CRR requests simultaneously, with higher weights assigned to ETCs and converted rights. In CRR Study 2, nominations for all LSE priority levels were evaluated in a single SFT run, with different weights (bids) assigned to represent each CRR priority level. Thus, if pro-rationing was required to achieve simultaneous feasibility, this approach was intended to result in a reduction, first, in the lower-priority CRR requests that impact the binding transmission constraints.

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29 CMD Transmittal, p. 74.

30 CMD Transmittal, p. 75.

31 This possibility was discussed in Scott M. Harvey, William W. Hogan and Susan L. Pope, "Comments on the California ISO MRTU LMP Market Design," February 23, 2005 (hereafter MRTU Comments), pp. 22-23, 97-98, 101, 106, and 119. These incentives may have been reflected in the nomination choices made by LSEs in CRR Study 2.

The objective used in CRR Study 2 allocation was to maximize the priority-based value of the allocated CRRs, thus taking into account the priorities associated with different CRR types as well as the impact of different CRRs on binding constraints.[32]

V. METRICS FOR EVALUATING ALTERNATIVE CRR ALLOCATIONS

The CAISO has proposed a key principle and several objectives for CRR allocation. The fundamental principle proposed in the CRR Allocation White Paper[33] is that:

> Parties who support the embedded costs of the ISO transmission grid are entitled to an allocation of CRRs in accordance with the nature and extent of their support for these costs.

The White Paper also proposes a number of specific objectives to guide the design of the CRR allocation rules, consistent with this principle.

1. The CRR allocation should provide an effective hedge for congestion charges by supporting the allocation of CRRs accounting for as large a proportion of the congestion rents collected by the ISO as is practical (“Full Payout”).

2. The CRR allocation should be consistent with CRR revenue adequacy (i.e., it should be simultaneously feasible) (“Revenue Adequacy”).

3. The CRR allocation should be equitable. Any reductions in parties’ requested CRR allocations should be performed in an equitable fashion (“Equity”).

4. The CRR allocation should be based to a reasonable degree on choices of the entitled party. The White Paper notes that there is a trade-off between maximizing choice and maximizing the total quantity of CRRs allocated to all parties (“Stakeholder Choice”).

5. The CRR allocation should be reasonably consistent with each LSE’s actual or expected use of the ISO grid to meet its load with its generation resources (“Grid Use”).

6. The CRR allocation rules should support efficient infrastructure investment, such as in new generation, and should also be consistent with the RAR rules developed at the state level (“New Investment”).

7. CRR allocation rules should be favored that simplify on-going ISO validation activities or the level of ISO modeling effort (“Simplicity”).

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32 CRR Study 2, p. 12. The CMD states: “In the event that not everything is simultaneously feasible [following the requests for CRRs by non-ETC loads] the ISO would curtail non-ETC load or LSE CRR requests first, and preserve converted ETC CRR obligations as far as possible, to provide converted ETCs a higher degree of certainty of receiving their desired CRRs as a benefit for converting. CRR obligations allocated to non-converted ETCs would maintain the highest degree of protection in this process.” The amount of curtailment of non-ETC load will depend on whether the CRR requests of ETCs and new PTOs are required to be obligations (as assumed by the previous quote), in which case they will provide counterflow, or are permitted to be options.

33 California ISO, CRR Allocation Rules, June 14, 2005.

The effectiveness of alternative allocation rules can be evaluated by assessing how well they achieve the objectives. This CRR Study 2 Report provides the first quantitative assessment of a provisional set of allocation rules – specifically the CRR Request Guidelines that were adopted as part of the study methodology – against these objectives.

Four metrics have been proposed for evaluating alternative CRR allocations. These metrics measure the consistency of alternative CRR allocations with the first ("Full Payout"), second ("Revenue Adequacy") and third ("Equity") objectives. The degree to which various CRR allocation methodologies are consistent with the first and second objectives will be measured by the congestion rent payout ratio metric discussed in Section V.A below. The degree to which various CRR allocation methodologies are consistent with the third objective will be measured by the variation across LSEs in the proration ratio metric, discussed in Section V.B below; the variation across LSEs in CRR payments per MW of peak load, discussed in Section V.C below; and the variability in the ratio of CRR receipts to congestion payments, discussed in Section V.D below.

A. Congestion Rent Payout Ratio

The first metric that will be calculated for use in comparing alternative CRR allocation rules and processes will be the ratio of the total congestion rents paid to the awarded CRRs, calculated based on the prices simulated in LMP Study 3b, to the total congestion rents collected by the ISO, again as calculated based on the prices simulated in LMP Study 3b.[34] This metric will be useful in comparing the extent to which alternative CRR allocation processes satisfy the first and second objectives, the allocation of CRRs supported by as large a proportion of the congestion rents as is practical, i.e., fully hedging LSEs against the congestion charges collected by the ISO; and revenue adequacy.

A comparison of the total congestion rent payout by the ISO to the ISO's total congestion rent collections is a meaningful measure of the congestion hedging performance of a given CRR allocation because if revenue adequacy is enforced in the CRR allocation, the congestion rent payout will be less than or equal to the congestion rent collections.[35] Since any outcome in which the congestion rent payout exceeds congestion rent collections entails subsidization of the congestion rent payout from another source, the best possible allocation of CRRs in terms of making congestion hedges available to LSEs is one that would exactly return all congestion rents to CRR holders, i.e., one in which the CRR payments are equal to congestion charges. Metric values above 1 will indicate revenue inadequacy.

The payout ratio metric may be useful in suggesting the extent to which revenue inadequacy would be likely to result from the application of the simultaneous feasibility test to disaggregated subzone CRR sinks while awarding and settling based on CRRs defined to sink at

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[34] In applying this measure it will be necessary to appropriately account for potential congestion rent shortfalls that are due to ETC infeasibility. In practice, it appears that reservations were maintained in the simultaneous feasibility test for ETC nominations in the six base case scenarios except for one reservation in a few months for Scenario V. Only the feasible ETCs have been included in the calculation of CRR payments in order to distinguish the impact of infeasible ETCs from infeasible LSE CRRs.

[35] Absent transmission system outages or adverse loop flows not modeled in the simultaneous feasibility analysis.

the LAPs, as is currently proposed under the MRTU. Metric values above 1 indicate revenue inadequacy. Conversely, this metric will also illustrate the extent to which applying the simultaneous feasibility test to CRRs defined to sink at the LAPs and also awarding CRRs sinking at the LAPs might reduce CRR awards to a degree that material congestion rents would remain unallocated (i.e., total ISO congestion charges would exceed total CRR payments by the ISO).

The payout ratio metric will be calculated for all LSEs in aggregate, rather than for individual LSEs, and is not intended to measure the impact of alternative allocations on individual LSEs. Rather, it provides information for evaluating the extent to which alternative allocation rules meet the broader objectives of revenue adequacy and fully hedging LSEs in aggregate against congestion charges (i.e. fully allocating the entitlement to the value of the transmission system to those who pay its embedded costs). The payout ratio metric is well defined, in part because it is calculated for all LSEs in aggregate.

The metric is also grounded in the reality that no set of CRRs satisfying the simultaneous feasibility/revenue adequacy test can pay out more than 100% of the congestion rents collected by the CAISO.[36] Conversely, if all of the congestion rents collected by the ISO are paid out to CRR holders, then the CRR holders are, at least collectively, fully hedged against ISO congestion charges. If all congestion rents collected by the ISO are paid out to CRR holders, then to the extent that the LSEs pay higher energy prices than they prefer, these higher prices reflect the actual cost of meeting load given the current capacity of the transmission system and the cost of meeting this load can only be reduced by building generation or transmission, not through a different allocation of CRRs.

In measuring the extent to which the aggregate CRR allocation hedges LSEs against congestion, the payout ratio metric is preferable to alternative measures that are based on the proportion of requested CRRs allocated to LSEs or the degree of proration because the payout ratio metric is tied to hedging of LSEs against the net congestion charges (i.e., congestion rents) collected by the CAISO. This is not the case for alternative metrics. For instance, depending on the rules for nominating CRRs, the number of CRRs nominated by LSEs could exceed the transfer capability of the grid or could leave considerable transfer capability unassigned. Low proration ratios therefore could be consistent with CRR allocations that fully pay out congestion rents or could be a result of allocation rules that leave a substantial proportion of congestion rents unassigned. In view of this ambiguity, proration ratios have little value in assessing whether the allocation rules have worked well or poorly or in assessing the impact of LAP disaggregation on the ability of LSEs to hedge themselves against congestion. While aggregate proration statistics are reported below, and variations in this ratio across LSEs is used to assess consistency with the fifth objective (“Equity”). The Congestion Rent Pay Out Ratio is the primary metric for use in judging consistency with Objective 1.

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[36] Again, aside from short-falls arising from transmission system outages or adverse loop flows.

B. Proration Equity Metrics

1. Overview

Three distinct metrics for assessing the equity of the CRR proration and allocation rules are described below. Different market participants will likely have different views of whether a particular CRR allocation is equitable and of which metric is most useful. We discuss below the limitations of each of these metrics as a stand-alone measure of the equity of the proration rules and how these metrics can be used in combination to identify anomalous allocation outcomes.

The analysis of proration and allocation equity is not a cost benefit analysis of LMP implementation. The evaluation of the equity of the CRR allocation rules is based on a single outcome of LMP Study 3b in which LMP prices and the cost of meeting load were simulated. The aggregate resource cost of meeting load is therefore fixed across all of the alternative allocations of CRRs. Thus, by definition, there are no differences in resource costs between scenarios nor is there any comparison to resource costs under a non-LMP pricing system. The only issue that is being addressed in CRR Study 2 is how the rules for allocating CRRs might shift costs or benefits among LSEs.

Some market participants have expressed a concern that the results of the CRR Study 2 and these equity metrics, in particular, should not be used as the basis for shifting CRRs among market participants. That concern is consistent with the approach adopted in this report, which is to use the metrics to identify specific features of the allocation rules that could produce unintended and inequitable outcomes. We apply the proration equity metrics in a two-step process in which we first use the metrics to assess whether there are differences in allocation results across market participants that might reflect inequitable allocation outcomes. We then analyze the reasons for these differences and assess whether the differences arose simply from the CRR requests of the individual LSEs, i.e., market participant choices regarding CRR sources etc., or whether the differences arose from particular features of the proration rules that might not have been intended to have the observed effects.

The focus in applying the proration equity metrics is therefore not on identifying specific LSEs that are disadvantaged, but rather on identifying changes in the proration rules that would avoid similar asymmetries in the actual CRR allocation. From this perspective it is important to keep in mind that CRR Study 2 is not evaluating the equity of a negotiated allocation of CRRs among LSEs. Rather the study is evaluating the result of applying specific proration and allocation rules to specific sets of LSE nominations. No LSE is required to make the same nominations in the actual CRR allocation process that it made for this study. While it might appear from the results of CRR Study 2 that the overall allocation and proration rules disadvantage LSE “A” and favor LSE “B” because LSE”B” is seen to receive a more favorable outcome in the allocation based on one or more metrics, LSE A might submit substantially different CRR nominations in the actual allocation with the result that the same allocation and proration rules produce an outcome that instead appears to favor LSE “A” and disadvantage LSE “B” based on the same metrics. We therefore do not recommend using the results of this study to identify whether specific LSEs are advantaged or disadvantaged. Instead, the results should be used to identify changes in the allocation and proration rules that will eliminate unpredictable and inequitable outcomes.

2. Proration Ratio

The first proration equity metric that is used to evaluate the results of the CRR Study 2 CRR allocations is the ratio of the value of an LSE's CRR awards to the value of the CRR requested by the LSE. This ratio is calculated for the ISO as a whole and for the individual LSEs, calculated separately for each LSE serving load in each LAP. The proration ratio is used to assess the degree to which alternative CRR allocation methods achieve the third objective of equity. Thus, while it is not proposed to use the overall proration ratio to measure the degree to which alternative CRR allocation rules meet the first objective of effectively hedging LSEs against congestion charges, the variations in the proration ratio across LSEs, given the ISO-wide average, is used to compare the equity of alternative CRR allocation rules and identify anomalies. This metric can be used to assess inter-LSE equity under alternative CRR allocation rules, under alternative LAP disaggregation rules and across scenarios.

Several features of the proration ratio metric deserve discussion. First, this metric is based on the dollar-valued ratio of CRR awards to CRR requests, rather than on the physical number of megawatts of CRRs prorated. The reason for relying primarily on a dollar value based approach is that equity is a financial concern. It is the value, not the number of the prorated CRRs, that is ultimately of interest to LSEs. Future LMP prices and congestion charges are not known, however, so application of this metric must be based on some forecast of future congestion charges. The results of LMP Study 3b are used for this purpose, but it must be kept in mind that different congestion patterns could result in very different values for the proration ratio metric.

A second feature of the proration ratio metric is that it is calculated only for LSE CRR nominations. Thus, the calculated proration ratios will exclude (from the numerator and the denominator) the ISO's CRR reservations for TOR and ETC rights as well as CRRs allocated to LSEs for converted ETC rights. These allocations are excluded because they have a different basis and priority.

Third, in the case of LSEs serving load in more than one LAP, the proration ratio is calculated separately for the LSE's load in each LAP. This will help make it apparent whether differences across LSEs in the proration ratio are due to characteristics of the different LAPs or to other features of the allocation rules.

A potential limitation of the proration ratio metric is that it uses the value of the nominated CRRs as the denominator. This metric would be most meaningful if the base set of nominated CRRs for each LSE were exogenous. The variation in the overall proration ratio across LSEs in each scenario would then reflect differences in the extent to which LSEs were awarded this exogenously determined set of CRRs. For example, if the sources for the nominated CRRs were determined solely based on an LSE's entitlement to the output of generation resources at the source location and CRRs were nominated from all LSE generation resources, an assumption of exogenous CRR nominations might be more or less reasonable.

In practice, however, the CRR nomination rules provide LSEs considerable choice in the set of CRRs they nominate, so the set of nominated CRRs is not exogenous. Since different

LSEs may have pursued very different strategies in defining the set of CRRs they nominate, this metric may not always be a good measure of equity.

More specifically, since LSE CRRs are defined to common LAP sinks, differences in the CRR award ratios among LSEs serving load in a common LAP are caused by differences in the nominated sources. If all LSEs serving load in a LAP nominated the same proportion of CRRs from each source, all would have the same award ratio. Thus, differences in award ratios due to differences in nominated CRR sources must be carefully interpreted. A lower than average award ratio for a particular LSE could mean that the LSE only nominated CRRs from low priced sources, entailing a lower proration ratio than other LSEs but perhaps entailing receipt of overall higher valued CRRs by that LSE than other LSEs.[37]

Since a limitation of the proration ratio as a measure of the equity of CRR allocations is therefore that differences in the proration ratio across LSEs do not necessarily reflect inequities resulting from application of the proration rules but may simply reflect differences in source nominations across LSEs, a second step in the analysis of the scenario results is to assess the reason for such differences and whether they result from a particular feature of the proration rules. Moreover, since very skewed allocations of CRR value across LSEs may not be reflected in the proration ratio, other measures of proration equity have also been calculated.

3. CRR Payments per MW of Peak Load

The discussion above of the proration ratio metric suggests an alternative metric for measuring the equity of the CRR allocation, which is the expected value of the awarded CRRs per MW of peak load. One rationale for using such a statistic as a measure of the equity of the CRR allocation is that if all LSEs pay the LAP price, LSEs allocated CRRs with a higher total value per MW of LSE load would, other things equal, have a lower cost of meeting load, so equity implies that the value of the awarded CRRs per MW of load should be similar across LSEs within a LAP or even across LSEs in all LAPs.

Using expected CRR payments per MW of peak load as a measure of equity also has limitations. First, differences in expected CRR payments may not be viewed as inequitable if they are consistent with historical usage and congestion charges, so that there is no cost shifting. Second, differences in expected CRR payments do not translate into differences in the cost of meeting load if the LSEs own or have a long-term contract with the generation resource at the CRR source. In the latter case, higher CRR payments may be offset by higher congestion charges involved in using these generation resources to meet load.

Given the potential ambiguities in the CRR payments per megawatt of peak load metric, differences in CRR value across LSEs are not necessarily assumed to reflect inequities resulting from the allocation. Instead, the study focuses on analyzing and understanding the reasons for differences in this metric across LSEs.

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[37] This is illustrated in Appendix E.

4. Ratio of CRR Receipts to Congestion Payments

A third way of comparing the equity of alternative CRR allocations is to compare the ratio of LSE CRR receipts to congestion payments across LSEs. That is, given the overall ISO wide ratio of CRR payments to total congestion rents, how variable is this ratio across LSEs? A critical issue in applying such a metric is that in order to calculate LSE specific congestion payments it is necessary to define the source of the power used to meet the load of each LSE. Underlying this issue is the question of what is meant by the source of the power purchased by an LSE in a centrally dispatched generation market.

Before turning to a discussion in Section 4b of how such a congestion charge metric could be implemented, we discuss these conceptual issues in greater detail.

a) Conceptual Issues

A comparison of an LSE's congestion rent payout to congestion payments requires specification of the generation sources to be used for the calculation of congestion charges for each LSE. If the generation sources used for the calculation of LSE congestion charges are assumed to be the same as the generation sources actually used to meet load, then this calculation for the ISO system as a whole is not difficult; it compares total ISO congestion rent collections to the CRR payout, which is the first metric. The calculation of the congestion payments by an individual LSE is more complicated, however, because it depends on the source chosen for the generation used to meet the individual LSE's load. Moreover, once such a metric is calculated, its interpretation is not straightforward because for an individual LSE, a change in generation sources that decreases the proportion of congestion charges covered by CRRs for a given dispatch does not necessarily imply a higher cost of meeting load.

A natural way to think of the source of the power purchased by a specific LSE is that it is purchased from a generating unit that is producing that quantity of power. Since all power consumed by LSEs is necessarily produced by some generator, there is in principle a mapping from the generation producing power to the loads consuming power in each hour.[38] If one ignores the generation used to provide losses, the sum of the LSE-specific congestion charges calculated from actual generation to LSE load would sum to the total ISO congestion rents. The fundamental difficulty in applying this approach to calculating congestion charges at the LSE level, however, is the need to define which generator's output is being used to meet which LSE's load. For a system as large as that dispatched by the ISO, the number of possible pairings between generation and load is enormous.

Moreover, if the CRR sources used to compare congestion charges to CRR revenues do not have a logical connection to the actual generation sources an LSE uses to meet its load, then a comparison of congestion charges and CRR payments for that LSE may not be meaningful. For example, if the assumed set of generation sources used to calculate congestion charges are such that injecting power at these sources to meet load would violate transmission constraints, then the sum of the calculated congestion charges paid by LSEs could substantially exceed total

[38] One complication is that generation will exceed consumption by the amount of losses and there can be congestion charges associated with this generation.

ISO congestion rent collections. A difference between the CRR payout and congestion charges calculated relative to an arbitrary set of generator locations might therefore merely reflect the existence of transmission constraints that prevent some low cost generation sources from being used to meet load and shed no light on the equity of the CRR allocation.

The degree to which a specific LSE's CRR revenues match its congestion charges between source and sink will depend in part on whether the CRR sources are the same as the generation sources. If an LSE owns generation at the same location as its CRR source, or has options to buy at a fixed price at this location, then the LSE's cost of meeting load would never be more than the cost of dispatching its generation to meet its load, regardless of congestion. This relationship does not depend on the actual generation used to meet load in a particular hour, and suggests a definition of congestion charges that is based on both generation resources and CRR allocations.

Thus, one way to think of the source of the power purchased by a specific LSE is that each LSE purchases power at the source point of its CRRs, either from generation or from the spot market, and uses that power to meet its load. If one defines the source of the power used to meet an LSE's load in this manner, then an LSE would be fully hedged against congestion charges as long as the number of CRRs (from some source) equals the LSE's load. The LSE might not be fully hedged to the extent that its load exceeds its CRR allocation (and thus it might pay congestion charges) or its load is less than its allocation of CRR obligations (and thus the LSE could potentially be obligated to make CRR payments that would not be offset by negative congestion charges).[39]

The lack of a well-defined link between LSE load and the specific generation dispatched to meet that load is a fundamental reality that undermines efforts to calculate meaningful LSE specific congestion charges. The only apparent measure of the effectiveness of a set of congestion hedges that is not ultimately arbitrary is the ratio of the total congestion rents collected by the ISO to the total CRR payout. One can, however, introduce assumptions to define which generation is assumed to be meeting which load and use this to calculate LSE-specific congestion charges for the purpose of gauging the equity of alternative CRR allocations, recognizing that these results depend on the assumptions.

One such approach to defining the source of the power used to meet the load of a specific LSE could be that the power used to meet an LSE's load is produced by generation owned by that LSE, or by generation to whose output the LSE has a contractual entitlement. This approach would be straightforward to apply if each LSE's generation were dispatched solely to meet that LSE's load. Its application becomes ambiguous, however, if some of an LSE's generation is dispatched down because it is uneconomic, if the LSE's load exceeds its generation, or if some of the LSE's generation is dispatched to meet another LSE's load. Thus, even if there is a well-defined set of generation owned or contracted for by each LSE, calculation of LSE specific

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[39] The LSE-specific congestion charges calculated in this manner from CRR sources might sum to be less than the total ISO congestion rents (if there are counterflow CRRs that do not match the generation used to meet the LSE's load) or to be greater than the total ISO congestion rents (if there are constraints binding that were not fully allocated to CRRs).

congestion charges in the end may require application of additional and potentially arbitrary assumptions.

The complications in calculating LSE-specific congestion charges are discussed below first for the portion of an LSE's load that is met with the output of LSE generation resources and then for the portion of an LSE's load that is met with purchases from the spot market.

LSE Generation that is Dispatched

While it might appear reasonable to assume that the generation owned or under contract to a specific LSE that is operating either under a self-schedule or under the ISO's dispatch is used to meet that LSE's load, this is not necessarily the case. There are several considerations. First, it is possible that not all of an LSE's low cost generation at a particular location could be dispatched to meet that LSE's load because of transmission constraints. The generation might nevertheless be dispatched in a particular hour to meet the load of another LSE that has load at the same location as the generation.[40]

Second, it is possible that some of an LSE's high cost generation might be operating not because it is needed to meet the LSE's load but might instead have been dispatched out of merit, because of transmission constraints, to meet the load of another LSE with load at the same location as the high cost generation.[41] Thus, a particular LSE could simultaneously be selling high cost generation into the spot market at one location that is used to meet the load of another LSE and backing down its own low cost generation at another location so that it can buy even cheaper power on the spot market to meet its load at this second location.

Third, it needs to be kept in mind that aggregate generation injections will exceed aggregate load by the amount of transmission system losses.

For all of these reasons, it is not necessarily the case that the output of generation owned or under contract to a particular LSE and dispatched in a particular hour has been dispatched to meet that LSE's load.

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[40] In the example in Figure F-1 in Appendix F, 95 MW of Red's generation is dispatched at B, but Red LSE has only 5 MW of load at B and can only export 50 MW to C. Some of Red's generation at B is therefore dispatched to meet Green LSE's load at B, not the Red LSE's load. There are several reasons why an LSE might own or contract for more low cost generation at some locations than can always be delivered to meet its load. First, an LSE's generation resources will exceed its actual load in order to make allowance for forced and maintenance outages, reserves, etc. During a particular hour in which all of an LSE's low cost generation in a particular area is available, it might not be possible to dispatch all of the generation to meet the LSE's load, while during other hours outages might reduce the available low cost generation to the point that all could be dispatched to meet the LSE's load. Second, an LSE could have low cost generation at a particular location that would be dispatched to meet the LSE's load at that location during peak load conditions, but during low load conditions the LSE would not need all of the low cost generation to meet its load and would sell the generation into the spot market, backing down the higher cost generation of other LSEs with load at that location.

[41] In the example in Figure F-1 in Appendix F, Green LSE has 61 MW of load at C and 25 MW of low cost imports from A. Green therefore only needs to generate 36 MW at C to meet its load at C; the rest of its output is sold into the spot market.

LSE Load Met with Spot Market Purchases

A second complication arises in determining which generation is used to meet the portion of an LSE's load that is met with spot market purchases. If an LSE's load is met in part with power purchased on the spot market rather than with the LSE's generation (i.e., load exceeds generation injections by the LSE resources), resource ownership cannot be used to link generation to load for the purpose of calculating congestion charges. One assumption that could be made regarding the location at which the power is purchased (and thus the source from which congestion charges are calculated) would be that the power used to meet the LSE's load is purchased at the location of the lowest cost undispatched generation resources of that LSE up to the capacity of each resource available to that LSE until the generation stack equals load. Thus, the premise of this calculation would be that any generation that is not used to meet an LSE's load was not used because lower cost spot purchases were available, and thus the LSE's load can be treated as having been met with power purchased at the location of the undispatched LSE generation.

This premise that an LSE's generation that was not dispatched to meet the LSE's load was not dispatched because power could be purchased for less than the avoided generating costs would not necessarily hold true, however, if the transmission system were constrained. If there is transmission congestion an LSE's low cost generation might be idle not because lower cost power could be purchased at the same location, but because congestion makes it impossible to use additional low cost generation at that location to meet the LSE's load.

b) Potential Metrics

The implication of these conceptual issues is that there is no single "best way" to calculate LSE specific congestion charges to assess the equity of alternative CRR allocations. What assumptions and procedures should be used to calculate reasonable LSE specific congestion charges for comparison to LSE CRR revenues?[42] Several approaches are possible.

i. CRR and Resource Based Congestion Charge Calculation

The CRR and Resource Based Congestion Charge Calculation is based on the assumption that each LSE has designated its CRRs to source from its generation and sink at its load. Given this assumption it is possible to calculate the congestion associated with meeting each LSE's load while taking account of the conceptual issues described above using a four-step approach. This approach is consistent with allocation objective 5, which presumes that LSEs designate CRRs sourced from their generation resources.

Step 1. The CRR and Resource Based Congestion Charge Calculation starts with the LSE's generation (owned or contracted for) that is operating in the hour studied. It is assumed that the generation output from the LSE's resources at the locations with the lowest LMPs is used to

42 Because of the complexity entailed in calculating LSE-specific congestion charges, it has been necessary to limit the calculation of some of these metrics to a subset of the time periods covered by the LMP Study 3b and to restrict the calculation to an illustrative scenario in order to keep the analysis manageable.

meet the LSE's load up to the quantity of the CRRs sourced at each generator location.[43] Thus, the amount of generation at each location assumed to be meeting the LSE's load will be the minimum of the LSE's actual generation output at that location and the LSE's CRRs sourced from that location. The presumption underlying this approach is that generation in excess of the LSE's CRRs sourced at a generation location is being sold into the spot market because the LSE does not have transmission to meet its load from that resource. Under the CRR and Resource Based Congestion Charge Calculation the LSE's generation would be stacked to meet the LSE's load in this manner until the output of the LSE's generation equaled the LSE's load or the LMP price at the location of the next generation source in the stack exceeded the LAP price. Implementation of this step requires information for each hour on: a) each LSE's CRRs sourced at each location; b) each LSE's generation output at each location; c) the LMP price at each location.; and (d) each LSE's load

Step 2. If the actual generation output of an LSE's resources at locations with LMP prices that are less than the LAP price (and thus the generation resource's offer price must be less than the LAP price) is less than the LSEs' total load, the next step in the CRR and Resource Based Congestion Charge Calculation is to assume that spot power is purchased at the location of undispatched LSE generation at locations with LMP prices that are lower than the LAP, until the total energy taken from generation at each location is equal to the lower of the LSE's generating capacity at that location or the quantity of the LSE's CRRs sourced at that location. If the LSE has CRRs sourced at a location that exceed its actual generation, then it is known that dispatch of that generation to meet the LSE's load is feasible in conjunction with all other CRRs.[44] If the LSE's generation is backed down in the hour, this is presumably because the LSE can buy cheaper power on the spot market and deliver it to its load using the same transmission that supports its CRRs. Implementation of this step requires knowledge for each hour of a) each LSE's CRRs sourced at each location; b) each LSE's generation output at each location; c) the LMP price at each location; and d) the total generation capacity available to each LSE at each location (whether or not it is on line).

The resource assignment in Step 2 would continue until either a) all LSE generation at locations with LMP prices less than the LAP has been used to meet LSE load up to the amount of the CRRs sourced at each generation location and there is additional unmet LSE load, or b) all LSE load is met.

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43 Generation has been stacked based upon the LMP price at the location, rather than the offer price of the generation. There are three rationales for this approach. First, reliance on LMP prices rather than offer prices greatly simplifies the analysis. Second, since there is no actual link between generation and individual LSE load in a centrally dispatched market, there is no basis for concluding that particular generation was running to meet the owning LSE's load rather than to sell power into the spot market. The reality is that it would be profitable for an LSE that owns generation to dispatch all of its generation with costs lower than the LMP price, without regard to the level of its load. Third, self-scheduling and other incentives under the current pricing system have resulted in zero generation offer prices in the LMP Study 3b data that do not actually reflect the generator costs yet might substantially impact the metric. Assuming that the generation at the locations with the lowest LMP prices is dispatched first, maximizes the assumed congestion payments paid by that LSE, so it is a kind of worst case assumption.

44 This assumes that there are no outages during the particular hour that reduce transfer capability to the point that the CRRs would be infeasible.

Step 3. If all LSE generation at locations with LMP prices less than the LAP has been used to meet LSE load up to the amount of the CRRs sourced at each of those generation locations and there is additional unmet LSE load, then the third step would be to continue the resource stacking to meet LSE load, but dropping the restriction that the generator LMP must be less than the LAP price. This approach would start with the LSE generation at the CRR source locations with the lowest LMP prices not yet used to meet LSE load,[45] adding these resources to the resource stacking up to the lower of the capacity of the resource at that location or the LSE's CRR allocation from that source.[46] This stacking would continue until either all LSE load was met or generation had been scheduled from all LSE CRR sources to meet load up to the available resource capacity but unmet LSE load remained.[47] Implementation of the third step requires knowledge for each hour of a) each LSE's CRRs sourced at each location; b) the LMP price at each location; c) resource capacity available to that LSE at each location.

At the end of Step 3, either all LSE load would have been met, or all of the LSE's CRRs sinking at the LAP would have been assigned to meeting the LSE's load.

Step 4. Finally, if an LSE's actual load exceeds its CRRs sinking at its load, LSE generation at locations with LMP prices in excess of the LAP price (i.e., generation with counterflow schedules for which the LSE would be paid) and also in excess of the CRRs sourced at that location would be used to meet this incremental load up to the amount of generation actually dispatched at that location in the simulated hour.[48] Any LSE load in excess of the amount that could be met with LSE resources at locations with LMP prices in excess of the LAP price would be assumed to be met with generation located at the LAP, i.e., neither requiring congestion payments nor earning counterflow payments.

The result of applying the CRR and Resource Based Congestion Charge Calculation is that an LSE will be fully hedged if all of its generation at locations with non-zero CRR values is notionally scheduled to meet its load. It is overhedged if the LSE has CRRs from low cost locations that are not needed to meet its load or generation at high cost locations that is operating but not offset by counterflow CRRs. It is underhedged if the LSE has counterflow CRRs from high cost locations that are not needed to meet its load.

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[45] These resources would necessarily be at locations at which the LMP price exceeded the LAP price since generation at lower priced locations would have been used to meet LSE load up to the lower of the CRRs sourced at that location or the generating capacity at that location in Steps 1 and 2.

[46] It is proposed that this stacking would be without regard to whether the generation was actually operating in the hour or not.

[47] For LSEs serving load in more than one LAP or in scenarios in which CRRs are defined to subzones, some additional complications would arise.

[48] The rationale for this is that the allocation of CRRs would generally exhaust the transfer capability across likely constraints so load in excess of the CRR allocation would likely be met with generation at the same location as load, or at a higher priced location. In practice, under a LAP pricing system much of the generation used to meet load in excess of the CRR allocation would likely be counterflow, earning congestion payments rather than making congestion payments. On the other hand, since the generation used to meet load in calculating congestion charges for the CRR and Resource Based Approach would be capped at the actual generation, it can be assumed that an LSE would only be credited with counterflow payments on the generation that was economic at the LMP price. This assumption is conservative, assuming that the generation is at locations with the lowest LMPs and thus earning the lowest counterflow payments.

As discussed previously, there is not a unique way to match LSE generation resources to an LSE's load, and the rules described above could be applied in a different order, potentially leading to different results. Moreover, the ambiguity as to which generation is used to meet load is particularly acute if load is priced at the LAP level, rather than at the nodal or subzonal level, because there is not necessarily any relationship between the generation that would be dispatched to meet load distributed across the LAP and the generation that would actually be dispatched to meet a particular LSE's physical load.

The CRR and Resource Based Congestion Charge Calculation provides a reasonable measure of congestion charges for LSEs that designate CRRs from their generation to their load as is presumed to be the case by the fifth objective in the CRR allocation process. It is less clear that the methodology would provide a meaningful measure of congestion charges borne by LSEs that, for one reason or another, designate sources for their CRRs at which the LSE neither owns nor contracts for generation. For such LSEs the metric would calculate congestion charges as if all of their load were met either with generation providing counterflow or with generation located at the LAP, and thus paying no congestion charges.

ii. Resource Based Congestion Charge Calculation

An alternative approach to estimating LSE congestion payments would be to use the same process of stacking resources from low LMP price locations to high LMP price locations, but to ignore CRR entitlements. Thus, the first step would stack generation that is running at locations with LMP prices that are lower than the LAP price. The second step would be to add to this LSE generation that is not running but that is located at nodes with LMP prices that are lower than the LAP price. The third step would be to stack LSE generation that is running at locations with LMP prices that are higher than the LAP price. The final step would be to assume that any remaining LSE load is met by generation at the LAP. This approach seems more reasonable than the first approach for calculating the congestion charges of LSEs that have not designated CRRs sourced from their generation resources.

A fundamental problem with the Resource Based Congestion Charge Calculation, however, is that it implicitly assumes that all LSE generation could be dispatched to meet LSE load without violating any transmission constraints. This will almost certainly not be the case for the reasons discussed above, so congestion charges will be overstated by the methodology.

Under the Resource Based Congestion Charge Calculation, the calculated LSE congestion payments summed over all LSEs will likely be more than the total congestion rents collected by the ISO.[49]

[49] This can be seen by applying the Resource Based Congestion Charge Calculation to the first example described in Appendix G. In the first step generation that was dispatched would be used to meet the LSE's load without regard to CRR allocation. The next step would be to use undispatched low cost generation to meet remaining LSE load, again without regard to CRR allocations. In the third step, generation that was operating at high LMP locations would be used to meet remaining LSE load, again without regard to the CRR allocation.

iii. CRR Based Congestion Charge Calculation

A third step of assumptions for calculating the congestion charges paid by an individual LSE would be to stack resources from low LMP price locations to high LMP price locations but to base the assignment of generator sources to LSEs solely on the CRR source quantities at each location, without regard to actual resource entitlements. This approach assumes that LSE load is met by stacking up CRR sources in the order of LMP prices until LSE load was met. If LSE load exceeds total CRRs sinking at the LAP, then the excess load would be assumed to be met with generation at the LAP.[50]

Like the Resource-Based Congestion Charge Calculation methodology, the CRR Based Congestion Charge Calculation will tend to overstate LSE congestion charges, so the sum of the calculated congestion charges will likely exceed total ISO congestion rents. The reason for this is that since CRR sources at counterflow locations will be included in the congestion charge stack only when LSE load is high, there will be a tendency for this approach to exclude these counterflow payments from the calculation of congestion charges when load is low, thus tending to overstate congestion charges.

iv. Discussion

All of the methods discussed for assigning congestion charges to individual LSE power purchases are ultimately arbitrary if the LSE is a net buyer or if its generation is made available for economic dispatch The outcome of the congestion charge calculation depends on the assumptions that are made as to which generation is used to meet the LSE's load and which is sold in the spot market, as well as assumptions about which power is implicitly purchased to meet the LSE's load instead of meeting the LSE's load with the LSE's own generation. There is no such matching in the actual dispatch, so any matching that is undertaken for the purpose of calculating "congestion charges" paid by individual LSEs is arbitrary. Thus, the congestion charges calculated for meeting an individual LSE's load will vary with the assumptions made, making a comparison of congestion charges to CCR payments an uncertain measure of the relative equity of alternative CRR allocations.

C. Uncertainty

A fundamental limitation of using the simulation results of the LMP study to compare LSE congestion charges and CRR payments and in particular to assess the equity of individual LSE CRR allocations, is that even if one develops an acceptable methodology for calculating LSE specific congestion charges, the annual congestion charge estimates based on the LMP study provide only a single view of an uncertain future. All of the metrics described above are evaluated in this report based on the congestion pattern in the LMP Study 3b, which is in many

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[50] In the example in Appendix G used to illustrate the operation of the CRR and resource-based methodology and the resource-based methodology in Appendix H, the CRR Based Congestion Charge Calculation results basically the same outcome as CRR Based Congestion Charge Calculation because in the example all of the LSEs CRRs were sourced from generation. Under the first congestion charge metric CRRs not sourced from generation would produce CRR revenues but there would be no offsetting congestion charges because the load would be assumed to be met at the LAP, so this third metric would provide a different perspective on equity for LSEs with such designations.

respects a single realization of many possible annual pricing outcomes. Hence, a set of CRRs that in aggregate offsets an LSE's congestion charges for the LMP Study 3b outcome, might not offset the LSE's congestion charges for a different market outcome. Even if the LMP study accurately modeled the expected value of LMP prices, and expected CRR payments were exactly equal to expected congestion charges for every LSE based on the LMP study results, it could nevertheless be the case that real-world CRR payments could differ substantially from real-world congestion charges for all LSEs for many possible pricing outcomes.

Similarly, if one were instead to use the LMP study to assess the annual cost for an LSE to meet its load given an its resource costs, it is also important to recognize that the LMP study is only one possible LMP pricing outcome. An individual LSE's costs of meeting load could vary widely across many possible real-world dispatch and pricing outcomes.

Assessment of the impact of alternative CRR allocations on the congestion hedging ability of individual LSEs or of all LSEs collectively would ideally take into account price volatility, and would not be based simply on a single set of LMP prices. The LMP prices from a single scenario give little indication of how a particular CRR allocation would impact LSEs under alternative congestion patterns and thus provides limited information for assessing whether this set of CRRs would be a good or bad hedge for a particular LSE. CRRs are a good or bad hedge against congestion charges depending on whether they match the generation sources owned or under contract to that LSE that would be used to meet that LSEs load. Assessing the hedge provided by a CRR allocation is more difficult if an LSE has no generation or contracts and simply buys power in the spot market. In this case, the only way to assess the hedge provided by a set of CRRs would be through assessment of their performance over multiple LMP scenarios.

A full analysis of the potential variability in either LSE congestion charges, CRR payments or the cost of meeting load would require extensive sensitivity analysis of varying congestion patterns and pricing in California. This would require modeling of varying load conditions inside and outside of California, low and high hydro conditions, differing patterns of gas pipeline transmission congestion, prolonged nuclear plant outages, etc. If one varied these conditions, and also varied the loads and resources of each LSE, the analysis could examine the sensitivity of the effectiveness of LSE hedging to changes in congestion; even this analysis is complicated, however, by simultaneous changes in an LSE's load and resources.

One approach to assessing the degree of sensitivity of LSE hedging to changes in congestion charges could be to use the results of the LMP Study 3b, and to apply the various metrics on a daily basis and portray the range as well as the mean of these metrics.[51] This would provide insight into the variability in the metrics over the conditions observed during the study year. However, under this approach many variables would be changing simultaneously and it would be relatively difficult to distinguish the impact of different factors.

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[51] One could calculate the variance of these ratios but this variance would be calculated for the probabilities in the LMP Study 3b which very likely would not be the probabilities of these outcomes across a wider set of transmission system environments. The intent is therefore to focus on the range in the daily values as a measure of the potential dispersion in hedging outcomes.

An alternative approach to accounting for the impact of uncertainty on LSE congestion charges would be to fix the load and resources (as well as their offer prices) of a specific LSE and then to examine the congestion hedging results for the LSE under alternative assumptions about the external conditions that it faces. The analysis could then introduce variations in the supply of other resources and the demands of other LSEs, and examine the impact on congestion hedging of the variety of LMP prices that might occur. One thus could calculate the LSE's cost of meeting its load using only its own resources versus if it were to buy and sells power in the spot market in order to examine how the LSE's cost of meeting this specific load would vary across changes in market conditions. A full scale analysis of this type is beyond what can be undertaken in the context of CRR Study 2, thought, because it would require rerunning LMP Study 3b many times for each LSE to generate multiple market outcomes.

A shortcut, however, would be to potentially implement the following. Choose a fixed load for a particular LSE, such as 1,500 MW. The analysis would also fix the LSE's resources and offer prices available to meet that load to correspond to the actual resources used in one hour of the LMP Study 3b. The analysis would then choose a larger set of hours in the LMP study whose aggregate load and generation levels would be consistent with that level of load for that LSE, and would assume that all load during those hours, other than the assumed 1500 MW, was the load of other LSEs. For each hour studied the analysis would calculate the cost of purchasing power to meet the LSE's load, value the LSE's CRRs, and value the power produced by the LSE's generation, without regard to whether that generation went to meet load or was sold in the spot market. The analysis would calculate a net cost of meeting load that would vary across the hours showing the variability in the cost of meeting a given level of load with a given CRR allocation due to changes in market conditions external to the LSE. The analysis could compare this to the cost to the LSE of just using its lowest cost generation to meet its load and not selling in the spot market, which would show that the LSE would always be better off taking advantage of the spot market. The analysis could also examine how the variability of this cost of meeting load changed with different CRR allocations.

A further analysis might define three load states for each LSE, high, medium and low, fix the LSE's resources for each state, and then assume that all variation in load and LMP prices across the hours included in the load state was due to the loads and resources of other LSEs. The analysis would need to define which of the 8,760 outcomes would be used for high load scenarios, which for medium and which for low. The analysis would then extract the LMP and congestion prices for the LAP and the generation locations of the LSE for each of these scenarios and calculate the net cost of meeting load based on the assumed resource costs. The analysis could then compare the variance in the cost of meeting each LSE's load across the various states of the world.

VI. CRR STUDY 2 SCENARIO DESCRIPTIONS

The CRR Study 2 base case was designed to analyze CRR allocations for six distinct scenarios. In addition, a number of sensitivity cases were run for some or all scenarios. The scenarios differ in terms of three elements: whether LSE CRRs are modeled as options or obligations, whether ETC reservations are modeled as options or obligations, and whether LSEs may source CRR nominations from trading hubs.

The combinations are summarized below:

- *Scenario I: LSE CRRs are obligations.* ETC reservations are modeled as obligations. CRRs cannot be sourced from trading hubs.

- *Scenario II: LSE CRRs are options.* ETC reservations are modeled as options. CRRs cannot be sourced from trading hubs.

- *Scenario III: LSE CRRs are obligations.* ETC reservations are modeled as options. CRRs cannot be sourced from trading hubs.

- *Scenario IV: LSE CRRs are obligations.* ETC reservations are modeled as obligations. CRRs can be sourced from trading hubs.

- *Scenario V: LSE CRRs are options.* ETC reservations are modeled as options. CRRs can be sourced from trading hubs.

- *Scenario VI: LSE CRRs are obligations.* ETC reservations are modeled as options. CRRs can be sourced from trading hubs.

The base case scenarios share a number of common assumptions. The CRR allocation process is based on the expected 2006 grid configuration. 75% of the transfer capability of the grid is made available in a first stage to support an "annual" CRR allocation, and the remaining transfer capability (taking account of transmission outages) is assumed to be made available in a subsequent "monthly" allocation process.[52] The two allocations were conducted sequentially in CRR Study 2 so that LSEs knew the outcome of the "annual" allocation before submitting their "monthly" nominations, just as planned under the MRTU. For the purpose of CRR Study 2, LSEs were allowed to submit different CRR nominations for each month, even for the "annual" allocation, and the nominations were capped based on 75% of each LSE's monthly peak load. LSEs were also permitted to submit distinct CRR nominations for the on- and off-peak period of each month. LSEs thus potentially made 24 distinct CRR nominations for annual CRRs for each scenario. LSEs also made separate nominations for each of the six scenarios of CRR Study 2.

Under all scenarios reservations reflecting transmission ownership rights were modeled as options, as were existing transmission rights that have been converted to CRRs.

The upper bound on LSE CRR nominations for the on- and off-peak period for each month was based on the 99.5% level on the LSE's load duration curve for the study year, adjusted for assumed load growth to 2006.

In addition to the base case, the study addresses several sensitivity cases:[53]

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52 The transmission system constraints modeled in the CRR Study 2 simultaneous feasibility test are described in Appendix K.

53 Appendix B of CRR Study 2 Final Scenario Assumptions mentioned several other possible sensitivity cases. Sensitivity 2 envisioned eliminating the priority distinction between ETC and TOR reservations, CVR awards and LSE CRR awards. The need for such a sensitivity case has not yet been evaluated. Sensitivity 3 was not

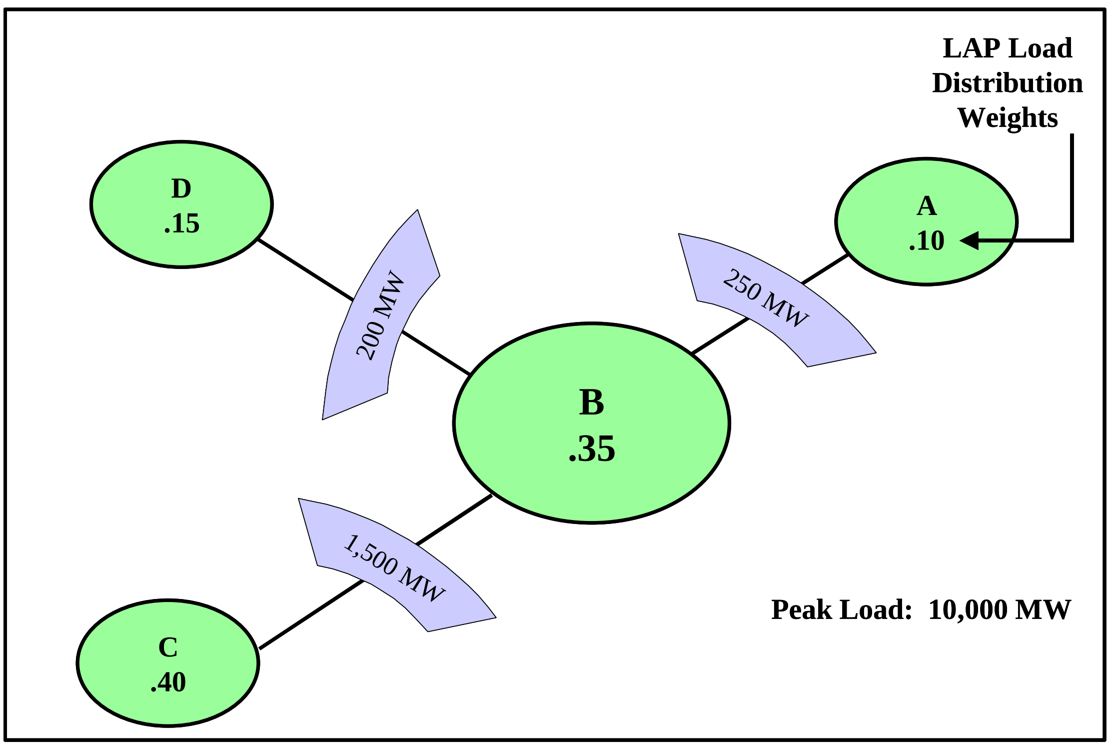
- *Sensitivity 1:* Out of control area LSEs can nominate CRRs sinking outside the CAISO control area for allocation. This sensitivity analysis has not yet been completed.

- *Sensitivity 5:* The simultaneous feasibility test for CRR nominations sinking at the LAPs is applied to the CRRs sinking at the LAP. CRRs are either feasible to the entire LAP or infeasible. CRRs would be settled based on LAP prices.

- *Sensitivity 7:* The simultaneous feasibility test for CRRs is applied to CRRs sinking in subzones as in the base case. CRRs are also valued based on the subzone prices.

The difference between the base case and Sensitivity 5 and 7 CRR allocation and settlement methodologies can be clarified with a simple example. The examples assume that the LAP is comprised of 4 sub-zones A, B, C, D with Load Distribution Factors (LDFs or LAP weights) and line limits between sub-zones as portrayed in Figure 1.

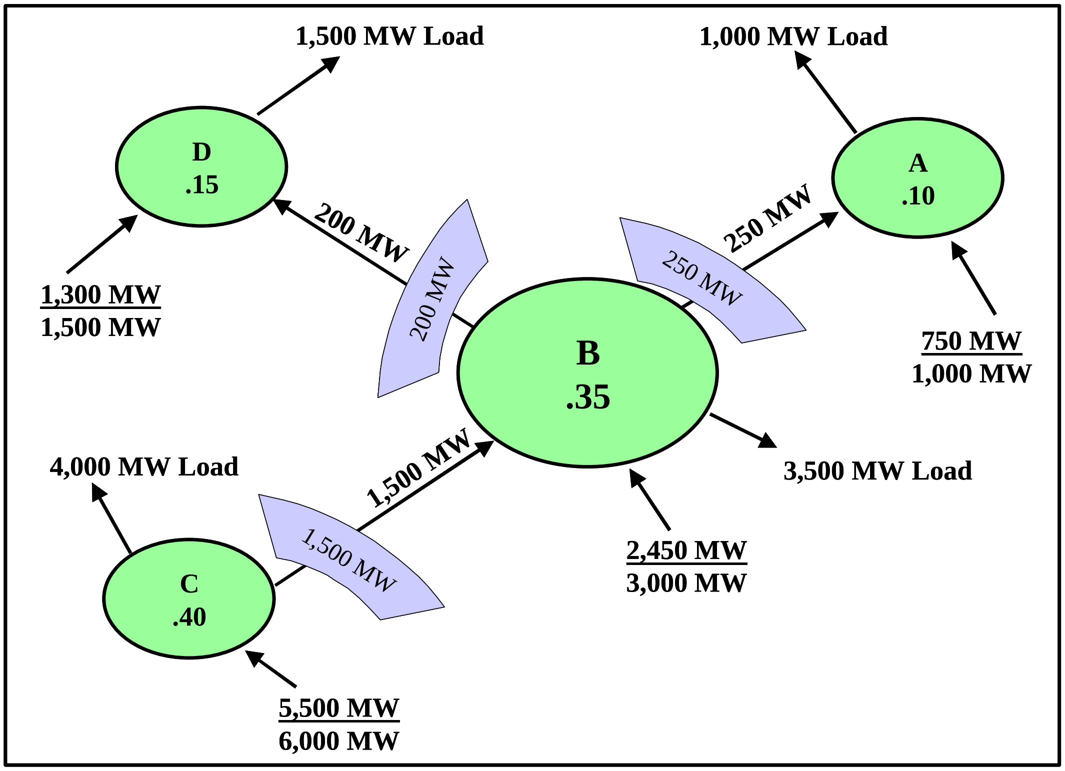
Figure 1
Illustrative Transmission Grid



run because WAPA was not modeled as part of the CAISO control area in the base case. Scenario IV envisioned changes in the proportion of the system made available to support CRRs awarded on an annual and monthly basis. The need for running such a sensitivity case has not yet been evaluated. Similarly, Sensitivity 6 envisioned modeling ETC reservations at the LAP level, rather than at the relevant nodes. The need for such a sensitivity case has not yet been evaluated.

The peak load of 10,000 MW can be met with generation located at A, B, C and D, as shown in Figure 2. Total generation resources are 11,500, providing a 15% reserve margin over peak load.

Figure 2
Dispatch to Meet Peak Load



This example will first be used to illustrate the application of the simultaneous feasibility test at the LAP level, the process modeled as Sensitivity 5 in CRR Study 2. This is also the process described in the MD02 filings.

Suppose that LSEs sought to nominate CRRs from all 6,000 MW of the generation located in subzone C to the LAP but did not nominate CRRs sourced from generation located in subzones A, B or D. This would be a likely outcome if LSEs expected the LAP price to be lower than the prices in subzones A, B and D. The simultaneous feasibility test would test whether 6,000 MW of load at the LAP could be met with 6,000 MW of generation at C without violating any transmission constraints. The LAP is not a physical location, however, so the load at the LAP is modeled by spreading it out to the subzones based on load distribution factors reflecting the expected proportions of load located in each subzone. Multiplying the 6,000 MW of LAP load by the load distribution factors portrayed in Figure 1 (.1 for subzone A, .35 for subzone B, .40 for subzone C and .15 for subzone D) results in the load distribution portrayed in Figure 3. The 900 MW of load at D, 600 MW at A, 2,100 MW at B and 2,400 MW at C sum to the 6,000 MW of LAP load.

Figure 3
Simultaneous Feasibility Test
6,000 CRRs

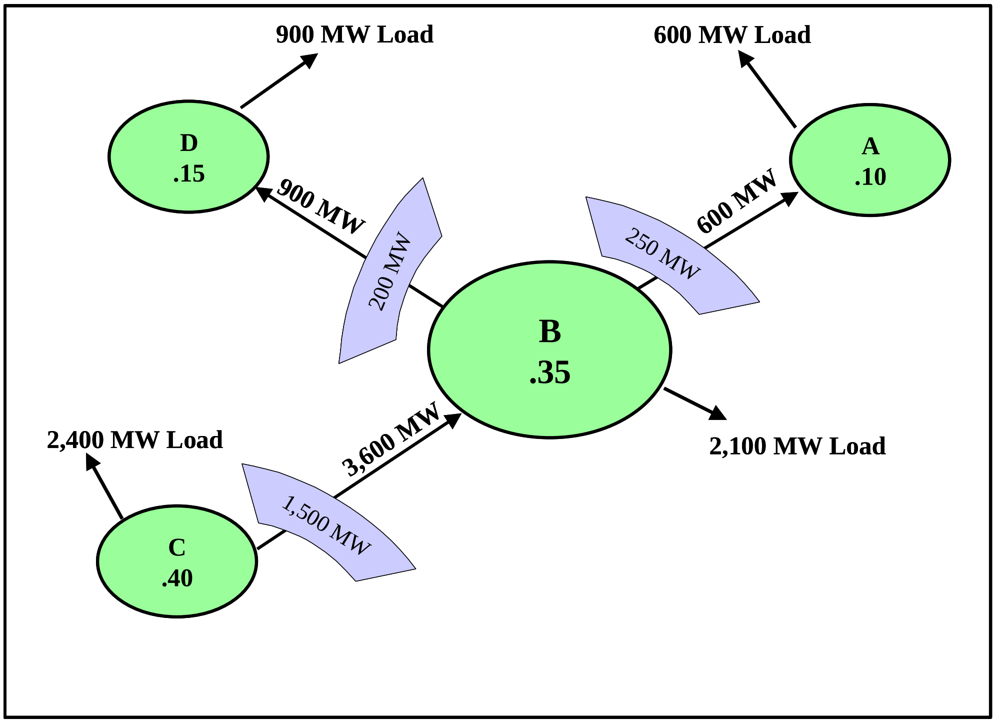


Figure 3 also shows the power flows entailed in meeting this load with generation at C. The power used to meet the 900 MW of load at D, the 600 MW at A and the 2,100 MW at B using generation at C must all flow from C to B, so those flows are 3,600 MW. The remaining 2,400 MW is generated at C to meet load in the C subzone. Similarly, the power used to meet the 600 MW of load at A must flow from B to A and the power used to meet the load at D must flow over the transmission lines from B to D.

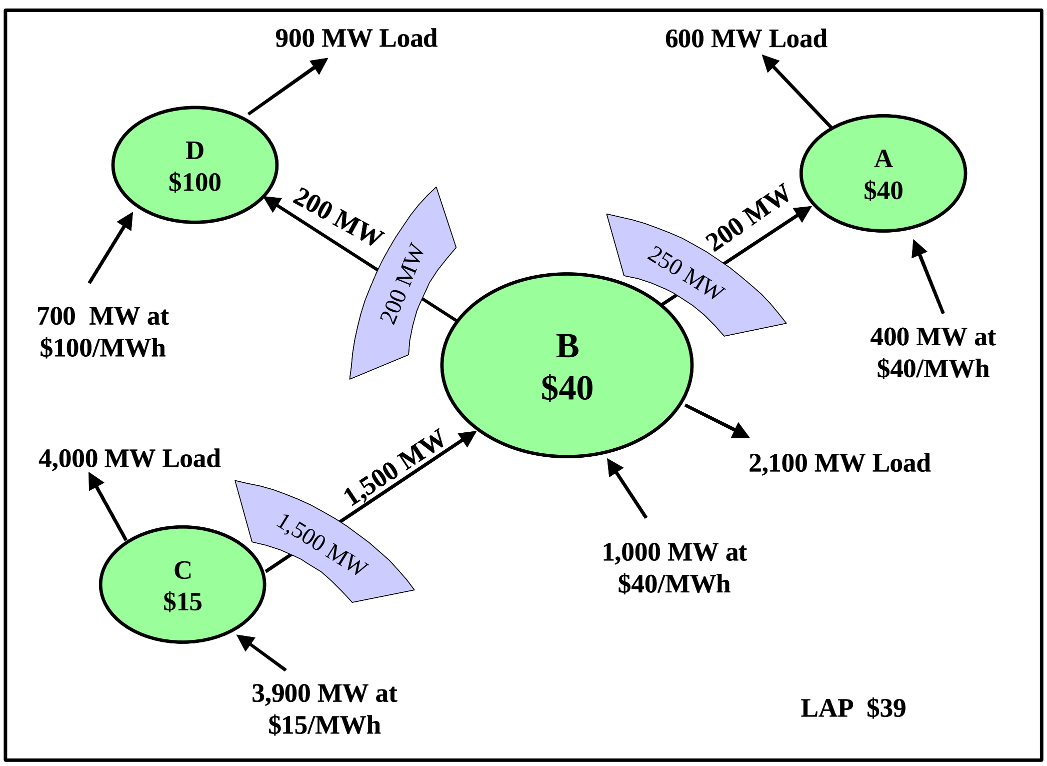
Figure 3 shows that attempting to meet these loads at B, A and D solely with generation located at C would overload several transmission constraints. Specifically, there would be 900 MW of power flowing over the 200 MW constraint from B to D, 600 MW flowing over the 250 MW constraint from B to A, and 3,600 MW flowing over the 1,500 MW constraint from C to B. These overloads mean that the award of 6,000 MW of CRRs from C to the LAP would not satisfy the simultaneous feasibility test.

These overloads in the simultaneous feasibility test do not have any significance regarding actual power system reliability; they just mean that the system would not be dispatched in this manner (i.e., that the system operator could not meet 6,000 MW of LAP load with generation at C). The simultaneous feasibility test is a financial test. If the CRR allocation satisfied the simultaneous feasibility test and if there no outages, deratings or loopflows that reduced transfer capability in the day-ahead market, then the congestion charges collected in the day-ahead market would be sufficient to fund payments to CRR holders.

Because the award of 6,000 CRRs from C to the LAP does not satisfy the simultaneous feasibility test, if those CRRs were awarded the ISO's congestion charges in the day-ahead market would not necessarily be sufficient to cover payments to CRR holders, even without any reductions in transfer capability due to outages, deratings or loopflows. The ISO would not necessarily be revenue-inadequate, but it could be.

Suppose, for example, that the load in the day-ahead market were 6,000 MW met with the dispatch portrayed in Figure 4. The cheapest power on the system is located at C where the offer price of the incremental generator is only $15/MW. Only 1,500 MW of power can be exported from C to B, however, without overloading the constraint from B to C, so higher-cost generation at B must be dispatched to meet the remaining load. The marginal generator dispatched at B to meet incremental load at B as well as at A and D, has an offer price of $40, which sets the LMP price at B. The 400 MW of generation located at A is also economic at a price of $40/MW, so the constraint between B and A is not binding (at a price of $40/MW, only 200 MW of imports from B are needed to meet load at A compared to a capacity of 250 MW) and the LMP price is $40/MW at A as well. Finally, load is 900 MW at D compared to import capacity of only 200 MW, so incremental load at D is met with generation having an offer price of $100/MWh, and the price at D is $100/MWh.

Figure 4
Day-Ahead Dispatch



The LAP price paid by LSEs would be the load weighted average LMP price, which would be $39/MWh in this example, as shown in Table 5.

Table 5
Calculation of LAP Price

	MW	Price ($/MWh)	Cost ($)
D	900	$100	$90,000
A	600	$40	$24,000
B	2,100	$40	$84,000
C	2,400	$15	$36,000
	6,000	$39	$234,000

The ISO's congestion rent collections (the difference between the total payments by loads and the total payments to generators) would be $49,500 in this hour as shown in Table 6.

Table 6
ISO Congestion Rent Collections
Payments by Load

	MW	Price ($/MWh)	Collections ($)	Payments ($)
Payments to Loads				
	6,000	39	$234,000	
Payments to Generators				
D	700	100		$70,000
A	400	40		$16,000
B	1,000	40		$40,000
C	3,900	15		$58,000
Total				$184,500
Net Congestion Rents			$49,500	

Now suppose that the ISO had awarded 6,000 CRRs from C to the LAP. Each CRR holder would be entitled to be paid the difference between the LAP price and the price at C -- $24/MWh ($39/MWh - $15/MWh). Paying CRR holders $24 for all 6,000 CRRs would cost $144,000 compared to the ISO's congestion rent collections of only $49,500. This is what is meant by revenue inadequacy.

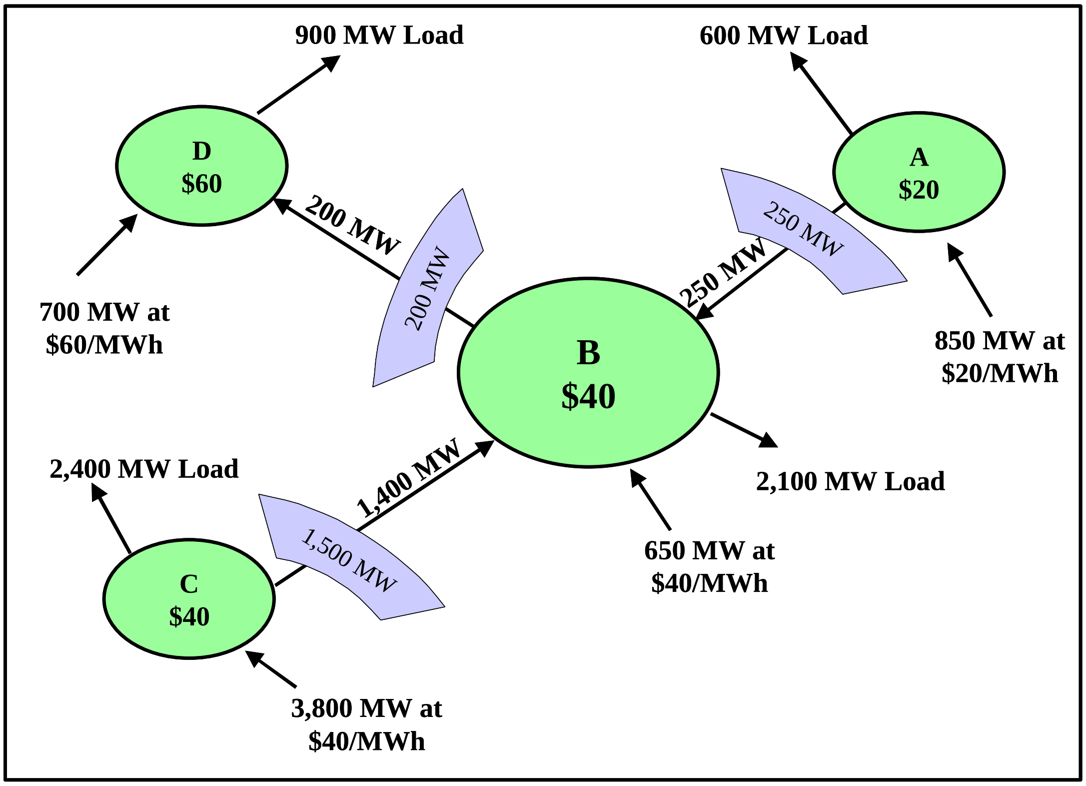
The ISO's revenue inadequacy in this example is directly attributable to the award of infeasible CRRs. This is illustrated in Table 7. Figure 3 showed that the award of 6,000 CRRs from C to the LAP entailed 700 MW of infeasible flows over the B-D constraint. At the $60 price difference between B and D shown in Figure 4, these infeasible flows entailed CRR payments of $42,000. Similarly, Figure 3 showed that the award of 6,000 CRRs from C to the LAP entailed 2,100 MW of infeasible flows over C-B. At the $25 price difference between C and B shown in Figure 4, these infeasible flows had a cost of $52,500. Thus, the total cost of the infeasible flows was $94,500. This is precisely the difference in the example between the ISO's CRR payment obligation and congestion rent collections.

Table 7
Source of Congestion Rent Shortfall

		MW	Price Difference ($/MW)	Total ($)
Infeasible	B-D	700	$60	$42,000
	C-B	2,100	$25	$52,500
Total				$94,500
Congestion Rents				$49,500
				$144,000

Whether the award of infeasible CRRs actually results in a shortfall in the ISO's CRR settlements depends on the pattern of congestion. An ISO could run a surplus despite awarding infeasible CRRs if the actual congestion pattern included constraints not overloaded in the simultaneous feasibility test or if some constraints were binding in a different direction than hedged by CRRs, as illustrated by the dispatch portrayed in Figure 8.

Figure 8
Alternative Day-Ahead Dispatch



The LAP price in this example is $41/MWh as shown in Table 9.

Table 9
LAP Price Calculation for Alternative Day-Ahead Market

	MW	Price ($/MWh)	Payment
D	900	$60	$54,000
A	600	$20	$12,000
B	2,100	$40	$84,000
C	2,400	$40	$96,000
Total	6,000	$41	$246,000

The ISO's congestion rent collections in this example would be $9,000, as shown in Table 10.

Table 10
Congestion Rent Calculation for Alternative Day-Ahead Market

	MW	Price ($/MWh)	Collections ($)	Payments ($)
Payments to Loads				
	6,000	41	$246,000	
Payments to Generators				
A	850	20		$17,000
B	650	40		$26,000
C	3,800	40		$152,000
D	700	60		$42,000
Total				$237,000
Net Congestion Rents			$9,000	

Since the price at C is $40/MWh and the LAP price is $41/MWh, each CRR holder would be entitled to a $1 payment. Total payments to CRR holders would therefore be $6,000, compared to the ISO's congestion rent collections of $9,000, so there would be a surplus in the TCC account, despite the award of infeasible CRRs. The reason for this surplus is that the infeasible CRRs into subzone D have a negative value in this example, so they reduce the payment to CRR holders rather than inflating that payment.

The outcome in which the congestion pattern is such that there is no shortfall in the ISO's CRR settlements despite the award of a substantial number of infeasible CRRs is fortuitous and cannot be counted upon. While good luck in terms of prices and congestion patterns might cause infeasible CRRs to produce a surplus in the ISO's CRR settlements, bad luck could produce a much larger shortfall than anticipated. For this reason, the simultaneous feasible test is applied to CRR awards to ensure that the ISO's CRR settlements will be revenue adequate, even in the event of unlucky congestion levels and patterns.

Returning to the CRR flows portrayed in Figure 3, since the award of 6,000 CRRs from C to the LAP would not be feasible, the actual awards would need to be scaled back to ensure the revenue adequacy of the awarded CRRs. Under Sensitivity 5, CRRs are awarded to the LAP as a whole, so the overall CRR awards would need to be scaled back such that no constraint would be violated.

The flows over constraint B-D are 900 MW in Figure 3 compared to the 200 MW limit so the CRR awards would need to be scaled down to restore feasibility by applying a factor of 2/9 to the 6,000 MW of nominations. Two-ninths of 6,000 is 1,333 1/3, so 1,333 1/3 C to LAP CRRs could be awarded without violating the B to D constraint.

The feasibility of the 1,333 1/3 CRRs from C to the LAP would be tested in the same manner as the original 6,000 CRRs. The first step would be to apply the load distribution factors to the CRRs to spread the load out to the subzones. The .15 load distribution factor for D applied to 1,333 1/3 MW assigns 200 MW of load to subzone D as shown in Figure 11. Similarly, the .1 load distribution factor for subzone A would assign 133 1/3 MW of load to subzone A. The .35 load distribution factor for subzone B would assign 466 2/3 MW of load to that subzone, while the .4 load distribution factor for subzone C would assign the remaining 533 1/3 MW of load to subzone C. The four subzone loads would sum to the 1,333 1/3 MW.

Figure 11
Sensitivity 5 CRR Allocation

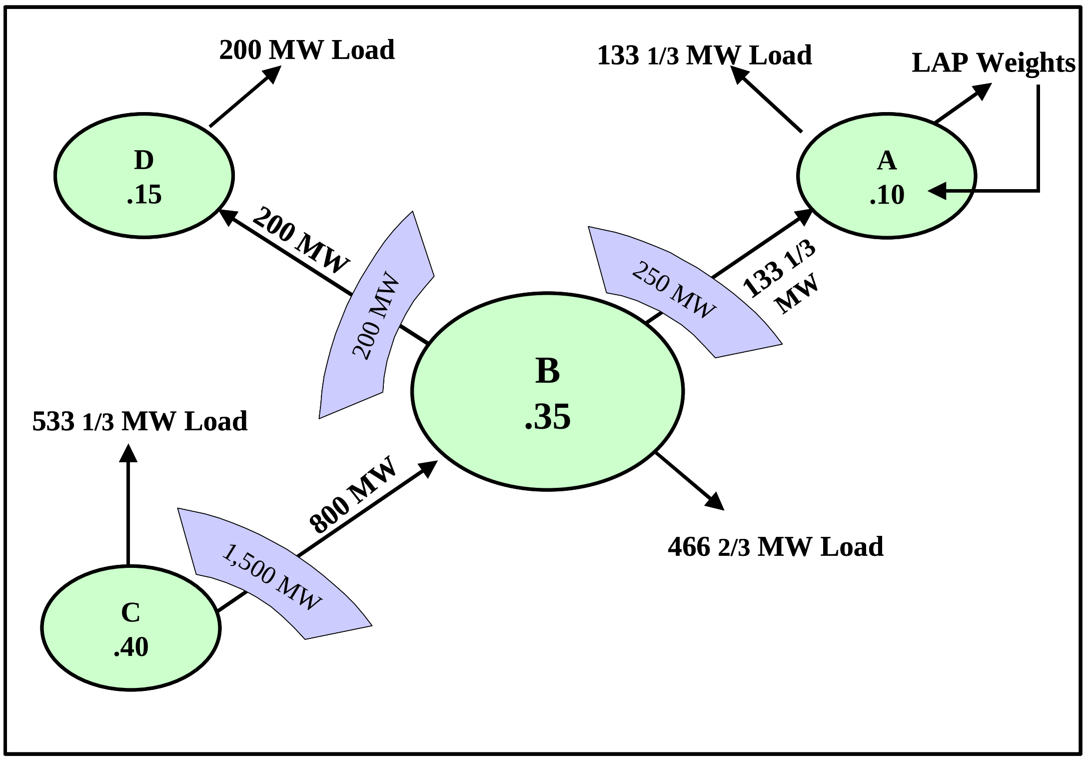


Figure 11 shows the transmission system flows that would be produced in meeting 1,333 1/3 MW of load at the LAP with generation at C. It can be seen that the B-D constraint is binding but not violated, while none of the other limits is binding.[54] The award of these 1,333 1/3 CRRs from C to the LAP therefore satisfies the simultaneous feasibility test and would be revenue adequate absent outages, deratings or adverse loopflows. The revenue adequacy of this CRR allocation can be illustrated using the dispatch portrayed in Figure 4. In this dispatch, the LAP price was $39, compared to the $15/MWh price at C, so each CRR would be worth $24. Paying $24 to each of 1,333 1/3 CRRs would cost $32,000, compared to ISO congestion rent collections of $49,500 (see Table 6), so the ISO would show a surplus in its CRR account.

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54 The flows on B-A are 133 1/3 compared to the 250 MW limit, and the flows are 800 MW on C-B, compared to the 1,500 MW limit.

This surplus arises because the award of 1,333 1/3 CRRs from C to the LAP does not exhaust the transfer capability on B-A or C-B so when these constraints are binding the ISO collects congestion charges on power flows equal to the limit, while the CRR flows on which the ISO's payment obligation are based use only part of the interface. Table 12shows that the difference between the ISO's congestion rent collections ($49,500) and its CRR payments ($32,000), is exactly equal to the congestion charges on the unallocated portion of the B-A and C-B constraints.

Table 12
Sources of Congestion Rent Surplus

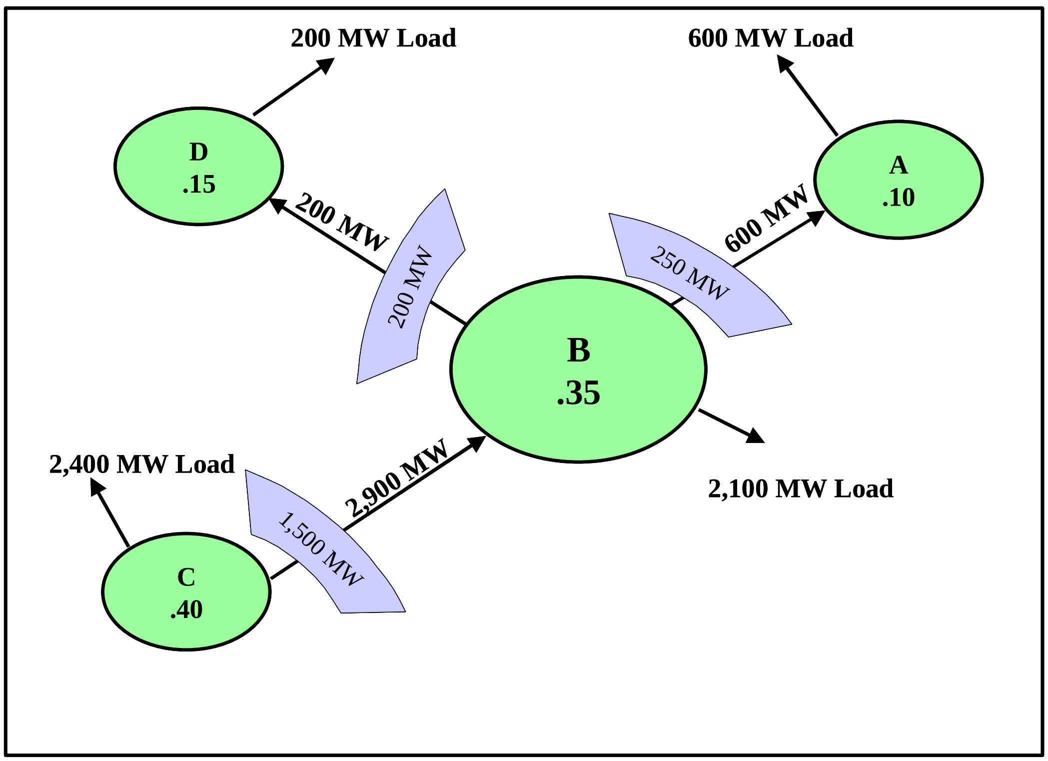
	Unsold Capacity	Price Difference	Value
B-A	116 2/3 MW	$0	$0
C-B	700 MW	$25	$17,500
CRR Payments			$32,000
Total			$49,500

These CRRs would also be revenue adequate for the dispatch portrayed in Figure 8, entailing payments of $1,333 1/3 ($1 on 1,333 1/3 CRRs) compared to $9,000 of congestion rent collections.

We now turn to a second method of applying the simultaneous feasibility test and settle CRRs. Under this approach, the simultaneous feasibility test would be applied at the subzonal level, with the CRRs awarded sinking in specific subzones rather than the LAP, and these CRRs would be settled based on the subzonal price rather than the LAP price. This approach is referred to as Sensitivity 7 in CRR Study 2.

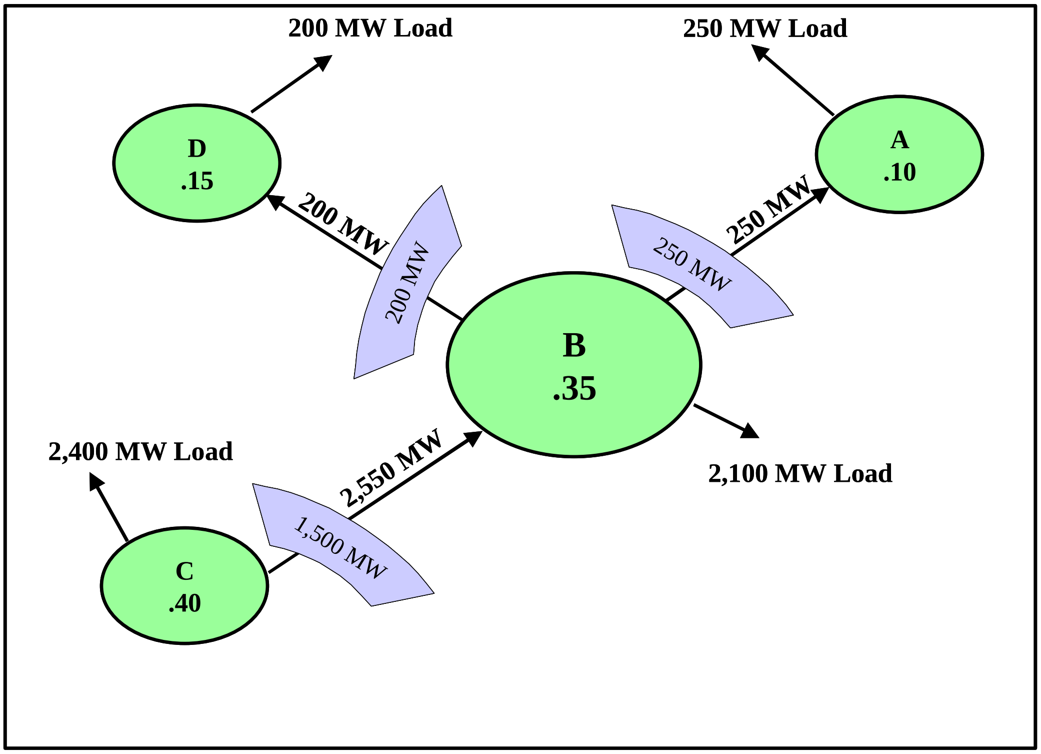
There is more than one way to handle CRR nominations under Sensitivity 7 but for clarity of explanation we will assume that LSEs submit the same 6,000 C to LAP nominations as in the Sensitivity 5 example. Thus, the initial load flow under this approach would be the same as portrayed in Figure 3. The difference would be in how the overloads would be resolved. Under the Sensitivity 5 approach, the overload on B-D was resolved by prorating back CRRs from C to the entire LAP by 2/9, reducing CRR awards to 1,333 1/3 from the 6,000 nominations. Under the Sensitivity 7 approach, on the other hand, the ISO would initially only prorate back the CRRs sinking in subzone D. Thus, the first step in defining a feasible set of CRR awards would be to reduce the awards sinking in subzone D from 900 to 200. This would eliminate the overloads in B-D and also reduce the flows on C-B by 700 MW. The CRR flows would still exceed the B-A and C-B limits as shown in Figure 13.

Figure 13
Sensitivity 7 Simultaneous Feasibility Test – Step 2



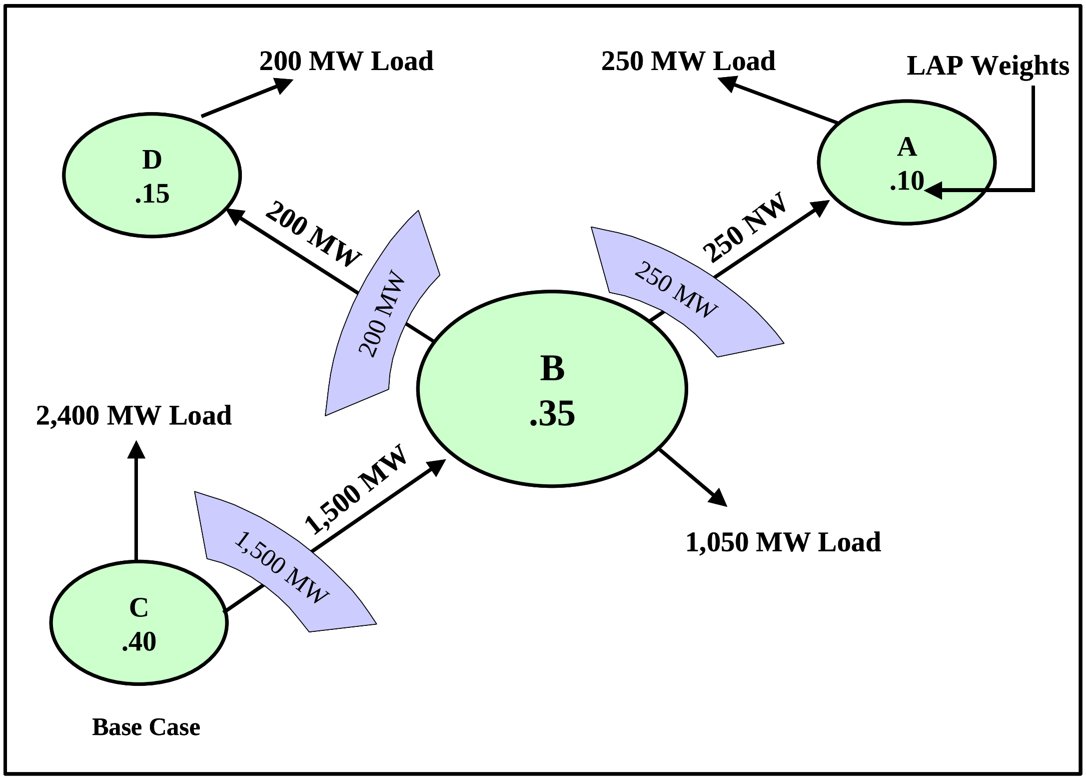
The next step would be to eliminate the overloads on B-A by reducing the CRR flows sinking in A from 600 to 250. This would eliminate the overload on B-A and also reduce the flows on C-B by a further 350 as shown in Figure 14.

Figure 14
Sensitivity 7 Simultaneous Feasibility Test – Step 3



The C-B interface would still be overloaded by these CRR flows as shown in Figure 14, so it would be necessary to reduce the flows over C-B by another 1,050 MW by eliminating 1,050 CRRs sinking at B. This would result in the CRR flows portrayed in Figure 15.

Figure 15
Sensitivity 7 CRR Allocation



Thus, under the Sensitivity 7 approach, the ISO would award 200 C-D CRRs, 250 C-A CRRs, 1,050 CRRs from C to B and 2,400 CRRs from C to C. Another way of thinking about this allocation of these subzonal CRRs is that LSEs are allocated as many CRRs sinking at the LAP as is feasible (1,333 1/3 in the example) and then any remaining transfer capability is used to support the award of additional CRRs sinking in particular subzones, as illustrated in Table 16.

Table 16
Rebundled Subzonal CRRs

		LAP CRRs	Net CRRs
C-D	200	- 200	0
C-A	250	- 133 1/3	116 2/3
C-B	1,050	- 466 2/3	583 1/3
C-C	2,400	- 533 1/3	1,866 2/3
LAP		1,333 1/3	1,333 1/3
Total	3,900	0	3,900

Like the CRR awards to the LAP in Sensitivity 5, these CRRs would be revenue adequate but would be likely to pay out a larger proportion of the congestion rents collected by the ISO than an allocation of CRRs sinking solely at the LAP as under the Sensitivity 5 approach. These outcomes can be illustrated using the dispatch in Figure 4. The ISO's congestion rent collections would still be $49,500 because neither generator prices nor the LAP price would be affected by the change in CRR allocation or settlement. Total payments to CRR holders, however, would rise to $49,500, paying out all of the ISO's congestion rent collections, as shown in Table 17.

Table 17
CRRs Payments – Sensitivity 7

	MW	$/MW	Payments
C-LAP	1,333 1/3	$24	$32,000.00
C-B	583 1/3	$25	$14,583.33
C-A	116 2/3	$25	$2,916.66
C-C	1,866 2/3	$0	0.0
Total			$49,500.00

Even under the Sensitivity 7 allocation methodology, however, it is possible that the congestion rent collections would sometimes exceed CRR payments. This potential can be illustrated using the alternative day-ahead dispatch portrayed in Figure 8. In this dispatch the C-LAP CRRs have a $1 value while the CRRs sinking in subzone A have a negative value. The negative value of the C to A CRRs is sufficiently large in this example that overall CRR payments are also negative as shown in Table 18.

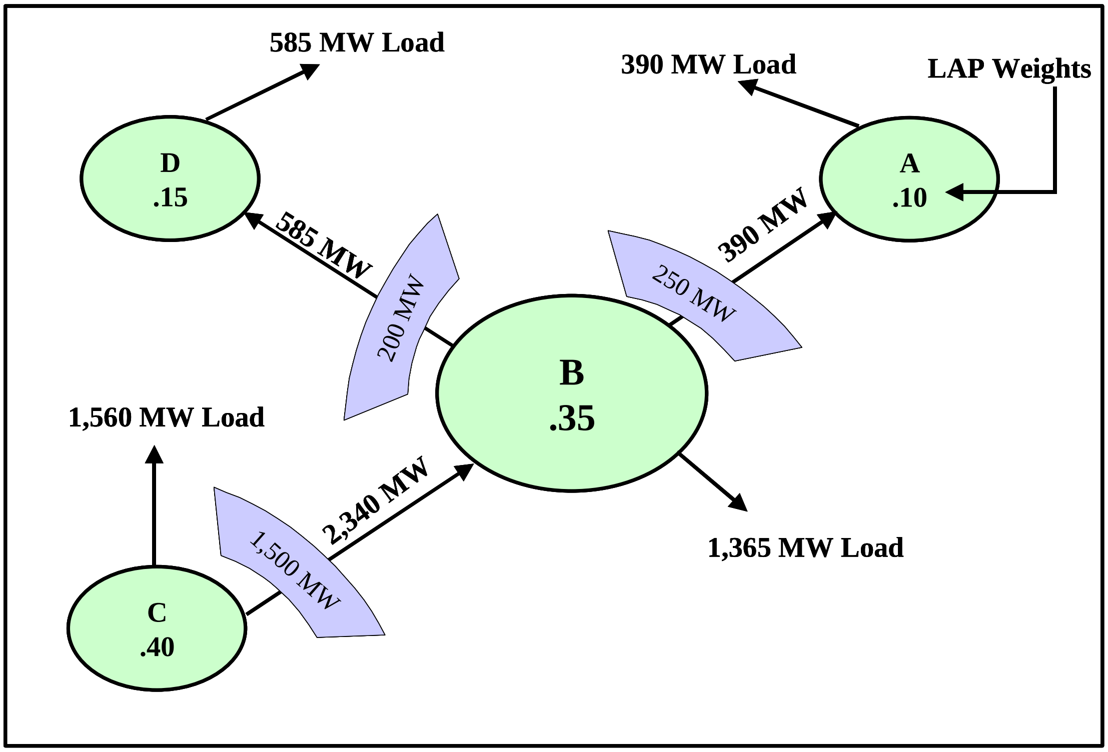
Table 18
CRR Payments – Sensitivity 7 Alternative Day-Ahead Market

	MW	$/MW	Total
C-LAP D	1,333 1/3	$24	1,333 1/3
C-B	583 1/3	$25	0
C-A	116 2/3	$25	2,333 1/3
C-C	1,866 2/3	$0	0
Total			-$1,000

A final potential approach to CRR allocation and settlement is the approach called the base case approach in CRR Study 2. Under this approach, the simultaneous feasibility test would be applied on a subzonal basis as under Sensitivity 7, however, the awarded CRRs would all be settled as if they sunk at the LAP rather than at specific subzones as under the Sensitivity 7 approach.

Under this approach the ISO in effect awards CRRs sinking at the LAP that do not satisfy the simultaneous feasibility test. Thus, if LSEs nominated 6,000 from subzone C to the LAP, the base case methodology would apply the simultaneous feasibility test as shown in Figure 15 to award 3,900 CRRs. All of these CRRs would then be settled as if they were defined to the LAP, but only 1,333 1/3 of these CRRs are actually feasible to the LAP. The remaining CRRs are feasible only to portions of the LAP. Thus, if we applied the simultaneous feasibility test to 3,900 CRRs sinking at the LAP it would be found that many are infeasible, as shown in Figure 19.

Figure 19
Base Case CRR Allocation



Because many of the CRRs allocated under this approach would be infeasible, there would be a potential for shortfalls in the CAISO CRR settlements. This can be illustrated using the dispatch in Figure 4. We have seen that CRRs sinking at the LAP would entitle the holder to $24 in this example, so the holders of these CRRs would be entitled to CRR payments of $93,600, compared to congestion rent collections of only $49,500.

VII. LMP STUDY 3B

A. LMP Study 3b Data

The CRR Study 2 analysis is based on preliminary LMP Study 3b results. The methodology for LMP Study 3b is described in "California ISO, Locational Marginal Pricing Study 3 Analysis of Market Based Price Differentials," July 7, 2004. A few elements of the study methodology relevant to the CRR Study 2 methodology are briefly described below. The LMP Study 3b is based on actual 2002-2003 hourly load patterns scaled up for 2006 expected load. The transmission system has also been modified to reflect expected changes. 2002-2003 generation resources have been augmented for expected generation additions and reduced for expected retirements.

LECG received load, generation and price data from the LMP Study 3b for use in calculating the metrics described in Section V above. The congestion component of the LMP prices in the LMP Study 3b was used for valuing CRRs and calculating congestion rents. The calculation of congestion rents also required using the LMP Study 3b data on net generation and load.

LECG received LMP price, loss component and congestion component data from the CAISO for each generation location (BIC 3b file), each subzonal load area (monthly and annual ZIC files) and for each LAP (Annual ZIC file). The congestion and loss components were calculated relative to Moss Landing.[55] These congestion components were used for valuing the CRRs nominated and awarded in the CRR Study 2. The Bus Names and Ids differ somewhat between the LMP Study 3b and the CRR Study 2 but were matched using the "APnode Mapping Time Invariant May 03 2005.xls" file received from the CAISO. In addition, since LSE CRRs were defined to subzones in the LMP Study 3b but are priced at the LAP in the base case scenarios, it was also necessary to match each subzonal sink to the appropriate LAP.

B. Review of the LMP Study 3b Data

We have not reviewed the LMP Study 3b results in detail but subjected the results to a few high level validity tests. The first test was to compare the aggregate loads in the model input to the loads in the model solution. The solution load was within a few hundred MW of the input load for all hours in the final data set provided by the CAISO. There were only 10 hours in which the difference exceeded 100 MW.

A second test was to compare the generation in the dispatch solution to the load in the solution to assess whether the difference was reasonably consistent with system losses. In all cases, the difference between load and generation appeared reasonable in the final CAISO data set.

A third test was to compare the reference bus prices used in the decomposition of LMP price into congestion and loss components to verify that the reference bus was the same for all locations in a given hour. All of the discrepancies identified were corrected except during a

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[55] The choice of the reference bus for calculating LMP prices does not affect LMP prices at any location but it does change the decomposition of the LMP price between the reference bus price, loss component and congestion component. The choice of the reference bus also has a second order impact on the difference in the loss and congestion components between locations and thus on CRR values. When the reference bus is change the location relative to which marginal losses are calculated changes. This change cancels out when calculating the difference in marginal losses or congestion between two locations as the MW of marginal losses between two locations does not depend on the choice of the reference bus. In addition, however, losses are valued at the reference bus price so a change in the reference bus can change the cost of losses on a per MW basis, which will not cancel out.

period of 32 hours during the simulated days of March 21-23 when the system was islanded and it is not possible to calculate loss and congestion components with respect to a single reference bus. Because the decomposition of the LMP price into loss and congestion components during these hours depends on the settlement rule used, these hours were excluded from the CRR Study 2 analysis.

A fourth test was to calculate the net congestion rents for each hour to verify that net congestion rents were positive. Net congestion rents are very slightly negative in a number of hours because of rounding conventions that result in -$.01 congestion components for LAP prices in some hours, which is satisfactory. In addition, negative congestion rents arose during a number of hours associated with negative congestion components for exports at bus 64023 with no positive congestion rents collected anywhere else on the system. It was resolved with the CAISO that this situation arose because the algorithm used to calculate LMP prices for nodes 32502, 32504, 32506, 32454, 32472, 32474, 324761, 324801, 32484 and 32488 did not reflect the impact of the generation constraint that gave rise to the low import price. This error was accounted for by using the 64023 congestion component to also price net generation at the 10 buses listed above. This correction eliminated the negative congestion rents in these hours. Finally, there were substantial negative congestion rents during hour 11 on July 29 and hour 13 on September 17. The reason for these negative congestion rents has not been fully resolved and the hours were excluded from the CRR Study 2 analysis to avoid distorting the results.

C. Adjustments to LMP Study 3b Data

There are six complications relating to the LMP Study 3b subzonal and LAP prices received from the CAISO that were accounted for in the calculation of CRR values and congestion rents. These issues concern: the calculation of the congestion component of LAP prices, treatment of ETC load internal to the CAISO in the calculation of LAP prices, determination of trading hub prices, hours excluded from the analysis, and adjustments to certain generator bus prices. Each topic is discussed in detail below.

1. LAP Congestion Components

The CAISO provided LAP and subzonal prices to LECG in an annual ZIC file (ZIC2003), along with loss components for these prices that were calculated relative to the same reference bus (Moss Landing) used to calculate nodal prices and congestion components in the BIC file and monthly ZIC files.

It was necessary to calculate the congestion component of the LAP prices in order to value CRRs or calculate total congestion rents.[56] It is best at least for the time being if the reference bus for this calculation remains at Moss Landing. Given this approach the congestion component at the LAP was calculated as follows:

[56] The data provided by the CAISO in the annual ZIC file contained a congestion component for the LAP price but it is not calculated consistent with the congestion component of nodal prices in the BIC file.

[1] $\text{LAP } CC_{t,m} = \text{LAP } lmp_t - \text{LAP } losses_{t,m} - \text{Moss Landing } lmp \ price_{t,m}$[57]

where:

$\text{LAP } CC_{t,m}$ = LAP congestion component in hour t calculated relative to Moss Landing.

$\text{LAP } lmp_t$ = the LMP price at the LAP in hour t from the annual ZIC file

$\text{LAP } losses_{t,m}$ = the losses component of the LAP price in hour t calculated relative to the reference bus at Moss Landing, from the annual ZIC file;

$\text{Moss Landing } lmp_t$ = the LMP price at Moss Landing in hour t from the monthly BIC file.

2. ETC Load Pricing

A second limitation of the LAP prices in the annual ZIC file is that the load weights used to calculate the LAP prices include all non-dispatchable load within the zone.[58] In particular, ETC load was included in the load weights used to calculate the LAP prices. Under the MRTU, however, ETC load would not be charged for congestion and the ETC load would not be included in the calculation of LAP prices. This feature of the LAP prices calculated by the LMP Study 3b model affects both the calculation of LSE CRR values and LSE congestion charges, which would be inaccurate to the extent that the LAP prices are calculated including ETC load in the load weights.

In order to base the analysis on more accurate LAP prices, and to assess the practical impact of these factors (the impact is not necessarily material depending on the amount of ETC and TOR load and whether it is located at buses having prices that differ materially from the LAP price), the LAP congestion components have been calculated by: (1) backing the ETC load out of the load weights used to calculate the LAP and (2) recalculating the LAP congestion components using load weights which do not include ETC load. The LAP congestion component calculated from the LMP price computed by Scope (as described in Section a above) was recalculated as follows:

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57 This approach will produce congestion rents with losses valued at the Moss Landing price, which is generally lower than the price at the CAISO load center. The congestion rents would likely be somewhat lower if they were calculated relative to a reference bus at the CAISO load center rather than relative to Moss Landing. We cannot directly recalculate the LAP congestion component for the load center because we do not have a LAP loss component calculated relative to the load center. We could, however, calculate the difference in the loss components between the source and sink of each CRR and multiply this difference in each hour by the ratio of the load center price to the Moss landing price for that hour, to calculate a loss component calculated relative to a reference bus at the load center. The value of each CRR could then be calculated by subtracting this difference in the loss components from the difference in the LMP prices at the source and sink of the CCR. We propose not to make this adjustment, since it is a small second order adjustment to the cost of losses.

58 The zonal load does not include dispatchable pumped storage load.

[2] $$LAP^{S}_{CC,t,N} = \frac{\sum_i CC_{i,t,N}\left(Q_{ijt} + Q_{ikt}\right)}{\sum_i \left(Q_{ijt} + Q_{ikt}\right)}$$

where CC_{it} is the congestion component at location i within LAP n in hour t;

Q_{ixt} is the load of entity x at location i in hour t;

j = LSE load,

k = ETC load; and

$LAP^{S}_{CC,t,N}$ = LAP congestion component for Region N as calculated in the simulation for hour t.

In order to correctly value LSE CRRs (and correctly price energy), an adjusted LAP congestion component $\left(LAP^{*}_{CC,t}\right)$ was calculated as follows:

[3] $$LAP^{*}_{CC,t,N} = \frac{LAP^{S}_{CC,t,N} \bullet \sum_i \left(Q_{ijt} + Q_{ikt}\right) - \sum_i CC_{it} Q_{ikt}}{\sum_i \left(Q_{ijt}\right)}$$

Given the definition of the LAP price calculated by Scope (see [2]), the adjusted LAP price formula in [3] reduces to:

[4] $$LAP^{*}_{CC,t} = \frac{\sum_i CC_{it}\left(Q_{ijt}\right)}{\sum_i \left(Q_{ijt}\right)}$$

which corresponds to a LAP price calculated based on LSE load weights.

The first step in making this correction was to identify all ETC nodal CRR sinks that are internal to the LAPs, i.e., that are not external tie lines.[59] The CAISO then placed these sinks into one of four categories and provided appropriate LSE load data:

1. All of the load at the bus is served by a single LSE whose ETC rights exceed its peak load. For this category the CAISO provided node specific hourly LSE load data which was used to measure ETC load at that location.

2. All of the load at the bus is served by a single LSE whose ETC rights are sometimes less than its load. The CAISO provided node specific LSE load data

[59] All load at the external tie line nodes is priced nodally and excluded from the calculation of the LAP prices so no adjustment is necessary.

and ETC load was set to the lower of the LSE's ETC rights or the LSE's hourly load.

3. There is more than one LSE serving load at the bus and one of the LSEs serves 100% of its load under an ETC or TOR right. The CAISO provided node specific hourly load data for the LSE that served all of its load under the rights. This hourly load data was used to measure that LSE's ETC load at this location.

4. There is more than one LSE serving load at the bus and one of the LSEs has load that sometimes exceeds its ETC rights. The CAISO provided hourly node specific LSE load data. ETC load was set equal to the lower of the LSE's ETC rights or the LSE's hourly load.

The second step was to use the node-specific hourly ETC load derived in the first step to apply Equation [3]. The LAP prices used to value CRRs for the base case and Scenario V were recalculated in this manner. In practice, the adjustment made virtually no difference in the LAP prices. There were two months in which one of the LAP prices changed by as much as 5¢/MWh. In almost all months the difference was less than 1 cent.

3. Trading Hub Prices

The LMP prices calculated in the LMP Study 3b did not include prices for the trading hubs that can serve as CRR sources in Scenarios IV, V and VI. The CAISO provided the nodal weights for the locations comprising the trading hubs and the trading hub prices were calculated for each hour based on these weights and the nodal prices contained in the BIC files from the LMP Study 3b.

4. Excluded Hours

The prices for a small number of hours were excluded from the analysis. First, during the period hour ending 20 on March 21, 2003 through hour ending 4 on March 23, transmission outages split the CAISO control area into two islands that remained linked by the rest of the WECC transmission system but were not linked under the modeling assumptions used in the LMP Study 3b simulation. These kind of transmission outages would potentially result in revenue inadequacy to the extent that CRRs were defined between the two "islands."

In this situation, loss and congestion components cannot be calculated relative to the Moss Landing reference bus for nodes located in the disconnected island. While a settlement rule could be established to handle such situations in actual operation, we did not want the arbitrary assumptions underlying such a settlement rule to mask the other results, so these hours were excluded from the calculation of the study metrics.

In addition, there were two hours (July 29, HE 11 and September 17, HE 13) in which there are as yet undiagnosed anomalies in the LMP prices at certain external nodes, resulting in negative congestion rents. These two hours have been excluded pending resolution of the cause of these anomalies. With these exclusions, CRR Study 2 analyzed CRR values over 8,725 hours.

5. Recalculated LAP Prices

Prior to using the LMP Study 3b prices to value CRRs several checks were undertaken of the LMP Study 3b data that identified various anomalies that were resolved in the final data provided to LECG by the CAISO. One of the anomalies concerned negative total congestion rents in some hours in which there were zero congestion components for internal load, internal generation and imports, but negative congestion components at certain external nodes at which exports were scheduled. It was determined that this circumstance arose because these exports provided counterflow on a transmission constraint ("BASE-CASE GENERALIZED-GROUP 154 Sierra_A") that limited generation output at several buses. Because of the way the constraint was modeled and prices calculated in the simulation tool, the impact of this constraint was not correctly reflected in the generator prices at the constrained locations. This problem was corrected by setting the congestion component of prices at internal buses 32502, 32504, 32506, 32454, 32472, 32474, 32476, 32480, 32484 and 32488 equal to the congestion component at bus 64023. There was no load at the impacted buses so this adjustment did not impact LAP prices.

6. Subzonal Prices

Under Sensitivity 7, CRRs are valued based on subzonal prices. There were two problems in carrying out this calculation. First, the subzones for which LMP prices were calculated in the LMP Study 3b were in some cases combined for the purpose of carrying out the simultaneous feasibility test in CRR Study 2. The relationship between the subzones used in the LMP Study 3b and in CRR Study 2 is shown in Appendix A. Second, the areas for which load data are available from the LMP Study 3b do not correspond to the subzones used to value CRRs in Sensitivity 7, making it impossible to back out ETC load and recalculate subzonal prices using the methodology described in Subsection 2 above.

Given these data limitations, CRRs are valued for Scenario VII based on the equal weighted average of the LMP prices of the LMP Study 3b subzones comprising the CRR Study 2 subzones.

D. CRR Valuation

Converted and LSE CRRs sinking at subzones were valued based on the appropriate LAP price, while converted and LSE CRRs sinking at nodes (generally associated with pumped storage units) were valued based on the nodal price. In general ETC and TOR CRRs were valued based on their nodal sources and sinks. The methodology for valuing CRRs is summarized in Table 20.

Table 20
Scenario I Pricing Rules

	CRR Sink	Base Case Price	Sensitivity 5 Price	Sensitivity 7 Price
LSE	Subzone Node	LAP* Nodal/Price	LAP* Nodal/Price	Subzones Nodal/Price
CVR	Subzone Node	LAP* Nodal/Price	LAP* Nodal/Price	Subzones Nodal/Price
TOR	Node	Nodal/Price	Nodal/Price	Nodal/Price
ETC	External Node	Nodal/Price	Nodal/Price	Nodal/Price
	Internal Node Subzone	Nodal/Price Subzone price	Nodal/Price Subzone price	Nodal/Price Subzone price

Peak and off-peak hours have been identified in the LMP study data for the 2002-2003 calendar for valuing on and off peak CRRs. The following NERC holidays were treated as off-peak for the purpose of CRR valuation: Thanksgiving, Nov 28, 2002; Christmas, Dec. 25, 2002; New Years, Jan 1, 2003; Memorial Day, May 26, 2003; Independence Day, July 4, 2003; and Labor Day, Sept 1, 2003.

Scenarios I through VI are based on different assumptions regarding the treatment of various types of CRRs as options or obligations. The treatment of CRRs in the CRR valuation calculations is summarized in Table 21.

Table 21
Scenario Valuation Rules

LSE	Obligation	Option	Obligation	Obligation	Option	Obligation
CVR	Option	Option	Option	Option	Option	Option
ETC	Obligation	Option	Option	Obligation	Option	Option
TOR	Option	Option	Option	Option	Option	Option

E. Calculation of Congestion Rents

In order to calculate the payout ratio, it is necessary to calculate the total congestion rents collected by the CAISO for the scenario underlying the LMP Study 3b. In a system with losses, total congestion rents are calculated by multiplying the injections and withdrawals at each location by the congestion component of the LMP price at that location.[60] Congestion rents can be calculated either by multiplying the load at each location by the nodal price at that location or equivalently by multiplying all load in each LAP by the LAP price, where the LAP price is the load-weighted average of the nodal prices within that LAP. The same LMP prices are used to calculate congestion rents for all of the scenarios and sensitivity cases so there is a single figure for congestion rents for all scenarios.

There are a few complications to address before turning to the details.

Area Load. Load is reported by areas in the monthly "area" files and annual "PI" file of the LMP Study 3b. We have verified that in all hours of the study year the loads in the annual file are within 261 MW of the load in the monthly files, indicating that the data for all hours are based on converged cases in which the dispatch was able to meet load. The calculation of congestion rents is based on the load data in the monthly area files because these data reflect the final load cleared in the dispatch and should be consistent with the generation data.[61] Table 22 shows the matching of areas to LAPs that was used in calculating congestion rents.

Table 22
Assignment of Area Load to LAPs

Area_3b (Monthly Files)	PI_Data_Load (Annual File)	LAP
PBA_Bay	BayArea	PGE
PGE_Othr	OtherPGE3	PGE
PF1_Fres	Fresno	PGE
PFG_Geys	SouthGeysers	PGE
PHB_Humb	Humboldt	PGE
PLP_ZP	ZP26	PGE
PNC_NCst	NorthGeysers	PGE
PSF_SFrn	SanFrancisco	PGE
PSI_Sier	Sierra	PGE
SCE_Othr	OtherSCE	SCE
SCSO_LAO	LA_Orange	SCE
SDG_SDGE	SDGE	SDGE

ETC and TOR load. As discussed above, ETC load is priced on a nodal basis in the LMP Study 3b. ETC and TOR load has been backed out of the area load data for each hour and

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60 Absent transmission system losses, congestion rents are total payments by transmission customers and loads less total payments to generators.

61 We have compared the total generation in the GMC file to the load in the area files and the differences appear to be consistent with plausible levels of transmission system losses.

congestion rents have been calculated by pricing the ETC and TOR withdrawals backed out of the zonal prices at the nodal sink price and pricing the remaining LSE load at the LAP price.

Internal Generation. Net generation by bus is reported in the "GMC" files in the "MW" field. This figure for net generation is multiplied by the nodal price at that location to calculate congestion rents. The figure for net generation may be either positive, or negative. Negative values for net generation reflect participating load (generally pumped storage load) that is priced on a nodal basis like generation. Generation resources in the GMC file are matched to LMP congestion components in the BIC file using the Bus ID or Bus Name. There is one exception to this which is that the GMC file does not include a Bus ID or Bus Name for block generators.

Block Generators. As noted above, no bus ID is provided for block generators in the GMC files because block generators consist of groups of generators situated at multiple locations.[62] In some instances the locations comprising a block generation have identical LMP prices, but in other instances this is not the case. The price differences among generator locations included in a block are sometimes substantial, as shown in Table 23.[63]

Table 23
Maximum Hourly Ranges in Congestion Component within Block Generators
(Nov 2002 – Oct 2003)

Block ID	Max CC Range,
5003	1.54
5016	30.26
5017	1.61
5018	134.15
5023	308.78
5038	18.50
5052	83.92
5055	28.38
5093	4.48

It is our understanding that for dispatch purposes in the LMP Study 3b, the output of block generators above Pmin is spread across all of the physical generators comprising the block in proportion to the difference between each generator's Pmax and Pmin. In the case of block generators for which all of the locations comprising the block have the same congestion

62 The resources and locations included in each block generator are described in a Scope output file, "bid_yyyymmddhh_gmc.csv". We have received five such files for May 28, HE16, July 30 HE14, November 1 HE 5, November 21 HE 17, and January 14 HE 13. The generator locations included in each block generator are summarized in Appendix B.

63 The CAISO informed us that Block generators Big Creek 5003, CDWR Pumps 5016, 5017, 5018, Metropolitan Water District pumps 5038 and WAPA generators 5093 include resources that do not connect to the transmission system at a common bus and thus may have different LMP prices. In addition, we have observed that the locations included in block generators 5023, 5052, and 5055 also have significant variation in congestion components across the locations comprising the Block. Table 21 below shows the maximum ranges of congestion component on generators within the above mentioned blocks over the LMP 3 study period.

component, the calculation of congestion rents does not depend on how the output was spread across the nodes comprising the block. Congestion payments for block generators having such identical congestion components, i.e., block generators other than those listed in Table 23, were therefore calculated by multiplying the MW output of the block generator from the "GMC" file by the congestion component of a single bus within the block from the "BIC" files.

Because congestion components differ across the block generators listed in Table 23, it is necessary to disaggregate the MW output of the block generator from the "GMC" files by bus to calculate the output of the individual generators comprising the block. The weights used for the disaggregation of block generator output are presented in appended as Appendix C. The dispatch in the simulation apparently used generator weights based on the difference between the P min and Max for each unit.[64] Pmin data for these units have not been received from the CAISO so the weights used in the calculation of congestion rents are based on the range between 0 and the unit maximum output. Given these weights, the congestion rents for the Block generators listed in Table 23 were calculated by multiplying the block output by a weighted average congestion component for the nodes comprising the block.

External Load and Generation (imports and exports). The GMC file also contains MW values for external load and generation. External load is generally identified by a Z in the ID but this is not the case for dispatchable imports and exports so the Bus ID is used to identify external tie line buses. All external load and generation is priced nodally.

Congestion rents were calculated in the following steps. First, calculate daily payments to generators (and payments for export and by pumped storage load) based on the net injections at each location (from file GMC3b) times the congestion component of the LMP price at that location (from BIC_2003xx).[65] Second, calculate daily payments by LSEs based on the net loads from the PI file times the congestion component of the LAP prices calculated in the LMP Study 3b plus ETC hourly load times the congestion component of the nodal price at the location of the ETC load. Total congestion rent payment by LSEs less total congestion rent payments to generators equal net congestion rents.

VIII. SCENARIO RESULTS

A. Overview

The review of the empirical analysis below has three components. Section B below discusses the payout ratio metric. This section is concerned with assessing the revenue adequacy of the alternative CRR allocations and the extent to which congestion rents are returned to LSEs through the CRR allocation in each. Section C assesses the proration equity metrics aggregated across all LSEs. Material differences across LSEs in proration equity metrics that do not appear to be related to LSE choices are investigated to determine whether they stem from the CRR

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64 It is assumed that these block generators were dispatched in the LMP Study 3b based on the weighted average LMP price at the locations of the resources comprising the block generators with the weights corresponding to the differences between Pmax and Pmin.

65 Again, we would like to calculate these payments separately for ETC and TOR schedules and for LSE and CVR schedules, but at this point we are not be able to do so.

nomination choices of the LSEs or from some aspect of the CRR allocation process. Because these investigations concern the confidential CRR requests of individual market participants, the details will not be described in the CRR Study 2 Report. To the extent that these investigations identify features of the allocation and proration procedures that appear to be having unintended effects and giving rise to anomalies identified through the metrics discussed in Section C, these features will be discussed in Section D.

B. Payout Ratio Metric

The overall CAISO congestion rent payout ratio metric is calculated for each scenario by summing the total payments to all CRRs awarded to LSEs, as well as the value of ETC and TOR reservations over the year and dividing by the total congestion rents in the LMP Study 3b. The payout ratio metric is calculated for the CAISO overall, treating all congestion charges and CRR payments the same (i.e., it includes the value of ETC and TOR reservations and payments to CVR and LSE CRRs). The payout ratios for each of the six scenarios are reported in the columns of Table 24. For example, the top row reports the payout ratio calculated for 100% of the awarded CRRs and 100% of the congestion rents. The rows of the table report the values of the metric for the base case and for two primary sensitivity analyses that were evaluated over the entire 12-month period. Because the time constraints of the CRR Study 2 did not provide an opportunity for market participants to make additional monthly CRR nominations based on the results of the allocation of annual CRRs in sensitivity cases, the sensitivity case results are reported only for the annual CRR allocation quantities (using 75% of the transmission system) and the base case results are also reported for the annual allocation for comparison purposes. The congestion rent payout ratios calculated based on only the annual CRR allocation are calculated based on 75% of the annual congestion rents.

Table 24
Payout Ratio Metric

	Scenario I [1] (A)	Scenario II [2] (B)	Scenario III [3] (C)	Scenario IV [1] (D)	Scenario V [2] (E)	Scenario VI [3] (F)
	No Trading Hubs			Trading Hubs		
Base Case						
100%	106.97%	89.80%	104.98%	105.65%	88.36%	104.02%
75%	106.60%	91.06%	102.62%	103.09%	91.08%	98.13%
Sensitivity Case 5[4] – 75%	102.78%	91.10%	98.46%	101.24%	92.09%	94.32%
Sensitivity Case 7[5] – 75%	105.47%	91.18%	101.67%	102.04%	91.41%	97.27%

1 CVR and TOR are options.
2 All CRRs are options.
3 ETC reservations modeled as options.
4 Simultaneous feasibility test applied at LAP level.
5 CRR awards valued at subzone prices for the subzone to which they are feasible.

It was anticipated that the base case methodology in which the simultaneous feasibility test is applied to CRRs sinking in subzones but the CRRs are valued at LAP prices might result in substantial revenue inadequacy (resulting in a payout ratio substantially greater than 100%). However, Table 24 shows that based on the LMP Study 3b prices there was at most a roughly 7% revenue inadequacy in any of the base case scenarios.

The revenue inadequacy of the allocated CRRs in the base case is not primarily due to the CRR allocation methodology but is a result of substantial transmission outages during March of the historical period (2003). LMP Study 3b reflects historical transmission outages, so even if the awarded CRRs were feasible on the grid used to apply the simultaneous feasibility test they would not necessarily be feasible on the grid used to calculate prices and determine congestion rents in LMP Study 3b. In fact, there was substantial revenue inadequacy during the simulated month of March, likely arising from transmission outages. The revenue inadequacy in March partially offset over the rest of the year by congestion rents collected on constraints that were not fully allocated in the CRR allocation.

Excluding CRR payments and congestion rents for March, the payout ratio was 93.84% for the base case Scenario I, so the allocation methodology left about 6% of the congestion rents unallocated but this congestion rent surplus was more than offset for the year as a whole by the congestion rent shortfalls during March.[66] As noted elsewhere the degree of revenue adequacy would likely be different for different congestion patterns.

The lowest monthly value of the base case payout ratio for annual and monthly CRRs was a little over 73% in the simulated April. Overall there were two months with payout ratios less than 80% and four months with payout ratios less than 90%. There were also five months with payout ratios above one, and all of these congestion rent shortfalls appear to reflect the impact of transmission outages, rather than the base case methodology for applying the simultaneous feasibility test, since the revenue inadequacy is very similar between the base case and Sensitivity 7 as shown in Table 25.

66 There would have been additional congestion rent shortfalls during the March hours excluded from the study due to the islanding of the CAISO system. Since there were material numbers of CRRs between the islanded regions, it is likely that the real-world settlement of these hours would have produced material congestion rent shortfalls.

Table 25
Monthly Payout Ratios
Scenario I

Month	Congestion Rent (A)	CRR Payment Base Case Annual/ Monthly (B)	CRR Payment Base Case Annual (C)	CRR Payment Sensitivity 5 Annual (D)	CRR Payment Sensitivity 7 Annual (E)	Base Case Annual/ Monthly (F)	Base Case Annual (G)	Sensitivity 5 Annual (H)	Sensitivity 7 Annual (I)
1	7,377,124	8,698,799	6,502,477	6,339,774	6,449,405	1.17915857	1.1752505	1.145843709	1.165658408
2	8,860,771	6,855,088	5,337,419	4,405,214	5,173,365	0.773644726	0.803153421	0.662879032	0.778467246
3	18,098,969	36,810,012	30,287,662	30,275,643	30,117,587	2.033818135	2.231262401	2.230376945	2.218733127
4	7,726,801	5,683,386	4,212,870	4,138,235	4,163,809	0.735541969	0.726970892	0.71409197	0.718504998
5	15,218,309	12,642,959	8,983,680	8,712,811	8,989,167	0.830772967	0.787093993	0.763362206	0.787574749
6	13,331,299	12,069,636	8,294,445	7,672,080	8,346,773	0.905360823	0.829571053	0.767325045	0.834804692
7	17,633,510	17,614,093	12,454,792	12,372,057	12,249,145	0.998898814	0.941751727	0.935495893	0.926202062
8	14,525,170	13,269,205	8,194,247	7,568,473	8,059,938	0.913531817	0.752188313	0.694745542	0.739859433
9	15,331,082	14,840,125	11,002,835	9,984,179	10,839,105	0.96797639	0.95690879	0.868316989	0.942669239
10	14,676,380	12,235,055	9,525,343	9,080,138	9,482,695	0.833656178	0.865367177	0.824920739	0.861492599
11	13,662,265	14,411,003	10,914,525	10,888,565	10,583,283	1.054803342	1.065174713	1.062641218	1.032848032
12	4,545,406	6,383,789	5,007,621	4,947,396	4,976,036	1.404448758	1.468918001	1.451251687	1.459652959
Total	150,987,086	161,513,151	120,717,914	116,384,564	119,430,307	1.069715004	1.06603302	1.027766166	1.054662444
Total-March	132,888,117	124,703,140	90,430,252	86,108,921	89,312,720	0.938407004	0.907332219	0.863974128	0.896119454
F = B/A G = C/.75 A H = D/.75 A I = E/.75 A									

It is noteworthy that the months with low payout ratios are low demand months. The low payout ratios for these months may in part be a result of limiting LSE CRR nominations based on the relatively low monthly peak loads in these months. An alternative approach would be to allow LSEs to nominate annual CRRs based on a fraction of their highest annual peak load.

Within the context of CRR Study 2, allocation of more CRRs in the low demand months would not have led to revenue inadequacy in the shoulder months but would have reduced the offset over the year as a whole provided by the congestion rent surpluses in these months. Given the substantial level of CRR revenue inadequacy due to transmission outages in the simulated year, the allocation of additional shoulder month CRRs would therefore appear to reduce the revenue adequacy of the CAISO CRR settlements. This apparent relationship is not valid outside the contest of CRR Study 2, because the CRRs that were not allocated to LSEs because of the demand constraint, could still have been purchased in the annual or monthly auctions and thus could still contribute to CRR shortfalls.

The near revenue adequacy of the base case CRR allocation portrayed in Table 24 does not, however, imply that the awarded CRRs were simultaneously feasible. As was anticipated, the base case allocation methodology appears to result in the award of many CRRs sinking at the aggregated LAPs that are infeasible.[67] This infeasibility arises because the CRRs awarded to the LAP in the base case are determined by summing the total CRRs that are found to be feasible to any of the subzones comprising the LAP. One way of gauging the level of infeasibility in the base case CRR awards would be to assess how many source to LAP CRRs could be assembled from the source to subzone awards. Table 26 provides illustrative calculations for the annual (75%) August on-peak CRR awards showing the number of CRRs defined to the LAP that satisfied the simultaneous feasibility test for all SCE subzones compared to the total CRRs

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[67] This is a result of applying the simultaneous feasibility test at the subzone level and then defining the portion of any CRR that is feasible to any subzone as feasible to the entire LAP. This was discussed in the MRTU Report, pp. 94-97 and Appendix VI.

awarded. Table 26 shows that in Scenario I only 4,156 source to LAP CRRs could be assembled from the more than 10,000 annual CRRs awarded to subzones within the SCE LAP. In particular, over 6,000 MW of CRRs to the LAP appear to be infeasible in hedging load in the low desert subzone. Table 26 also shows that the subzonal CRRs awarded under base case methodology can be assembled into only 4,300 CRRs feasible to the LAP as a whole, compared to the 8,565 CRRs feasible to some subzones within the LAP, the low desert subzone again being the subzone with the greatest proportionate shortfall. Table 26 also reports the average August on-peak congestion charge calculated for each subzone relative to the reference bus based on the LMP Study 3b results.[68]

Table 26
LSE and Annual CVR CRRs Sinking by SCE Subzone And LAP
Base Case August 2003 On-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price[4] ($) (C)
Feasible LAP CRRs[1]	4,156	4,302	6.74
Additional Feasible Subzonal CRRs[2]			
SCEC -- Core + Northeast	3,630	2,423	6.70
SCEN -- North	246	220	6.66
SCES -- West + Southwest	1,957	1,527	6.82
SCHD -- High Desert	199	92	6.13
SCLD -- Low Desert	0	0	6.65
Total Potentially Infeasible LAP CRRs[3]	6,032	4,263	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.
[2] CRRs that are feasible only to specific subzones.
[3] Base Case LAP CRRs that are not feasible to all subzones.
[4] Congestion relative to reference bus.

[68] The values in Columns A and B in Table 26 are calculated as follows. First, the number of CRRs awarded to each subzone for the August on-peak period for the corresponding base case scenario is divided by the subzonal load weight used in the CRR Study 2. The resulting figure is the number of CRRs to the SCE LAP that could be supported by the number of CRRs that were feasible to that subzone. The lowest number calculated for any of the SCE subzones (4,150.5 in Scenario I) is the number of CRRs that are feasible to the entire SCE LAP. This figure was then subtracted from the number of CRRs defined to the LAP that could be supported by the awards to each subzone and this difference was then multiplied by the subzonal weight to calculate the number of “left-over” CRRs defined just to the individual subzone. All subzones other than the SCE low desert subzone have some of these “leftover” CRRs. In Scenario I, 169.112 CRRs were awarded to the low desert subzone. With a 4 percent weight, these 169.112 subzonal CRRs would support 4,155.728 CRRs to the LAP. These calculations are illustrative, not exact, because the CRR awards sinking in each subzone are from multiple sources, and the proportion of CRRs from each source that are feasible into the various subzones may also vary across sources.

Another way of examining CRR infeasibility at the LAP level is to calculate how many CRRs would need to be feasible to each subzone in order for the number of CRRs awarded to the LAP in the base case to be feasible, and to compare these figures to the numbers that are actually feasible to each subzone. The application of this approach is shown in Table 27 for the SCE LAP. Table 27 shows that there were insufficient CRRs awarded into the North, West and Low Desert subzones to be reassembled into 10,188 CRRs to the LAP as a whole.

Table 27
Total and Feasible LSE and CVR Annual CRRs by SCE Subzone
Base Case August 2003 On-Peak

	Scenario I			Scenario IV			
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Congestion Price
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
SCEC -- Core + Northeast	5,215	5,757	542	4,384	4,625	241	6.70
SCEN -- North	729	543	-185	612	528	-84	6.66
SCES -- West + Southwest	3,574	3,415	-159	3,005	3,036	31	6.82
SCHD -- High Desert	255	303	48	215	200	-15	6.13
SCLD -- Low Desert	415	169	-245	349	175	-173	6.65
Total LAP CRRs	10,188	10,188	0	8,565	8,565	0	6.74

A, D Total of the awardedCRRs disaggregated by subzone using subzonal weights
B, E CRRs feasible to subzones.
C B - A
F E - D
G Average hourly congestion relative to reference bus.

Another way of looking at these results is that the award of LAP 10,188 annual CRRs sinking at the LAP in effect resulted in the award of 590 infeasible CRRs sinking in the SCEN, SCES, and SCLD areas, and also resulted in the underaward of 590 feasible CRRs sinking in the SCEC and SCHD areas. The CAISO's potential revenue inadequacy from the award of these CRRs sinking at the LAPs that are not feasible to all of the LAP is therefore less than if CRRs were awarded that were infeasible to any portion of the LAP. Moreover, if congestion were higher into the SCEC and SCHD areas than into the SCEN, SCES and SCLD areas, the CAISO would not be revenue inadequate and would instead be revenue surplus. With such a congestion pattern, however, LSEs serving load in the SCE LAP would tend to be under hedged against congestion, as the CAISO would collect more congestion rents than it would pay out to CRR holders.

Table 28 shows a measure of the financial impact of the award of infeasible CRRs to the LAP and under award of feasible CRRs to the SCEC and SCES subzones calculated at LMP Study 3b prices. It can be seen that using these prices the financial impact of the revenue inadequacy is less than $20 or 0.2 cents per awarded CRR over the on-peak August hours in Scenario I and there is a roughly 0.3 cents per CRR revenue surplus for the Scenario IV CRR allocation over this same period.

Table 28
Allocation-Related Shortfall in Annual CRRs
August On-Peak, SCE LAP, LMP Study 3b Prices

	Scenario I	Scenario IV		Scenario I	Scenario IV
	Zonal CRR Imbalance		Congestion Price	Shortfall Impact	
	(A)	(B)	(C)	(D)	(E)
SCEC	542	241	6.7	3631.4	1614.7
SCEN	-185	-84	6.66	-1232.1	-559.44
SCES	-159	31	6.82	-1084.38	211.42
SCHD	48	-15	6.13	294.24	-91.95
SCLD	-245	-173	6.65	-1629.25	-1150.45
Total $				-20.09	24.28
LAP CRRs				10188	8565
$/CRR MW				-0.001972	0.002835

In drawing conclusions based on these results it is important to recognize that the purpose of holding CRRs is to hedge LSEs against unexpected changes in congestion. If congestion patterns are different from those simulated in LMP Study 3b, then the impact of the shortfall due to the allocation of infeasible CRRs on the CRR settlements could also be different. For example, if the hourly congestion component were $53 in the SCEN, SCES and SCLD subzones while zero elsewhere, then the impact on the CRR account of the infeasible CRRs would be $30,000/hour or about $3/CRR per hour for CRRs sinking at the SCE LAP, as shown in Table 29.

Table 29
Allocation-Related Shortfall in Annual CRRs
August On-Peak, SCE LAP, Hypothetical Prices

	Scenario I	Scenario IV		Scenario I	Scenario IV
	Zonal CRR Imbalance		Congestion Price	Shortfall Impact	
	(A)	(B)	(C)	(D)	(E)
SCEC	542	241	0	0	0
SCEN	-185	-84	53	-9805	-4452
SCES	-159	31	53	-8427	1643
SCHD	48	-15	0	0	0
SCLD	-245	-173	53	-12985	-9169
Total $				-31217	-11978
LAP CRRs				10188	8565
$/CRR MW				-3.064095	-1.398482

Table 30 portrays similar data for the PG&E LAP. It can be seen that in the Scenario I base case annual CRR allocation for the August on-peak period slightly over 8,800 CRRs feasible to the entire PG&E LAP can be assembled from the subzonal CRR awards, while another 1,900 CRRs would be awarded to the LAP under the base case methodology because they were feasible into some subzones. In particular, these 1,900 CRRs would apparently not be feasible into the East Bay subzone.

Table 30
Case LSE and CVR CRRs Sinking by PG&E Subzone and LAP
Base Case August 2003 On-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price ($) (C)
Feasible LAP CRRs[1]	8,817	8,678	3.78
Additional Feasible Subzonal CRRs[2]			
PGCC -- Central Coast	78	48	3.45
PGEB -- East Bay	0	0	3.64
PGFI -- Fresno	340	394	4.39
PGFG -- Fulton Geysers	57	25	3.68
PGHB -- Humboldt	6	8	4.94
PGLP -- Los Padres	347	283	3.64
PGNB -- North Bay	17	11	3.65
PGNC -- North Coast	26	18	4.14
PGNV -- North Valley	137	154	3.53
PGP2 -- Peninsula	127	87	3.66
PGSA -- Sacramento Valley	132	81	3.72
PGSB -- South Bay	274	193	3.61
PGSF -- SF	95	67	3.75
PGSI -- Sierra	91	49	3.69
PGSN -- San Joaquin	19	16	3.65
PGST -- Stockton	178	110	3.83
PGVA -- Vaca-Dixon	42	29	3.62
Total Potentially Infeasible LAP CRRs[3]	1,966	1,575	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.
[2] CRRs that are feasible only to specific subzones.
[3] Base Case LAP CRRs that are not feasible to all subzones.
[4] Congestion relative to reference bus.

Table 31 provides another perspective on the infeasibility of base case CRRs sinking at the PG&E LAP by showing the number of CRRs that would need to be feasible to each PG&E subzone in order to rebundle them into CRRs to the LAP as a whole. It can be seen that most of the shortfall for the PG&E LAP is CRRs into the East Bay and North Bay subzones. Since these subzones have prices in the LMP Study 3b simulation that are lower than the LAP average, these potential infeasibilities would not give rise to revenue adequacy when evaluated using the LMP Study 3b prices.

Table 31
Total and Feasible LSE and CRV Annual CRRs by PG&E Subzone
Base Case August 2003 On-Peak

	Scenario I			Scenario IV			
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Congestion Price
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
PGCC -- Central Coast	323	342	19	307	308	1	3.45
PGEB -- East Bay	1,777	1,453	-324	1,689	1,430	-260	3.64
PGFI -- Fresno	1,480	1,550	70	1,407	1,585	178	4.39
PGFG -- Fulton Geysers	369	359	-10	351	322	-29	3.68
PGHB -- Humboldt	63	57	-6	60	59	-1	4.94
PGLP -- Los Padres	1,115	1,258	143	1,060	1,181	121	3.64
PGNB -- North Bay	328	286	-42	312	276	-37	3.65
PGNC -- North Coast	135	136	2	128	126	-2	4.14
PGNV -- North Valley	421	482	60	401	493	92	3.53
PGP2 -- Peninsula	709	707	-2	674	658	-16	3.66
PGSA -- Sacramento Valley	545	578	32	519	520	1	3.72
PGSB -- South Bay	1,518	1,515	-3	1,444	1,415	-29	3.61
PGSF -- SF	583	572	-11	555	537	-18	3.75
PGSI -- Sierra	311	345	34	296	300	4	3.69
PGSN -- San Joaquin	59	67	8	56	63	8	3.65
PGST -- Stockton	828	854	27	787	776	-11	3.83
PGVA -- Vaca-Dixon	219	221	2	208	205	-3	3.62
Total LAP CRRs	10,783	10,783	0	10,253	10,253	0	3.78

[A, C] Total of the subzonal feasible CRRs disaggregated by subzone using subzonal weights

[B, E] CRRs feasible only to subzones.

[C] B - A

[F] E - D

[G] Average hourly congestion relative to reference bus.

The small amount of revenue inadequacy in the overall payout ratio is in part accounted for by the fact that the East Bay congestion component in the LMP Study 3b simulated prices is lower than the overall LAP congestion component so the award of infeasible CRRs into the East Bay does not give rise to a revenue shortfall at simulated prices. At the simulated prices for the August on-peak period, the congestion charge for meeting load in the East Bay subzone with generation at the reference bus ($3.64) is lower than the congestion charge for meeting load in the subzones to which extra CRRs are feasible, such as Fresno ($4.35).

Overall, Table 32 shows the financial impact of the award of infeasible CRRs to the LAP and under award of feasible CRRs to the Fresno, Los Padres and North Valley subzones calculated at LMP Study 3b prices. It can be seen that the financial impact of these over and under awards is a CRR account surplus of slightly more than .3 cents/CRR in Scenario I and slightly more than 1 cent/CRR in Scenario IV. Had congestion into the East Bay and North Bay subzones been higher than the LAP average, however, the financial impact of this infeasibility could have been larger.

Table 32
Allocation-Related Shortfall in Annual CRRs
August On-Peak , PG&E LAP, LMP Study 3b Prices

	Scenario I Zonal CRR Imbalance (A)	Scenario IV (B)	Congestion Price (C)	Scenario I Shortfall Impact (D)	Scenario IV (E)
PGCC	19	1	3.45	65.55	3.45
PGEB	-324	-260	3.64	-1179.36	-946.4
PGF1	70	178	4.39	307.3	781.42
PGFG	-10	-29	3.68	-36.8	-106.72
PGHB	-6	-1	4.94	-29.64	-4.94
PGLP	143	121	3.64	520.52	440.44
PGNB	-42	-37	3.65	-153.3	-135.05
PGNC	2	-2	4.14	8.28	-8.28
PGNV	60	92	3.53	211.8	324.76
PGP2	-2	-16	3.66	-7.32	-58.56
PGSA	32	1	3.72	119.04	3.72
PGSB	-3	-29	3.61	-10.83	-104.69
PGSF	-11	-18	3.75	-41.25	-67.5
PGSI	34	4	3.69	125.46	14.76
PGSN	8	8	3.65	29.2	29.2
PGST	27	-11	3.83	103.41	-42.13
PGVA	2	-3	3.62	7.24	-10.86
Total	-1	-1		39.3	112.62
LAP CRRs				10783	10253
$/CRR MW				0.003645	0.010984

Similar tables showing off-peak August and on-peak and off-peak April annual CRR allocations are included in Appendix D. The CRR allocations for these other periods show a similar infeasibility pattern except that there are no infeasible CRRs to the SCE LAP in April because there was no prorationing of nominations due to constraints on delivery of power to the subzones.[69]

The payout ratio metric is also shown in Table 24 for the CRR allocations calculated for each of the 6 scenarios under Sensitivity Cases 5 and 7. Market participants were not asked to provide monthly (25%) nominations based on their annual awards for sensitivity cases, so the

69 I.e., all prorationing in this month was due to export constraints from generator pockets.

metric is calculated based solely on the annual CRR allocation for these metrics, and the payout ratio is based on 75% of the calculated congestion rent. Sensitivity 5 applies the simultaneous feasibility tests at the LAP level for CRRs sinking at the LAP as well as settling these CRRs based on LAP prices. It was anticipated that the results would show that defining CRRs to the LAP and applying the simultaneous feasibility test at the LAP level would reduce the level of CRR awards and reduce the CRR payout ratio relative to the base case, potentially resulting in a ratio of CRR payout to congestion rent that could be materially less than 100%. Based on LMP Study 3b congestion patterns and pricing, however, the Sensitivity Case 5 CRRs pay out to CRR holders only about 2-4% less of the total congestion rents collected by the CAISO than does the base case.[70]

A noteworthy feature of the difference between the base case CRR allocation and the Sensitivity 5 allocation is that although fewer CRRs were awarded to the LAP as a whole using the Sensitivity 5 methodology than the base case methodology, far more feasible CRRs were allocated than expected base on the number of CRRs awarded in the base case that were feasible to the LAP as a whole, as indicated by Tables 26 and 30. In the Scenario I base case only 169 CRRs were awarded to the SCE Low desert subzone, limiting the number of CRRs that could be assembled to the LAP as a whole to 4,156.[71] The implicit number of CRRs awarded to SCE low desert subzone in Sensitivity 5, however, is 367.57.[72] It is striking that the same CRRs sinking in the SCE low desert (and SCE north) subzones that are feasible in Sensitivity 5 were not feasible and were prorated, often to zero, in the base case. Some of these proration differences were present even in the tier 1 allocation. Further analysis of these proration patterns between the base case and Sensitivity 5 revealed some interesting properties of the base case allocation methodology. The base case methodology unbundles CRR nominations into CRRs from sources to subzones and then awards CRRs from source to subzone so as to maximize the number of CRRs awarded, weighted by the priority level of the CRR nomination. It is noteworthy that the objective function does not attempt to award CRRs from source to the LAP, even if such a CRR would be feasible. It turns out that much of the inability in CRR Study 2 to assemble the subzonal awards into CRRs to the LAP as a whole does not necessarily imply that those CRRs would not have been feasible, only that the CRRs were not awarded to the subzones required for such a rebundling to be possible, even though the CRRs could have been awarded.

For example, it was observed above in Tables 26 and 27 that under the base case methodology 10,188 CRRs would be awarded to the LAP for the August on peak period, although the number of CRR awards into the Low Desert subzone was sufficient only to allow the rebundling of 4,156 CRRs to the LAP as a whole. In Sensitivity 5, however, 9,032.5 CRRs could be awarded to the LAP as a whole. What happens in the base case is that the CRR allocation award process often does not award CRRs sinking in the subzones required to form a balanced CRR to the LAP, even though the needed CRRs would be feasible. The CRR awards were compared at the source level between the base case and Sensitivity 5 for the August on-

70 The payout ratio exceeds 1 because of transmission outages during March. Excluding March the Sensitivity 5 payout ratio is 86.4%, compared to 90.7% for the base case annual allocation.

71 See Tables 26 and 27.

72 Sensitivity 5 CRRs are defined to the LAP as a whole, but the number feasible to the subzone is at least equal to the subzonal weight times the number of CRRs feasible to the LAP as a whole.

peak period, with the basecase awards summed over the subzones, and there were only 1,270 more CRRs awarded on a source by source basis in the base case than in Sensitivity 5. Thus, most of the apparent 6,032 of potentially infeasible base case CRR awards were not actually infeasible. They could have been awarded under the simultaneous feasibility test but were not.[73]

The anomalous pattern of CRR awards under the base case methodology is even more striking in the August off-peak period. In this period, the number of priority 1 CRR awards is exactly the same between the base case and Sensitivity 5. Moreover, if one adds up the awards from each source to subzones in the SCE LAP, the number of priority 1 CRR awards is exactly the same between the two cases. The base case CRR allocation, however, does not award CRRs in proportion to subzone weights so the subzonal awards do not add up to the Sensitivity 5 LAP awards. Instead, the base case allocation of priority 1 awards disproportionately awards CRRs sinking in certain subzones, so as to permit additional awards of other subzonal CRRs in the lower priority tiers.[74] Overall, of the 11,450 CRRs awarded to subzones under the base case methodology for Off-Peak August in Scenario I, all but 450 CRRs were awarded from the same source to the LAP in the same amount in Sensitivity Case 5.

One implication of these features of the base case allocation methodology is that the base case CRR awards were actually not nearly as infeasible as suggested by the calculations in Tables 26, 27, 30 and 31, or the corresponding tables in Appendix D. Thus, the finding that infeasible CRR awards under the base case methodology do not appear to contribute to substantial revenue inadequacy even on an hourly basis is in part explained by the fact that CRRs could have been awarded to the LAP in almost the same quantities as they were to the various subzones, even though this did not happen under the base case methodology. Thus, in August on peak, about 10% of the CRRs to the SCE LAP were actually infeasible, not 60% as suggested by Tables 26 and 27.

These features of the basecase methodology, however, introduce further complications in conjunction with the annual and monthly CRR auctions, which follow the annual and monthly CRR allocations. If the CRRs allocated using the base case methodology were modeled in the auction simultaneous feasibility test as sinking at the LAP, the CRRs outstanding prior to the auction would be infeasible and the following auction process would attempt to buy counterflow CRRs to restore feasibility. If market participants did not offer the right counterflow CRRs, the auction might not solve. If the auction solved, there would be a potential for negative auction revenues which would be allocated to LSEs. If auction participants did not understand the degree of infeasibility existing prior to the auction, and thus did not offer the necessary quantities of the appropriate counterflow CRRs at prices reflecting expected values, the auction solution might purchase counterflow CRRs at very high prices to restore feasibility of the allocated CRRs.

The comparison of the Sensitivity 5 and base case awards above suggests that the base case methodology may not result in a very substantial level of infeasible CRR awards, so the cost

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[73] There were also 115 more CRRs awarded from certain sources in Sensitivity 5 than in the base case, so the difference between the 9,032.5 awarded in sensitivity 5 and 10,188 in the base case differ by only 1,155.5.

[74] This kind of trade off could not occur if the various nomination priority levels were evaluated individually, rather than in a single pass using different weights as in CRR Study 2.

of purchasing counterflow CRRs to restore feasibility might not be too substantial, but even purchasing 1,000 or 1,200 counterflow CRRs as implied by the on-peak August results could be expensive. In essence the CAISO would be awarding infeasible rights, buying counterflow to support the infeasible rights in the auction and then charging LSEs the cost of buying the counterflow CRRs. This has the potential for unfavorable cost surprises for LSEs with the process causing the CAISO to buy CRRs for LSEs at prices that exceed the value of the CRRs to the LSEs. It would be preferable to let LSEs buy CRRs for themselves in the auction with price capped bids rather than giving the LSEs infeasible CRRs purchased at uncapped prices, and then sending the LSEs a bill.

An alternative approach to modeling allocated CRRs in these auctions would be to model the CRRs allocated using the base case methodology as sinking at the individual subzones, rather than at the LAP. This approach would avoid the potential for the auction to begin with an infeasible CRR allocation leading to the purchase of counterflow CRRs to restore feasibility. Under this approach, however, there would be a potential for the auction to exacerbate the revenue inadequacy arising from the base case allocation methodology as additional CRRs could be sold impacting constraints that were already oversold if CRRs were modeled as sinking at the LAP but that appear undersold with CRRs modeled as sinking at subzones under the base case methodology.

Under this approach the peculiarities of the base case allocation methodology could become much more expensive than suggested by CRR Study 2. It was pointed out above that while the subzonal CRR awards could not be reassembled into CRRs sinking at the LAP, most of the awarded CRRs sinking at the LAP were actually feasible. In effect, although the subzonal CRR awards did not hedge the CRRs sinking at the LAP, most of the CRRs sinking at the LAP were hedged by the combination of the subzonal CRR awards and unallocated capacity in the allocation simultaneous feasibility test. If the CRR reservations in the auction are based on the subzonal CRR awards, however, there is a potential for the unallocated capacity that served to hedge infeasibility in CRR Study 2 to be sold in the auction, so auction could raise the level of infeasible CRR awards towards the levels suggested by the calculations in Tables 26, 27, 30 and 31.

Incremental CRRs would be sold in the auction in a competitive market in which CRR prices would reflected expected congestion patterns, so that if the infeasible CRRs were sold in the auction as a result of apply the auction simultaneous feasibility test to CRRs sinking in the subzones rather than the LAP, this would not necessarily produce a net shortfall (CRR payout – auction revenues). The sale of infeasible CRRs would, however, exacerbate the potential for significant shortfalls if actual congestion levels and patterns differ from those expected at the time of the auction.

Attempting to address these complications by developing auction algorithms that take account of both sets of flows or with other adjustments to the auction simultaneous feasibility test would likely impact project timetables.

The calculation of infeasible on-peak August CRR awards to the LAP in Tables 26, 27, 30 and 31 above, as well as the comparison to the Sensitivity 5 awards, is based on the annual CRR allocation. Surprisingly, the number of apparently infeasible on-peak August CRR awards to the LAP declines when the monthly allocation is combined with the annual allocation, apparently because many more CRRs were awarded to the constraining subzone in the monthly CRR allocation. For example, in Tables 33 and 34, 12,489 of the 18,071 combined annual and monthly subzonal CRRs could be combined into CRRs to the SCE LAP as a whole, as shown in Table 33, compared to only 4,156 out of 10,188 CRRs sinking at the SCE LAP in the annual allocation.

Table 33
Base Case LSE and CVR CRRs Sinking by SCE Subzone
Monthly and Annual, August 2003 On-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price[4] ($) (C)
Feasible LAP CRRs[1]	12,489	12,786	6.74
Additional Feasible Subzonal CRRs[2]			
SCEC -- Core + Northeast	3,445	2,635	6.70
SCEN -- North	283	291	6.66
SCES -- West + Southwest	1,665	1,486	6.82
SCHD -- High Desert	189	92	6.13
SCLD -- Low Desert	0	0	6.65
Total Potentially Infeasible LAP CRRs[3]	5,582	4,504	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.
[2] CRRs that are feasible only to specific subzones.
[3] Base Case LAP CRRs that are not feasible to all subzones.
[4] Congestion relative to reference bus.

Strikingly, only 169 CRRs awarded sinking in the SC low desert subzone in the annual allocation using 75% of the transmission system, while 508 CRRs were awarded to the SC low desert subzone when the remaining 25% of the transmission system was made available in the monthly allocation.

Table 34
Base Case LSE and CVR CRRs Sinking by SCE Subzone
Monthly and Annual, August 2003 On-Peak

	Scenario I			Scenario IV			
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Congestion Price
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
SCEC -- Core + Northeast	9,250	9,838	588	8,851	9,180	329	6.70
SCEN -- North	1,292	1,176	-117	1,236	1,205	-31	6.66
SCES -- West + Southwest	6,340	6,047	-293	6,066	5,972	-94	6.82
SCHD -- High Desert	453	502	49	433	413	-21	6.13
SCLD -- Low Desert	735	508	-227	704	520	-183	6.65
Total LAP CRRs	18,071	18,071	0	17,290	17,290	0	6.74

[A, D] Total of the awardedCRRs disaggregated by subzone using subzonal weights
[B, E] CRRs feasible to subzones.
[C] B - A
[F] E - D
G Average hourly congestion relative to reference bus.

The difference between the annual and monthly allocation results is less striking for CRRs sinking at the PG&E LAP, 12,078 of the subzonal CRRs could be combined to form CRRs to the entire LAP in the monthly allocation with 4,272 awarded to portions of the LAP based on the combined monthly and annual allocation as shown in Tables 35 and 36, while 8,817 could be combined to form CRRs to o the entire LAP in the annual allocation while 1,966 were awarded only to portions of the PG&E LAP.

Table 35
Base Case LSE and CVR CRRs Sinking by PG&E Subzone
Monthly and Annual, August 2003 On-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price ($) (C)
Feasible LAP CRRs[1]	12,078	13,124	3.78
Additional Feasible Subzonal CRRs[2]			
PGCC -- Central Coast	179	110	3.45
PGEB -- East Bay	0	0	3.64
PGFI -- Fresno	729	615	4.39
PGFG -- Fulton Geysers	89	45	3.68
PGHB -- Humboldt	19	15	4.94
PGLP -- Los Padres	779	531	3.64
PGNB -- North Bay	27	17	3.65
PGNC -- North Coast	50	23	4.14
PGNV -- North Valley	312	271	3.53
PGP2 -- Peninsula	273	143	3.66
PGSA -- Sacramento Valley	315	187	3.72
PGSB -- South Bay	623	349	3.61
PGSF -- SF	156	98	3.75
PGSI -- Sierra	188	118	3.69
PGSN -- San Joaquin	43	31	3.65
PGST -- Stockton	396	234	3.83
PGVA -- Vaca-Dixon	93	54	3.62
Total Infeasible LAP CRRs[3]	4,272	2,840	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.
[2] CRRs that are feasible only to specific subzones.
[3] Base Case LAP CRRs that are not feasible to all subzones.
[4] Congestion relative to reference bus.

Table 36
Base Case LSE and CVR CRRs Sinking by PG&E Subzone
Monthly and Annual, August 2003 On-Peak

	Scenario I			Scenario IV			Congestion Price
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
PGCC -- Central Coast	490	541	51	478	503	25	3.45
PGEB -- East Bay	2,694	1,990	-704	2,630	2,162	-468	3.64
PGFI -- Fresno	2,243	2,386	143	2,191	2,415	225	4.39
PGFG -- Fulton Geysers	559	502	-57	546	493	-53	3.68
PGHB -- Humboldt	96	90	-7	94	93	-1	4.94
PGLP -- Los Padres	1,690	2,028	338	1,650	1,888	238	3.64
PGNB -- North Bay	498	395	-103	486	416	-70	3.65
PGNC -- North Coast	204	200	-3	199	187	-13	4.14
PGNV -- North Valley	639	784	145	624	784	160	3.53
PGP2 -- Peninsula	1,075	1,068	-8	1,050	1,006	-44	3.66
PGSA -- Sacramento Valley	827	926	99	808	851	44	3.72
PGSB -- South Bay	2,302	2,324	22	2,248	2,197	-51	3.61
PGSF -- SF	885	809	-75	864	808	-56	3.75
PGSI -- Sierra	472	537	65	460	497	36	3.69
PGSN -- San Joaquin	89	109	20	87	102	15	3.65
PGST -- Stockton	1,255	1,323	68	1,226	1,241	16	3.83
PGVA -- Vaca-Dixon	332	338	6	324	321	-3	3.62
Total LAP CRRs	16,350	16,350	0	15,964	15,964	0	3.78

[A, C] Total of the subzonal feasible CRRs disaggregated by subzone using subzonal weights

[B, E] CRRs feasible only to subzones.

[C] B - A

[F] E - D

[G] Average hourly congestion relative to reference bus.

Differences between the sources of the CRRs nominated in the monthly and annual allocations could account for this difference in proration levels and it might be that the number of CRRs feasible to the entire PG&E LAP might be considerably less than 12,489 if evaluated source by source.

A detailed examination of CRR sources in the monthly and annual CRR allocation for August On-peak revealed, however, that the difference in CRR awards in the monthly allocation arises largely because CRR nominations that were prorated to zero in the annual allocation are unprorated in the monthly allocation.[75] No monthly allocation was completed for Sensitivity 5 so it is not possible to undertake a comparison of the Sensitivity 5 and base case monthly allocations in order to examine the extent to which these differences are due to the peculiarities of the base case allocation methodology discussed above. The pattern observed for the monthly and annual allocation is consistent with the finding in the discussion of the annual allocation that although the awarded subzonal CRRs could not be combined into CRRs sinking at the LAP, the transfer capability to support the award of CRRs sinking at the LAP was available to a much greater extent that suggested by the recombination of subzonal CRRs in Tables 26, 27, 30 and

[75] Analogous tables reporting combined monthly and annual allocation results for the August off-peak, April on-peak and April off-peak periods are included in Appendix J.

31. Thus, some of the transfer capability that was available but not used to support the allocation of CRRs sinking in particular subzones could be used in the monthly allocation.

Once again, however, the interpretation of these patterns needs to take account of the auctions that will fall between the annual allocation and the monthly allocation in the real world implementation of this allocation methodology. If the auction reserves capacity on a subzonal basis to support CRRs allocated sinking at the LAP, then CRRs could as noted above be awarded in the auction that use up transfer capability into some subzones, so that the monthly allocation would more likely exacerbate than mitigate the infeasibility of the annual CRR allocation.

Sensitivity 7 applies the simultaneous feasibility test at the subzonal level as in the base case but awards and values the feasible CRRs based on subzonal congestion prices rather than LAP prices. The awarded subzonal CRRs are therefore simultaneously feasible, providing stronger assurance of revenue adequacy than the base case allocation. It was anticipated that the Sensitivity 7 payout ratio would be noticeably lower than those in the corresponding base case scenarios and that the ratio would be less than 1. Based on the prices in the LMP Study 3b, however, as shown in Table 24, the payout ratios for the Sensitivity 7 scenarios are nearly indistinguishable from the base case payout ratios, differing by slightly over 1%. As in the base case, the overall shortfall in Sensitivity 7 is due to the large outage related shortfalls during March. Over the rest of the year, the payout ratio for Sensitivity 7 is 89.6% compared to 90.7% for the annual CRRs in the base case. These small differences in the magnitude of the payout ratio between the base case and Sensitivity 7 scenarios are in part a result of the fact that the base case and Sensitivity 5 CRR awards are similar and in part a result of the price patterns present in the LMP Study 3b. As explained above, a combination of allocations and auctions could magnify the infeasibility of the base case methodology. Moreover, actual market conditions may be different than simulated in LMP Study 3b and could lead to larger differences or to even smaller differences.

Table 37 shows the dollar magnitude of the annual congestion rents in the LMP Study 3b simulation and the CRR payments across the allocation scenarios.

Table 37
Congestion Rent and CRR Valuation
November 2002-October 2003

	Scenario I (A)	Scenario II[1] (B)	Scenario III[2] (C)	Scenario IV (D)	Scenario V[1] (E)	Scenario VI[2] (F)
	No Trading Hubs			Trading Hubs		
Congestion Rent (100%)	$150,987,086	$150,987,086	$150,987,086	$150,987,086	$150,987,086	$150,987,086
Base Case CRR Value (100%)	$161,513,151	$135,588,829	$158,504,975	$159,521,414	$133,414,020	$157,060,012
Congestion Rent (75%)	$113,240,314	$113,240,314	$113,240,314	$113,240,314	$113,240,314	$113,240,314
CRR Values						
Base Case (75%)	$120,717,914	$103,113,732	$116,212,671	$116,740,964	$103,143,177	$111,121,681
Sensitivity 5[3] (75%)	$116,384,564	$103,157,384	$111,500,741	$114,641,484	$104,284,438	$106,811,351
Sensitivity 7[4] (75%)	$119,430,307	$103,249,955	$115,132,602	$115,546,584	$103,515,982	$110,149,759

[1] All CRRs are options.
[2] ETC reservations modeled as options.
[3] Simultaneous feasibility test applied at LAP level.
[4] CRR awards valued at subzone prices for the subzone to which they are feasible.

Finally, Tables 24, 37 and 47 also portray the results for the Scenario II and IV CRR allocation in which LSE CRRs and ETC reservations are defined as options. It is apparent that defining LSE CRRs as options leads to reduced payout of congestion rents as shown in Tables 24 and 37 and also leads to greater proration of CRR requests on a MW basis (Table 47). This reduced payout reflects several distinct effects.

First, the elimination of payments associated with negatively valued CRRs, $26.5 million for Scenario I and $23.2 million for Scenario IV in the base case, tends to raise the payout ratio in Scenarios II and V relative to Scenarios I and IV (because the negatively valued CRRs reduce the net payout). The total CRR payout in Scenario II falls by about $25 million relative to Scenario I and by about $26 million in Scenario V relative to Scenario IV rather than rising, so there must be other factors that account for the reduction in the CRR payout ratio between Scenarios I and II and Scenarios IV and V.

Second, these differences in the payout ratios between Scenarios I and II and between Scenarios IV and V are consistent with the expectation that the proration ratio will be higher if LSE CRRs are allocated as options rather than obligations if fewer CRRs in total can be allocated without the counterflow provided by CRR obligations. These differences are also consistent with the expectation that the counterflow provided by CRR obligations may be important to achieving an overall allocation of CRRs that allocates more of the transfer capability of the transmission grid, and hence leads to a higher payout ratio. This is expected to occur because in an interconnected grid the counterflow from CRR obligations may make additional room available on some transmission constraints, enabling additional CRRs to be awarded that utilize transfer capability on other constraints that would otherwise be slack. If fewer constraints bind in the CRR simultaneous feasibility test, the payout ratio will generally be lower.

A further analysis of the differences in proration and awards in particular periods for CRRs sinking at particular LAPs indicates that the differences between Scenarios I and II and IV and V are not simply a result of differences in LSE CRR nominations but are instead a result of specific CRR awards that provided counterflow in Scenarios I and IV but not in Scenarios II and V.

The payout ratio for CCR options is even lower if examined at the monthly level, as the annual payout ratio is heavily impacted by the revenue inadequacy in the simulated March. Table 38 shows that excluding March the payout ratio in Scenario II for the base case CRR allocation is only 73.4%, and is less than 70% in five months, with a low of 49.4% in June.

Table 38
Scenario II Monthly Payout Ratio
(November 2002 – October 2003)

Month	Congestion Rent	Base Case CRR Value Annual and Monthly Allocation	Base Case CRR Value Annual Allocation	Sensitivity 5 CRR Value Annual Allocation	Sensitivity 7 CRR Value Annual Allocation	Payout Ratio Base Case Annual and Monthly Allocation	Payout Ratio Base Case Annual Allocation	Payout Ratio Sensitivity 5 Annual Allocation	Payout Ratio Sensitivity 7 Annual Allocation
January	7,377,124	6,862,874	5,329,423	5,160,825	5,304,363	93.03%	96.32%	93.28%	95.87%
February	8,860,771	6,046,419	4,632,673	4,283,978	4,517,546	68.24%	69.71%	64.46%	67.98%
March	18,098,969	38,002,637	29,307,451	28,750,421	29,535,636	209.97%	215.91%	211.80%	217.59%
April	7,726,801	4,743,436	3,714,476	3,692,155	3,696,738	61.39%	64.10%	63.71%	63.79%
May	15,218,309	9,334,627	7,085,931	7,071,988	7,155,899	61.34%	62.08%	61.96%	62.70%
June	13,331,299	6,587,789	4,188,157	6,004,488	4,536,473	49.42%	41.89%	60.05%	45.37%
July	17,633,510	11,321,730	8,543,975	8,631,497	8,415,060	64.21%	64.60%	65.27%	63.63%
August	14,525,170	11,262,197	8,423,797	8,123,190	8,387,923	77.54%	77.33%	74.57%	77.00%
September	15,331,082	11,473,054	8,537,801	8,342,486	8,480,659	74.84%	74.25%	72.55%	73.76%
October	14,676,380	11,449,394	9,030,409	9,116,595	9,138,874	78.01%	82.04%	82.82%	83.03%
November	13,662,265	12,343,166	9,460,809	9,239,883	9,228,107	90.34%	92.33%	90.17%	90.06%
December	4,545,406	6,161,506	4,858,830	4,739,876	4,852,676	135.55%	142.53%	139.04%	142.35%
Total	150,987,086	135,588,829	103,113,732	103,157,384	103,249,955	89.80%	91.06%	91.10%	91.18%
Total less March	132,888,117	97,586,192	73,806,280	74,406,962	73,714,319	73.43%	74.05%	74.66%	73.96%

Table 24 shows that the payout ratio for the combined annual and monthly CRR allocation is very similar between Scenarios I (no trading hub sources) and Scenario IV (allowing trading hub CRR sources), differing by about 1%. The difference is larger, about 3.5%, for the payout ratio calculated only for the annual CRR allocation. The difference in the payout ratio reflects multiple conflicting factors. First, there is very substantial proration of CRR requests sourced from some trading hubs in some months. For example, in the August On-peak allocation all priority 2, 3 and 4 CRR nominations sourced at the SP EZ Gen Trading Hub were prorated to zero in both the annual and monthly allocation. The reason for this proration is that one of the generators included in the trading hub is located in a generation pocket that became a binding constraint on priority 1 CRR awards. Once this constraint became binding on awards from this single generator, no CRRs could be awarded from the trading hub in the lower priority allocations.[76]

[76] This feature of CRRs sourced from trading hubs is discussed further, with examples, in Section VIII D.

A second factor impacting the payout ratio results is that some of the prorated CRRs sourced from trading hubs had negative values, so their proration raised rather than lowered the payout ratio.

The difference between the Scenario I and Scenario IV payout ratios is a little larger if the simulated March data are excluded as shown in Table 39, but the patterns are generally very similar at the monthly level.

Table 39
Scenario IV Monthly Payout Ratio
(November 2002 – October 2003)

Month	Congestion Rent	Base Case CRR Value Annual and Monthly Allocation	Base Case CRR Value Annual Allocation	Sensitivity 5 CRR Value Annual Allocation	Sensitivity 7 CRR Value Annual Allocation	Payout Ratio Base Case Annual and Monthly Allocation	Payout Ratio Base Case Annual Allocation	Payout Ratio Sensitivity 5 Annual Allocation	Payout Ratio Sensitivity 7 Annual Allocation
January	7,377,124	8,716,940	6,294,213	6,268,733	6,247,779	118.16%	113.76%	113.30%	112.92%
February	8,860,771	6,973,498	5,391,917	4,584,561	5,291,493	78.70%	81.14%	68.99%	79.62%
March	18,098,969	37,811,978	30,193,181	30,178,611	30,021,427	208.92%	222.43%	222.32%	221.16%
April	7,726,801	5,804,792	4,271,433	4,196,898	4,223,592	75.13%	73.71%	72.42%	72.88%
May	15,218,309	12,847,092	8,877,399	8,924,252	8,835,538	84.42%	77.78%	78.19%	77.41%
June	13,331,299	12,678,303	8,217,353	8,039,573	8,161,612	95.10%	82.19%	80.41%	81.63%
July	17,633,510	16,141,604	10,968,699	11,064,840	10,963,219	91.54%	82.94%	83.67%	82.90%
August	14,525,170	12,151,919	7,676,281	7,478,643	7,611,972	83.66%	70.46%	68.65%	69.87%
September	15,331,082	14,172,878	10,574,718	9,670,409	10,386,552	92.45%	91.97%	84.10%	90.33%
October	14,676,380	11,939,419	8,940,917	8,928,343	8,851,402	81.35%	81.23%	81.11%	80.41%
November	13,662,265	14,033,987	10,573,604	10,577,354	10,217,707	102.72%	103.19%	103.23%	99.72%
December	4,545,406	6,249,005	4,761,249	4,729,264	4,734,291	137.48%	139.66%	138.73%	138.87%
Total	150,987,086	159,521,414	116,740,964	114,641,484	115,546,584	105.65%	103.09%	101.24%	102.04%
Total less March	132,888,117	121,709,436	86,547,783	84,462,873	85,525,157	91.59%	86.84%	84.75%	85.81%

A factor that potentially influences the value of the payout ratio metric both in the base case and in the sensitivity cases is that a material proportion of the CRRs awarded to LSEs in CRR Study 2 have a negative value based on LMP Study 3b prices. It was anticipated that many of the CRRs implicitly defined under Sensitivity 7 would have negative values because the CRRs that were feasible on a subzonal basis but not to the LAP are likely to be counterflow CRRs.[77] In the CRR Study 2 results, however, around 16% of the base case CRRs have negative values

[77] The CRR nominations used for the Sensitivity 7 analysis are the same nominations for CRRs sinking at the LAP that were used for the base case analysis. The LSEs did not ask to be awarded CRRs sinking in particular subzones if CRRs sinking at the LAP were not feasible, as might be the procedure under an actual allocation system for subzonal CRRs. Instead, the CRRs sinking in the subzones were awarded simply because the CRRs were feasible to the subzone but not to the LAP.

when settled based on the LAP prices (see Table 40) and the proportion of negatively valued CRRs is little different if the CRRs are valued based on subzonal prices as in Sensitivity 7.

Table 40
Counterflow CRR Awards (November 2002-October 2003)
Negatively Valued CRRs as Percent of Total CRR Value

	Scenario I (A)	Scenario III (B)	Scenario IV (C)	Scenario VI (D)
Base Case – 100%	16.13%	16.10%	14.59%	15.40%
Sensitivity Case 5 – 75%	13.65%	13.29%	12.14%	12.69%
Sensitivity Case 7 – 75%	16.29%	16.57%	14.98%	15.35%

If the LMP Study 3b provides a reasonable assessment of future congestion patterns, it should be anticipated that LSEs would not nominate such large quantities of negatively valued CRRs in the actual allocation process. The failure of LSEs to nominate the counterflow CRRs in the actual allocation process, however, might materially reduce the number of other CRRs that could be awarded. Overall, there might be little net impact on the payout ratio metric of such a failure to designate negatively valued CRRs if there were a balanced reduction in the award of positively and negatively valued CRRs. The effects might not necessarily be exactly offsetting, however, so it was recommended that an additional allocation sensitivity case be run for one or more scenarios to assess the actual impact of such a failure to nominate negatively valued CRRs.

For this additional sensitivity case, which we refer to as Sensitivity 8, we identified all of the LSE CRRs that were negatively valued for the allocation period in question and asked the CAISO to rerun the CRR allocation process without these CRR nominations. The intent of this procedure is to roughly approximate the impact on the overall CRR allocations of LSEs choosing not to nominate such negatively valued CRRs.[78] This is an imperfect measure of the actual change in nominations if LSEs expected these CRRs to be negatively valued, as if individual LSEs had not nominated these CRRs they would likely have nominated other CRRs. Nevertheless, the sensitivity case illustrates the impact of such negatively valued CRR awards on aggregate awards to the extent the aggregate awards were constrained by the simultaneous feasibility test. Because of the time required to rerun the CRR allocation process, in particular the simultaneous feasibility test, for all of the scenarios and all of the time of use periods, we did not ask the CAISO to run Sensitivity 8 for all scenarios and months but only for Scenarios I and IV and the month of August.

[78] Individual LSEs might wish to hold negatively valued CRRs in order to hedge themselves against possible congestion patterns for which the CRRs would provide positive payments. Such counterflow hedges could generally be acquired in the auction at a negative price (i.e., the LSE would be paid to hold the CRR), so it would be more financially attractive to acquire such CRRs in the auction than in an allocation.

The Sensitivity 5, 7, 8 and base case results for Scenarios I and IV for the month of August are shown in Table 41.

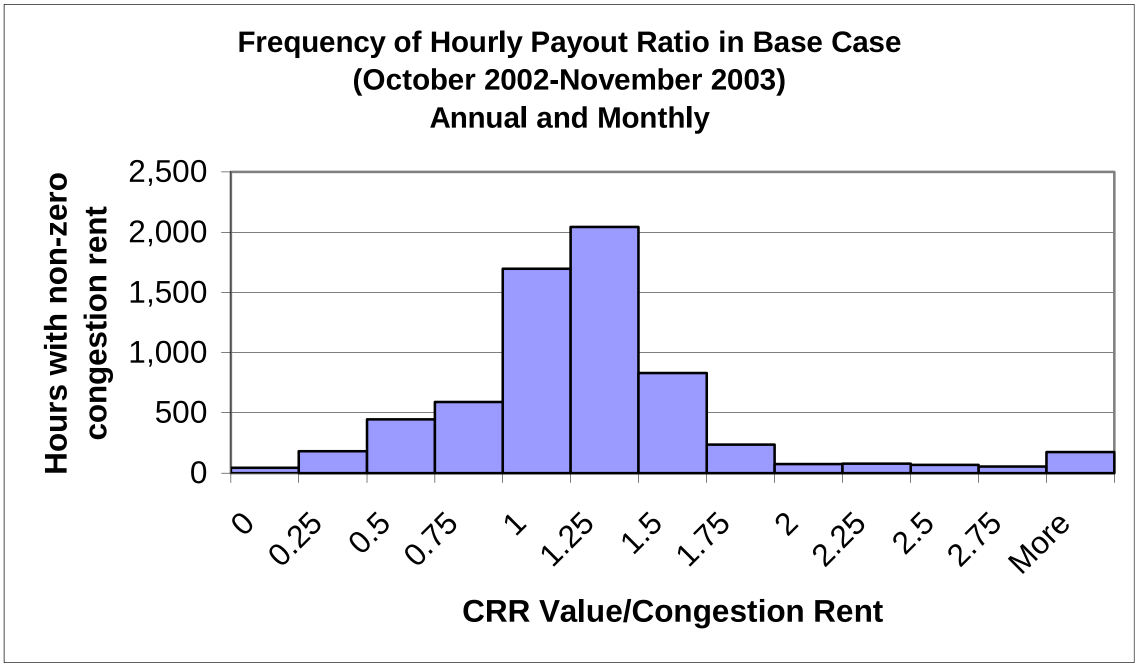
Table 41
Payout Ratio Metric
CRR Value/Congestion Rent (August 2003)

	Scenario I (A)	**Scenario IV (B)**
	No Trading Hubs	**Trading Hubs**
Base Case		
Annual and Monthly	91.35%	83.66%
Annual	75.22%	70.46%
Sensitivity Case 5[1] – Annual	69.47%	68.65%
Sensitivity Case 7[2] – Annual	73.99%	69.87%
Sensitivity Case 8[3] – Annual	82.75%	85.29%

[1] Simultaneous feasibility test applied at LAP level.
[2] CRR awards valued at subzone prices for the subzone to which they are feasible.
[3] Negatively valued nominations excluded from the CRR allocation.

It has been noted above that one limitation of the scenario assessments above based on LMP Study 3b prices, is that the overall LMP study results are in some respects a single realization of many potential outcomes. As discussed with market participants, one approach to assessing the potential variability in congestion payout ratio outcomes is to analyze the distribution of this metric on an hourly basis in the LMP Study 3b data. Figure 42 portrays the distribution of hours with non-zero congestion rent by payout ratio and it can be seen that there are a material number of hours with payout ratios less than .75 and more than 1.5.[79]

Figure 42



[79] Tables 41 and 45 and Figures 42 and 44 exclude 2,207 hours with zero congestion. Both CRR values and congestion rents are zero in these hours.

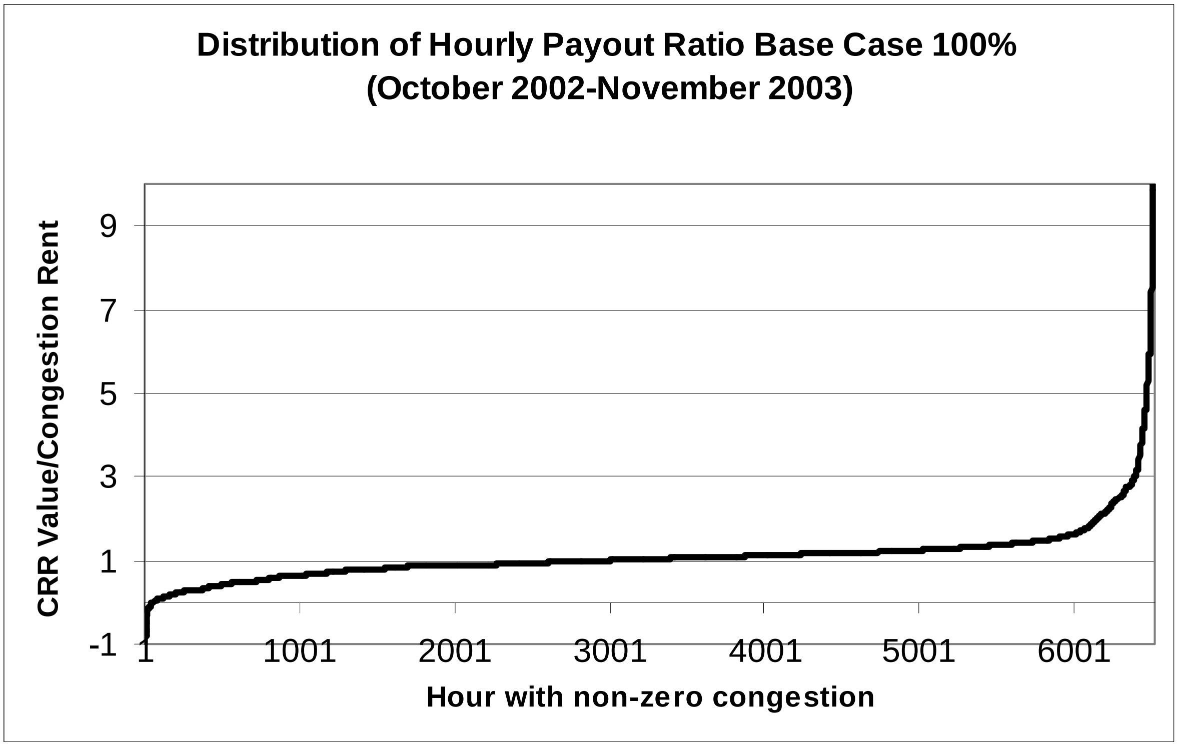
Table 43 reports these same data in a tabular manner and shows that the payout ratio exceeds 1.5 in 10.52% of the hours with non-zero congestion rent, exceeds 1.25 in a little more than 23% of the hours, and is less than 75% in 19.39% of all hours.

Table 43
Distribution of Hourly Payout Ratio, Base Case Scenario I
(October 2002 - November 2003)
Annual and Monthly CRR Allocations

Payout Ratio	*Frequency*	
< 0	45	0.69%
0 - 0.25	181	2.78%
0.25 - 0.5	446	6.84%
0.5 - 0.75	592	9.08%
0.75 - 1	1,697	26.04%
1 - 1.25	2,041	31.31%
1.25 - 1.5	830	12.73%
1.5 - 1.75	236	3.62%
1.75 - 2	75	1.15%
2 - 2.25	77	1.18%
2.25 - 2.5	67	1.03%
2.5 - 2.75	54	0.83%
> 2.75	177	2.72%

Figure 44 portrays these data in the form of a cumulative distribution of payout ratios.

Figure 44



As observed above, not all of the payout ratios above 1 are due to the award of CRRs that are infeasible because of the way the simultaneous feasibility test was applied. Many of the hours with high payout ratios are March hours in which the high payout ratios reflect transmission outages.[80] Table 45 portrays the distribution of payout ratios in a tabular form, excluding March.

Table 45
Distribution of Hourly Payout Ratio, Base Case Scenario I
(October 2002 - November 2003 Excluding March)
Annual and Monthly CRR Allocations

Payout Ratio	*Frequency*	*%*
< 0	39	0.65%
0 - 0.25	170	2.82%
0.25 - 0.5	423	7.01%
0.5 - 0.75	575	9.53%
0.75 - 1	1,559	25.83%
1 - 1.25	1,922	31.85%
1.25 - 1.5	770	12.76%
1.5 - 1.75	224	3.71%
1.75 - 2	68	1.13%
2 - 2.25	74	1.23%
2.25 - 2.5	62	1.03%
2.5 - 2.75	49	0.81%
> 2.75	100	1.66%

Table 45 shows that if March is excluded, the base case CRR allocation payout ratio exceeds 1.5 in 9.56% of the remaining hours, and exceeds 1.25 in about 22% of the remaining hours. Some of this revenue inadequacy is likely also attributable to transmission outages in other hours. These daily data provide an indication of the extent to which the payout proportion is robust to changes in congestion patterns.

An examination of the hour by hour values of the CRR payments under the base case methodology (which is potentially revenue inadequate due to the method of applying the simultaneous feasibility test) and Sensitivity 7 (which should be revenue inadequate only as a result of transmission outages and deratings) indicates that virtually all of the revenue inadequacy in the base case in the hours with payout ratios in excess of 2.75 is also present in Sensitivity 7.[81] This suggests that the revenue inadequacy in these hours is not attributable to the base case methodology for assigning CRRs but either to transmission system outages not modeled in the monthly allocation, infeasibilities of the annual CRRs in the monthly allocation, or as yet unidentified limitations of the LMP Study 3b simulation.

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[80] It was noted above that we excluded the March hours in which the pricing model produced meaningless loss components due to the islanding of the transmission grid. There were a number of hours on following days in which there were still substantial transmission outages but no islanding and these hours are included in the CRR Study 2 analysis.

[81] See Table 67 appended.

C. Proration Metrics

1. Proration Ratio

This report discusses three aspects of the proration ratio metric. The first aspect of this metric is the calculation of the proration ratio for each LSE's CRR awards. The proration ratio is calculated only for CRR nominations by LSEs, i.e., it does not include the ISO's ETC and TOR reservations or ETC converted to CRRs. The ratio is calculated annually for each LSE and also separately for the on- and off-peak periods of each month.

Second, the report calculates the average value weighted proration ratio over all LSEs. This is defined as the sum over all LSEs of the total value of the awarded CRRs divided by the sum over all LSEs of the total value of the requested CRRs. This ratio is calculated both on an overall annual basis and for each on-peak and off-peak period for each month and is calculated separately for CRRs sinking in each LAP.

The values of the proration metric for the base case scenarios and Sensitivity Cases 5 and 7 are reported in Table 46. To preserve confidentiality the report shows only the high and low value of the proration ratio for each scenario, as well as the average value, in Table 46. It is readily apparent that there are wide ranges in the value of the proration ratio across LSEs for all six scenarios, in both the base case and in Sensitivity 7. The data reported in Table 46 has been aggregated across LAPs to preserve confidentiality but the dispersion does not simply reflect LAP specific affects, there is also substantial dispersion in the proration ratio for LSEs serving load in the same LAP.

Table 46
Proration Ratio Metric (November 2002-October 2003)
Awarded Value/Nominated Value

	Scenario I[1] (A)	Scenario II[2] (B)	Scenario III[3] (C)	Scenario IV[1] (D)	Scenario V[2] (E)	Scenario VI[3] (F)
	No Trading Hubs			Trading Hubs		
Base Case – Annual and Monthly Allocation[4]						
Average – All LSEs & LAPs	87.35%	42.05%	75.96%	87.63%	43.70%	78.71%
Low LSE	38.70%	14.43%	27.97%	-544.81%	17.27%	-722.36%
High LSE	108.68%	84.36%	124.43%	102.92%	76.14%	102.67%
Base Case – Annual and Monthly Allocation[5]						
Average – All LSEs & LAPs	93.59%	55.10%	85.55%	94.54%	56.82%	90.23%
Low LSE	68.22%	22.98%	38.07%	-397.51%	27.29%	-464.15%
High LSE	112.03%	100.00%	124.34%	103.94%	100.00%	103.84%
Base Case – Annual Allocation						
Average – All LSEs & LAPs	90.61%	57.13%	82.97%	89.60%	72.80%	80.91%
Low LSE	22.16%	23.45%	25.82%	39.08%	23.45%	27.23%
High LSE	106.05%	89.49%	100.06%	99.11%	84.99%	98.97%
Sensitivity Case 5 - Annual Allocation[6]						
Average – All LSEs & LAPs	86.74%	57.14%	78.79%	87.67%	60.02%	76.97%
Low LSE	25.92%	23.71%	9.02%	31.84%	24.85%	22.65%
High LSE	123.67%	92.09%	136.19%	99.24%	86.31%	142.25%
Sensitivity Case 7 – Annual Allocation[7]						
Average – All LSEs & LAPs	90.70%	56.25%	83.15%	89.79%	58.06%	81.17%
Low LSE	20.48%	23.60%	23.02%	35.96%	24.42%	24.33%
High LSE	131.40%	89.49%	115.50%	101.32%	83.59%	111.14%

[1] CVR and TOR are options.
[2] All CRRs are options.
[3] ETC reservations modeled as options.
[4] Proration ratio is calculated as (value of annual and monthly awards)/(value of annual and monthly nominations)
[5] Proration ratio is calculated as (value of annual and monthly awards)/(value of annual awards and monthly nominations)
[6] Simultaneous feasibility test applied at LAP level.
[7] CRR awards valued at subzone prices for the subzone to which they are feasible.

An important factor accounting for some of the seemingly anomalous values of the proration ratio is the previously mentioned nomination of negatively valued CRRs by various LSEs. Some of the very high values for the proration ratio are impacted by the nomination of negatively valued CRRs. When the award of the negatively valued CRRs is prorated, the proration raises the value of the awarded CRRs relative to the nominated value. This factor accounts for the values of the proration metric in excess of 100 and impacts many of the other values. Nomination of negatively valued CRRs is also the reason that some of the proration ratios are negative.

It is apparent, however, that there are also substantial variations in the value of the proration metric in Scenario II in which all LSE CRRs are valued as options so not all of the variation is due simply to the impact of negatively valued CRRs. Table 47 portrays proration ratios calculated for the megawatt awards, rather than the dollar valued awards, and it is apparent that except for the elimination of negative values, there is a similar level of dispersion in these ratios.

Table 47
Proration Ratio Metric (November 2002-October 2003)
Awarded MW/Nominated MW

	Scenario I[1] (A)	Scenario II[2] (B)	Scenario III[3] (C)	Scenario IV[1] (D)	Scenario V[2] (E)	Scenario VI[3] (F)
	No Trading Hubs			Trading Hubs		
Base Case – Annual and Monthly Allocation[4]						
Average – All LSEs & LAPs	83.53%	36.22%	76.19%	81.49%	36.96%	76.17%
Low LSE	43.90%	9.69%	35.03%	27.27%	13.45%	27.51%
High LSE	98.48%	94.31%	94.35%	98.67%	94.61%	96.69%
Base Case – Annual and Monthly Allocation[5]						
Average – All LSEs & LAPs	90.98%	49.63%	86.20%	90.96%	50.25%	88.28%
Low LSE	60.43%	15.88%	50.95%	37.50%	21.45%	37.75%
High LSE	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Base Case – Annual Allocation						
Average – All LSEs & LAPs	87.45%	48.56%	81.69%	83.73%	49.73%	77.81%
Low LSE	49.35%	16.52%	39.57%	50.00%	20.79%	44.63%
High LSE	99.28%	98.44%	99.00%	98.82%	98.44%	97.85%
Sensitivity Case 5 - Annual Allocation[6]						
Average – All LSEs & LAPs	81.49%	49.12%	74.82%	80.23%	49.83%	72.05%
Low LSE	44.99%	17.46%	34.82%	50.00%	22.10%	39.12%
High LSE	97.98%	98.44%	97.71%	96.81%	98.44%	94.65%
Sensitivity Case 7 – Annual Allocation[7]						
Average – All LSEs & LAPs	87.45%	48.56%	81.69%	83.73%	49.73%	77.81%
Low LSE	49.35%	16.52%	39.57%	50.00%	20.79%	44.63%
High LSE	99.28%	98.44%	99.00%	98.82%	98.44%	97.85%

[1] CVR and TOR are options.
[2] All CRRs are options.
[3] ETC reservations modeled as options.
[4] Proration ratio is calculated as (MW of annual and monthly awards)/(MW of annual and monthly nominations)
[5] Proration ratio is calculated as (MW of annual and monthly awards)/(MW of annual awards and monthly nominations)
[6] Simultaneous feasibility test applied at LAP level.
[7] CRR awards valued at subzone prices for the subzone to which they are feasible.

The proration ratio for the combined annual and monthly allocation in the top row of Tables 46 and 47 is the ratio of the sum of the value or megawatts of CRRs awarded in the annual and monthly allocation to the sum of the value or megawatts of CRRs nominated in the annual and monthly allocations. A market participant pointed out that these ratios could in a sense overstate the effective proration ratio because LSEs whose annual nominations were prorated could potentially submit nominations that summed to more than their peak load. The second set of rows in Tables 46 and 47, Base Case Adjusted, accounts for this possibility by defining the denominator as the sum of the value or megawatts of CRRs awarded in the annual round and those nominated in the monthly round. It can be seen that this alternative measure raises the proration ratios by between 7 and 13% across the various scenarios. Overall, the proration ratio for the combined annual and monthly allocation measured in this way is much more like the proration ratio for the annual allocation alone (the third set of rows) and is universally higher than the proration ratio for the annual round alone, rather than lower as suggested by the measure in the first set of rows.

From this perspective LSEs were awarded a very high proportion of the CRR requests in Scenario I, about 93% in dollar terms or 90% in megawatt terms.

Viewed at the monthly level, the adjusted megawatt proration ratio portrayed in Table 48 exceeds 90% of nominations in every month and period except the July and August on-peak periods when it falls to 89.8 and 87.7%.

Table 48
Scenario I, Base Case
Proration Ratio Metric (November 2002 – October 2003)
MW Award/MW Nomination

Month	Time of Use	MW Annual and Monthly Nomination	MW Annual and Monthly Awards	MW Annual Nominations	MW Annual Awards	MW Proration Ratio[1]	Adjusted MW Proration Ratio[2]
January	Off-Peak	36,358	30,224	23,574	20,343	83.13%	91.24%
February	Off-Peak	35,166	29,694	23,645	20,735	84.44%	92.06%
March	Off-Peak	34,918	29,949	23,957	21,075	85.77%	93.49%
April	Off-Peak	34,154	29,472	22,867	20,516	86.29%	92.67%
May	Off-Peak	35,638	30,722	23,743	21,270	86.21%	92.63%
June	Off-Peak	38,717	32,142	26,768	23,388	83.02%	90.96%
July	Off-Peak	44,678	36,452	30,214	25,856	81.59%	90.41%
August	Off-Peak	42,819	35,750	30,802	26,744	83.49%	92.23%
September	Off-Peak	43,368	35,318	30,578	26,041	81.44%	90.95%
October	Off-Peak	37,561	31,678	26,565	24,197	84.34%	90.01%
November	Off-Peak	35,513	30,564	24,612	21,706	86.06%	93.73%
December	Off-Peak	38,114	32,455	25,868	22,885	85.15%	92.38%
January	On-Peak	37,142	33,163	25,294	23,816	89.29%	92.99%
February	On-Peak	37,047	32,411	25,347	23,470	87.49%	92.15%
March	On-Peak	34,415	32,795	25,457	25,069	95.29%	96.38%
April	On-Peak	36,083	33,580	25,086	24,320	93.06%	95.08%
May	On-Peak	43,220	38,658	31,633	29,447	89.44%	94.21%
June	On-Peak	47,063	41,037	32,250	28,796	87.20%	94.10%
July	On-Peak	49,890	41,973	33,102	29,957	84.13%	89.79%
August	On-Peak	54,525	42,941	33,673	28,100	78.75%	87.72%
September	On-Peak	49,324	42,062	34,379	30,231	85.28%	93.11%
October	On-Peak	43,319	37,780	30,050	27,254	87.21%	93.23%
November	On-Peak	36,770	34,627	25,960	25,107	94.17%	96.41%
December	On-Peak	38,140	35,049	27,001	25,763	91.90%	94.98%

[1] Proration calculated as MW annual and monthly awards per MW of annual and monthly nominations
[2] Proration calculated as MW annual and monthly awards per MW of annual awards and monthly nominations

Tables 49 through 54 report the LSE and LAP specific proration ratio metric on a dollar and megawatt basis as well as the LSE CRR payment per MW of net peak load.[82] The LSE data is ordered by proration ratio and no LAP identification is provided to preserve confidentiality. The number of LSE/LAP statistics varies in some cases across the scenarios because not all LSEs requested CRRs for all scenarios.

Table 49
Scenario I LSE-LAP Specific Equity Measures
Base Case Annual and Monthly CRR Allocation

LSE-LAP	Value Based Proration Ratio (%)[1]	Value Based Proration Ratio Adjusted (%)[2]	MW Based Proration Ratio (%)[3]	MW Based Proration Ratio Adjusted (%)[4]	CRR Value per MW ($)[5]
A1	108.68%	112.03%	91.61%	93.94%	2,416
B1	104.37%	104.34%	94.97%	95.44%	-2,795
C1	102.12%	104.01%	91.40%	92.57%	895
D1	97.78%	99.20%	96.02%	98.64%	4,208
E1	97.02%	98.04%	98.48%	99.26%	4,958
F1	95.68%	96.73%	97.47%	98.64%	730
G1	91.62%	96.51%	94.66%	97.75%	2,605
H1	90.38%	98.64%	92.02%	98.18%	2,672
I1	90.32%	94.39%	91.31%	96.25%	5,367
J1	85.17%	88.23%	77.49%	85.48%	1,527
K1	79.02%	85.69%	79.82%	88.63%	5,220
L1	77.83%	87.02%	69.30%	83.03%	5,786
M1	74.34%	88.09%	71.56%	86.46%	9,984
N1	69.96%	69.71%	93.91%	95.35%	1,564
O1	69.32%	81.05%	85.81%	94.50%	2,720
P1	68.88%	100.00%	65.64%	100.00%	1,656
Q1	68.88%	81.85%	68.88%	81.85%	-10
R1	67.59%	100.00%	68.04%	100.00%	6,035
S1	66.93%	98.04%	95.14%	99.10%	1,184
T1	65.57%	83.44%	71.56%	88.98%	4,933
U1	64.01%	100.00%	59.02%	100.00%	4,284
V1	61.32%	85.29%	82.06%	90.87%	340
W1	61.05%	100.00%	57.19%	100.00%	5,717
X1	60.27%	75.15%	58.45%	75.73%	2,287
Y1	59.18%	71.89%	60.26%	75.28%	1,387
Z1	58.75%	76.50%	65.64%	82.11%	1,112
AA1	58.62%	75.73%	63.22%	79.60%	3,971
AB1	51.14%	68.22%	43.90%	60.43%	1,121
AC1	38.70%	70.66%	53.69%	80.86%	407

[1] Dollar value of annual and monthly CRR awards per dollar value of annual and monthly CRR nominations (%)
[2] Dollar value of annual and monthly CRR awards per dollar value of annual CRR awards and monthly CRR nominations (%)
[3] MW of annual and monthly CRR awards per MW of annual and monthly CRR nominations (%)
[4] MW of annual and monthly CRR awards per MW of annual CRR awards and MW of monthly CRR nominations (%)
[5] Dollar value of annual and monthly CRR awards per MW of LSE peak load in 2003 ($)
Different LSE identifier codes have been assigned to each LSE in Tables 14 through 19.

[82] Net peak load is annual peak load net of ETC, TOR and CVR rights.

Table 50
Scenario II LSE-LAP Specific Equity Measures
Base Case Annual and Monthly CRR Allocation

LSE-LAP	Value Based Proration Ratio (%)[1]	Value Based Proration Ratio Adjusted (%)[2]	MW Based Proration Ratio (%)[3]	MW Based Proration Ratio Adjusted (%)[4]	CRR Value per MW ($)[5]
A2	84.36%	91.31%	47.66%	60.53%	4,485
B2	65.46%	98.51%	94.31%	95.20%	7,572
C2	61.48%	100.00%	62.36%	100.00%	4,452
D2	60.54%	72.86%	50.51%	60.74%	2,062
E2	53.07%	100.00%	51.56%	100.00%	5,007
F2	51.27%	60.89%	49.69%	65.84%	4,959
G2	51.09%	85.51%	48.78%	81.37%	9,939
H2	50.84%	64.55%	48.27%	62.97%	2,022
I2	48.19%	61.88%	71.05%	74.67%	3,701
J2	47.39%	59.59%	42.04%	56.02%	3,997
K2	45.99%	53.67%	51.12%	64.25%	267
L2	41.99%	46.47%	49.68%	68.16%	3,204
M2	41.39%	51.17%	46.99%	60.30%	1,352
N2	40.45%	100.00%	36.77%	100.00%	979
O2	40.13%	42.62%	86.55%	88.11%	1,401
P2	39.03%	52.38%	36.87%	50.26%	2,313
Q2	37.86%	50.27%	38.63%	49.51%	2,656
R2	37.77%	51.98%	39.63%	53.66%	787
S2	37.03%	51.13%	42.61%	54.56%	1,272
T2	36.44%	50.09%	36.44%	50.09%	0
U2	35.07%	36.40%	55.16%	64.72%	1,089
V2	33.84%	49.03%	31.70%	46.82%	3,022
W2	32.06%	46.67%	29.57%	45.19%	1,485
X2	28.53%	40.98%	26.30%	40.19%	869
Y2	27.83%	43.10%	40.54%	58.34%	718
Z2	25.25%	27.27%	68.03%	77.64%	451
AA2	24.52%	33.91%	52.80%	59.99%	1,762
AB2	20.76%	40.78%	32.85%	60.68%	282
AC2	19.56%	28.68%	26.54%	37.58%	823
AD2	14.43%	22.98%	9.69%	15.88%	369

[1] Dollar value of annual and monthly CRR awards per dollar value of annual and monthly CRR nominations (%)

[2] Dollar value of annual and monthly CRR awards per dollar value of annual CRR awards and monthly CRR nominations (%)

[3] MW of annual and monthly CRR awards per MW of annual and monthly CRR nominations (%)

[4] MW of annual and monthly CRR awards per MW of annual CRR awards and MW of monthly CRR nominations (%)

[5] Dollar value of annual and monthly CRR awards per MW of LSE peak load in 2003 ($)

Different LSE identifier codes have been assigned to each LSE in Tables 49 through 54.

Table 51
Scenario III LSE-LAP Specific Equity Measures
Base Case Annual and Monthly CRR Allocation

LSE-LAP	Value Based Proration Ratio (%)[1]	Value Based Proration Ratio Adjusted (%)[2]	MW Based Proration Ratio (%)[3]	MW Based Proration Ratio Adjusted (%)[4]	CRR Value per MW ($)[5]
A3	124.43%	124.34%	94.35%	95.01%	-2,429
B3	105.93%	108.10%	91.08%	93.44%	2,462
C3	84.44%	90.18%	85.56%	91.94%	3,835
D3	84.44%	89.54%	84.14%	91.81%	5,382
E3	82.61%	91.33%	88.10%	95.22%	2,473
F3	80.35%	95.06%	86.27%	95.08%	2,574
G3	79.99%	81.68%	88.13%	89.49%	4,091
H3	78.14%	79.58%	67.88%	70.11%	1,756
I3	69.15%	100.00%	68.46%	100.00%	8,743
J3	68.83%	74.48%	73.01%	81.12%	4,550
K3	68.07%	90.04%	89.64%	95.41%	1,264
L3	66.19%	83.09%	67.69%	83.82%	4,917
M3	62.17%	63.69%	90.29%	92.20%	487
N3	60.32%	76.73%	63.17%	79.48%	4,618
O3	59.96%	100.00%	59.82%	100.00%	4,013
P3	59.31%	114.28%	76.91%	88.81%	295
Q3	58.38%	59.03%	87.14%	91.52%	1,079
R3	57.07%	100.00%	57.15%	100.00%	1,372
S3	56.54%	73.08%	56.54%	73.08%	-9
T3	56.45%	69.17%	55.22%	68.10%	7,839
U3	55.00%	65.95%	76.54%	88.23%	2,388
V3	54.06%	100.00%	53.08%	100.00%	5,062
W3	53.75%	66.89%	68.58%	79.45%	1,156
X3	52.15%	67.48%	53.28%	67.01%	3,526
Y3	51.33%	68.21%	51.94%	70.64%	2,105
Z3	50.30%	65.26%	51.98%	68.53%	1,210
AA3	40.61%	58.00%	35.03%	50.95%	909
AB3	39.45%	60.03%	56.70%	76.06%	879
AC3	37.28%	38.07%	82.28%	85.97%	476
AD3	27.97%	52.04%	48.87%	77.21%	312

[1] Dollar value of annual and monthly CRR awards per dollar value of annual and monthly CRR nominations (%)
[2] Dollar value of annual and monthly CRR awards per dollar value of annual CRR awards and monthly CRR nominations (%)
[3] MW of annual and monthly CRR awards per MW of annual and monthly CRR nominations (%)
[4] MW of annual and monthly CRR awards per MW of annual CRR awards and MW of monthly CRR nominations (%)
[5] Dollar value of annual and monthly CRR awards per MW of LSE peak load in 2003 ($)
Different LSE identifier codes have been assigned to each LSE in Tables 49 through 54.

Table 52
Scenario IV LSE-LAP Specific Equity Measures
Base Case Annual and Monthly CRR Allocation

LSE-LAP	Value Based Proration Ratio (%)[1]	Value Based Proration Ratio Adjusted (%)[2]	MW Based Proration Ratio (%)[3]	MW Based Proration Ratio Adjusted (%)[4]	CRR Value per MW ($)[5]
A4	102.92%	103.94%	85.01%	86.94%	3,150
B4	99.17%	100.03%	98.06%	98.86%	5,026
C4	98.82%	99.51%	98.67%	99.32%	748
D4	98.26%	99.92%	97.76%	99.56%	4,198
E4	96.36%	101.26%	86.67%	94.21%	1,579
F4	95.87%	98.72%	94.59%	97.93%	2,329
G4	94.44%	97.14%	94.06%	98.45%	2,662
H4	92.52%	0.00%	90.06%	0.00%	694
I4	91.33%	93.09%	78.72%	86.44%	1,624
J4	87.77%	94.78%	83.50%	93.83%	5,378
K4	84.65%	100.00%	76.87%	100.00%	2,034
L4	80.79%	100.00%	78.09%	100.00%	5,407
M4	79.98%	100.00%	85.15%	99.96%	4,398
N4	79.29%	100.00%	76.67%	100.00%	7,426
O4	78.84%	100.00%	83.42%	100.00%	1,462
P4	77.45%	90.67%	70.24%	85.69%	2,248
Q4	76.96%	80.00%	76.95%	86.94%	6,198
R4	76.08%	95.95%	79.55%	95.81%	2,245
S4	75.37%	87.85%	82.45%	93.29%	5,201
T4	74.75%	81.47%	86.87%	91.28%	1,117
U4	70.45%	83.52%	69.16%	83.26%	1,231
V4	70.25%	89.32%	73.15%	88.54%	1,058
W4	69.22%	81.46%	77.50%	87.41%	4,288
X4	63.68%	72.59%	77.90%	93.03%	3,209
Y4	63.03%	96.40%	77.21%	92.23%	711
Z4	63.03%	77.62%	54.66%	72.16%	1,352
AA4	48.20%	84.01%	63.76%	88.22%	498
AB4	27.27%	37.50%	27.27%	37.50%	-4
AC4	-36.21%	-34.91%	78.10%	91.81%	-251
AD4	-544.81%	-397.51%	73.01%	84.66%	-623

[1] Dollar value of annual and monthly CRR awards per dollar value of annual and monthly CRR nominations (%)
[2] Dollar value of annual and monthly CRR awards per dollar value of annual CRR awards and monthly CRR nominations (%)
[3] MW of annual and monthly CRR awards per MW of annual and monthly CRR nominations (%)
[4] MW of annual and monthly CRR awards per MW of annual CRR awards and MW of monthly CRR nominations (%)
[5] Dollar value of annual and monthly CRR awards per MW of LSE peak load in 2003 ($)
Different LSE identifier codes have been assigned to each LSE in Tables 49 through 54.

Table 53
Scenario V LSE-LAP Specific Equity Measures
Base Case Annual and Monthly CRR Allocation

LSE-LAP	Value Based Proration Ratio (%)[1]	Value Based Proration Ratio Adjusted (%)[2]	MW Based Proration Ratio (%)[3]	MW Based Proration Ratio Adjusted (%)[4]	CRR Value per MW ($)[5]
A5	76.14%	86.56%	44.67%	57.76%	3,830
B5	68.81%	77.17%	52.79%	70.86%	2,155
C5	66.56%	98.90%	94.61%	95.39%	3,920
D5	66.20%	100.00%	66.73%	100.00%	4,793
E5	64.04%	84.30%	45.39%	58.94%	3,331
F5	60.76%	72.97%	50.48%	60.88%	2,070
G5	57.42%	100.00%	56.66%	100.00%	5,417
H5	51.31%	62.97%	43.78%	57.26%	4,019
I5	46.54%	61.17%	72.45%	76.11%	3,664
J5	46.30%	55.19%	88.09%	89.74%	583
K5	45.58%	59.97%	48.76%	63.09%	2,185
L5	45.30%	55.64%	55.62%	72.76%	1,505
M5	44.34%	66.25%	48.94%	69.03%	1,019
N5	41.62%	100.00%	39.50%	100.00%	1,007
O5	40.21%	42.93%	55.49%	67.64%	2,878
P5	39.59%	52.84%	37.79%	51.11%	2,333
Q5	38.57%	51.94%	41.58%	53.14%	2,760
R5	38.48%	44.16%	53.97%	67.24%	2,103
S5	37.11%	50.75%	42.79%	54.88%	1,294
T5	36.21%	61.10%	34.08%	51.49%	1,255
U5	35.51%	52.41%	36.35%	50.79%	844
V5	35.19%	44.44%	49.47%	62.02%	1,174
W5	30.49%	48.61%	29.75%	44.75%	704
X5	29.02%	55.87%	43.95%	63.16%	565
Y5	24.56%	30.00%	55.67%	71.19%	724
Z5	24.48%	33.76%	53.12%	60.16%	1,758
AA5	22.34%	31.93%	22.34%	31.93%	0
AB5	20.91%	43.69%	32.57%	60.30%	277
AC5	19.50%	28.67%	25.92%	36.71%	818
AD5	17.27%	27.29%	13.45%	21.45%	440

[1] Dollar value of annual and monthly CRR awards per dollar value of annual and monthly CRR nominations (%)

[2] Dollar value of annual and monthly CRR awards per dollar value of annual CRR awards and monthly CRR nominations (%)

[3] MW of annual and monthly CRR awards per MW of annual and monthly CRR nominations (%)

[4] MW of annual and monthly CRR awards per MW of annual CRR awards and MW of monthly CRR nominations (%)

[5] Dollar value of annual and monthly CRR awards per MW of LSE peak load in 2003 ($)

Different LSE identifier codes have been assigned to each LSE in Tables 49 through 54.

Table 54
Scenario VI LSE-LAP Specific Equity Measures
Base Case Annual and Monthly CRR Allocation

LSE-LAP	Value Based Proration Ratio (%)[1]	Value Based Proration Ratio Adjusted (%)[2]	MW Based Proration Ratio (%)[3]	MW Based Proration Ratio Adjusted (%)[4]	CRR Value per MW ($)[5]
A6	102.67%	103.84%	84.49%	87.68%	3,140
B6	95.59%	97.38%	95.85%	97.12%	4,841
C6	94.04%	98.30%	85.83%	93.21%	1,737
D6	89.99%	94.20%	92.58%	96.96%	2,222
E6	87.20%	93.16%	92.11%	98.07%	4,055
F6	85.59%	94.96%	80.52%	93.49%	5,347
G6	85.31%	85.95%	96.69%	97.84%	658
H6	82.44%	96.50%	86.11%	96.97%	2,641
I6	80.54%	100.00%	82.98%	99.95%	1,458
J6	77.39%	100.00%	82.50%	100.00%	4,338
K6	76.19%	91.06%	80.23%	93.12%	5,391
L6	75.61%	94.96%	78.91%	94.31%	2,280
M6	74.24%	77.20%	75.80%	85.17%	5,985
N6	71.18%	79.86%	83.30%	90.65%	1,090
O6	70.21%	100.00%	69.60%	100.00%	4,699
P6	68.52%	69.60%	83.75%	86.45%	1,776
Q6	67.61%	82.72%	74.10%	87.02%	4,347
R6	66.51%	100.00%	65.91%	100.00%	6,228
S6	65.69%	100.00%	62.62%	100.00%	1,579
T6	64.54%	88.01%	62.85%	83.10%	2,035
U6	64.04%	73.16%	77.93%	92.31%	3,185
V6	61.46%	81.72%	60.36%	77.55%	1,105
W6	58.86%	71.89%	70.17%	80.98%	1,253
X6	55.35%	84.80%	74.05%	88.99%	567
Y6	47.59%	82.78%	65.16%	86.09%	787
Z6	46.78%	65.73%	42.70%	60.51%	1,030
AA6	34.02%	65.68%	53.55%	82.79%	357
AB6	27.51%	37.75%	27.51%	37.75%	-4
AC6	-48.40%	-45.51%	78.85%	92.41%	-251
AD6	-722.36%	-464.15%	73.23%	84.43%	-632

[1] Dollar value of annual and monthly CRR awards per dollar value of annual and monthly CRR nominations (%)
[2] Dollar value of annual and monthly CRR awards per dollar value of annual CRR awards and monthly CRR nominations (%)
[3] MW of annual and monthly CRR awards per MW of annual and monthly CRR nominations (%)
[4] MW of annual and monthly CRR awards per MW of annual CRR awards and MW of monthly CRR nominations (%)
[5] Dollar value of annual and monthly CRR awards per MW of LSE peak load in 2003 ($)
Different LSE identifier codes have been assigned to each LSE in Tables 49 through 54.

Table 55 portrays the August proration ratios for Sensitivity 8 in which negatively valued CRRs are excluded from the allocation and simultaneous feasibility test, and comparable data for the base case, Sensitivity 5 and Sensitivity 7. It can be seen that while the dollar valued proration ratio for the annual CRRs is slightly lower for Sensitivity 8 than the base case, the MW based proration ratio is actually higher for Sensitivity 8 than for the base case. These results reflect that fact that the exclusion of the negatively valued CRRs has three distinct effects. First, the exclusion raises the value of the nominated CRRs by excluding the negatively valued CRR nominations. This tends to reduce the dollar valued proration ratio. Second, the exclusion tends to raise the value of the awarded CRRs by excluding the negatively valued CRR awards. This tends to raise the dollar valued proration ratio. Third, the exclusion potentially eliminates counterflow that enabled the award of additional positively valued CRRs. This effect tends to reduce the dollar valued proration ratio. There are similar mixed effects of the exclusion on the MW based proration ratio.

Table 55
Proration Ratio Metrics (August 2003)

	Awarded Value/Nominated Value		Awarded MW/Nominated MW	
	Scenario I[1] (A)	Scenario IV[1] (D)	Scenario I[1] (A)	Scenario IV[1] (D)
	No Trading Hubs	Trading Hubs	No Trading Hubs	Trading Hubs
Base Case – Annual and Monthly				
Average – All LSEs & LAPs	75.37%	72.15%	77.85%	72.50%
Low LSE	-201.20%	13.41%	41.34%	51.72%
High LSE	176.84%	154.00%	92.54%	97.66%
Base Case – Annual				
Average – All LSEs & LAPs	77.68%	69.53%	81.81%	71.57%
Low LSE	-1.87%	-135.43%	34.93%	36.00%
High LSE	124.25%	121.32%	100.00%	97.28%
Sensitivity 8[2] – Annual				
Average – All LSEs & LAPs	75.11%	75.53%	82.42%	79.72%
Low LSE	21.45%	49.18%	41.84%	50.00%
High LSE	100.00%	100.00%	100.00%	100.00%
Sensitivity Case 5[3] - Annual				
Average – All LSEs & LAPs	70.33%	67.27%	76.46%	68.90%
Low LSE	-0.58%	-135.43%	38.36%	31.77%
High LSE	125.32%	125.78%	92.86%	95.51%
Sensitivity Case 7[4] – Annual				
Average – All LSEs & LAPs	77.61%	70.18%	81.81%	71.57%
Low LSE	-3.72%	-135.43%	34.93%	36.00%
High LSE	132.62%	134.84%	100.00%	97.28%

[1] LSE CRRs and ETC reservations modeled as obligations.
[2] Negatively valued CRRs excluded from allocation.
[3] Simultaneous feasibility test applied at LAP level.
[4] CRR awards valued at subzone prices for the subzone to which they are feasible.

Overall, the exclusion of the negatively valued CRRs does not have a dramatic impact on the proration metrics. The main purpose of the proration ratio metric is to identify large differences in the proration ratio across LSEs by comparing individual LSE proration ratios to the average ratio. Differences in the proration ratio metric across LSEs may simply reflect choices made by the specific LSEs in nominating CRR sources and do not necessarily indicate the existence of any inequity or problem with the allocation methodology. An effort has been made to identify the cause of large differences in individual LSE proration ratios. The purpose of this second stage inquiry is to identify features of the allocation process that are having unintended consequences leading to large differences in individual LSE proration ratios across similarly situated LSEs that are making similar CRR nomination choices. LSEs that had relatively low CRR value per megawatt metric values but high proration ratio metric values (i.e., that received a high proportion of the CRR value they requested), were not investigated for allocation anomalies because the low value of the awarded CRRs is likely to reflect the low value of the CRRs that were requested. Similarly, LSEs that had low proration ratio metric values but high CRR value per megawatt metric values were also not investigated for allocation anomalies because the low proration ratio is consistent with these LSEs requesting CRRs with a relatively high per megawatt value being subject to prorationing on these nominations, but still receiving a relatively high value set of CRRs relative to their load. The focus of the second-stage inquiry has therefore been on understanding the reasons for the prorationing of the CRR nominations of LSEs with low proration values and low CRR values per megawatt. The results of this second-stage inquiry are discussed in Section D below.

2. CRR Payments per Megawatt of Peak Load

The second CRR allocation metric that has been calculated is the total value of the allocated CRRs per MW of peak load. This metric has been calculated on an annual basis for LSE CRRs as a whole and separately for each LSE, for CRRs sinking at each LAP and for each scenario. As with the proration ratio metric the CRR payments per megawatt of peak load metric is calculated for the CRRs allocated based on LSE nominations and does not include TOR and ETC reservations nor converted ETC CRRs. The peak load used in the denominator of this metric is reduced by the amount of ETC or TOR rights or CVR CRRs held by the LSE so that the value of the CRR payments is divided by the megawatts of LSE load hedged by those CRRs.

Table 56 reports summary values for this metric calculated at the LSE level for the base case scenarios and the Sensitivity 5 and 7 cases.[83] The values reported are combined across LAPs and show only an average, high and low LSE metric for all LAPs combined. It is readily apparent from the values reported in Table 56 that there is considerable dispersion in the value of the CRRs awarded to LSEs. It is also apparent from the negative values that at least some of this dispersion occurs because some LSEs are awarded CRRs that are negatively valued in aggregate.

Table 56
CRR Revenue per Megawatt (November 2002-October 2003)

	Scenario I (A)	Scenario II[1] (B)	Scenario III[2] (C)	Scenario IV (D)	Scenario V[1] (E)	Scenario VI[2] (F)
Base Case – Annual and Monthly						
Average – All LSEs & LAPs	$2,702	$2,508	$2,624	$2,645	$2,072	$2,514
High LSE	$9,984	$9,939	$8,743	$7,426	$5,417	$6,228
Low LSE	($2,795)	$0	($2,429)	($623)	$0	($632)
Base Case – Annual[5]						
Average – All LSEs & LAPs	$2,183	$2,190	$1,944	$2,291	$1,844	$2,291
High LSE	$7,623	$12,276	$6,750	$9,901	$7,223	$9,901
Low LSE	($2,971)	$0	($2,971)	($1,387)	$0	($1,387)
Sensitivity Case 5[3] – Annual[5]						
Average – All LSEs & LAPs	$2,036	$2,077	$1,714	$2,133	$1,735	$2,133
High LSE	$7,263	$10,837	$5,819	$9,112	$6,351	$9,112
Low LSE	($2,856)	$0	($2,957)	($1,387)	$0	($1,387)
Sensitivity Case 7[4] – Annual[5]						
Average – All LSEs & LAPs	$2,151	$2,213	$1,917	$2,255	$1,886	$1,994
High LSE	$7,588	$12,319	$6,719	$9,853	$7,263	$8,316
Low LSE	($2,971)	$0	($2,971)	($1,387)	$0	($1,378)

[1] All CRRs are options.
[2] ETC reservations modeled as options.
[3] Simultaneous feasibility test applied at LAP level.
[4] CRR awards valued at subzone prices for the subzone to which they are feasible.
[5] Denominator is Annual Allocation of peak load.

It is also apparent in the detailed data some of the variation reflects LAP specific differences (i.e., there is more congestion into some LAPs than others) but there are also substantial differences across LSEs in the value of this metric among LSEs serving load in a common LAP.

[83] The calculations for Sensitivity 7 are based on 75% of peak load.

Table 57 portrays the CRR revenue per MW for Sensitivity 8 in which negatively valued CRRs are excluded from the allocation and simultaneous feasibility test. Table 57 shows that the elimination of the negatively valued CRRs would somewhat reduce the dispersion in awarded CRR values because no LSEs would receive negatively valued allocations, there is still a considerable range in the value of the awarded CRRs.

Table 57
CRR Revenue per Megawatt (August 2003)

	Scenario I (A)	Scenario IV (B)
Base Case – Annual and Monthly		
Average – All LSEs & LAPs	$220	$241
High LSE	$1,015	$1,325
Low LSE	($516)	($145)
Base Case – Annual[4]		
Average – All LSEs & LAPs[4]	$134	$187
High LSE	$526	$798
Low LSE	($726)	($121)
Sensitivity 8 – Annual[1, 4]		
Average – All LSEs & LAPs	$211	$245
High LSE	$528	$798
Low LSE	$4	$4
Sensitivity Case 5[2] – Annual[4]		
Average – All LSEs & LAPs	$112	$123
High LSE	$486	$423
Low LSE	($711)	($121)
Sensitivity Case 7[3] – Annual[4]		
Average – All LSEs & LAPs	$130	$185
High LSE	$518	$796
Low LSE	($726)	($121)

[1] Negatively valued CRRs excluded from the allocation and simultaneous feasibility test.

[2] Simultaneous feasibility test applied at LAP level.

[3] CRR awards valued at subzone prices for the subzone to which they are feasible.

[4] Denominator is 75% of peak load.

As with the proration ratio metric, the CRR payments per MW metric is intended to be used to identify anomalies in the CRR allocation results whose cause needs to be understood. The reason for the differences may simply be differences in LSE choices and differences in the locations of their generation resources. It some cases, this metric may identify the same anomalies identified by the proration ratio metric, in which case no additional analysis would be required. Further analysis has been undertaken in selected cases where there are large differences in the value of this metric across LSEs having similar proration ratios.

3. Congestion Charge Ratio

A final measure of proration impacts that some LSEs requested is a comparison of individual LSE CRR payments to individual LSE congestion charges. The difficulties in conceptualizing how to carry out such a calculation were discussed at length in Section V above. In addition, there are practical difficulties in carrying out such calculations in terms of lack of a complete assignment of generation capacity across LSEs, as well as the complexity of the required calculations.

For illustrative purposes, this measure has been calculated for the August peak period under the assumption that each LSE owned generating capacity equal to its CRRs at each CRR source and that this generation was dispatched to meet the LSEs load in sequence of the LMP at the source. These assumptions are to a degree arbitrary, again as discussed at length in Section V, but the alternatives are equally or even more arbitrary.

The results of this calculation are portrayed in Table 58. It can be seen that the congestion hedge ratio exceeds 100% for all but 3 LSE/LAPs, and only one ratio was less than 97.5%.[84] In the single instance in which the hedge ratio was less than 97.5% both the congestion payments and the CRR values were negative, meaning that the LSE received payments for counterflow and the negatively valued CRRs it was assigned did not completely offset the counterflow payments so the LSE as actually benefited from the unhedged congestion. One LSE with a congestion hedge ratio exceeding 100% had negatively valued CRRs which more than offset the counterflow payments it received for its schedule, but the difference was only .11%.

[84] A separate statistic is calculated for each LSE for each LAP, so LSEs serving multiple LAPs would have a ratio calculated for each LAP.

Table 58
CRR – Congestion Charge Ratio

	Hedge Ratio[1]
LSE A7	93.18%
LSE B7	102.01%
LSE C7	111.42%
LSE D7	107.12%
LSE E7	106.31%
LSE F7	117.67%
LSE G7	111.14%
LSE H7	122.43%
LSE I7	100.00%
LSE J7	100.00%
LSE K7	100.00%
LSE L7	120.08%
LSE M7	100.17%
LSE N7	102.54%
LSE O7	98.97%
LSE P7	102.33%
LSE Q7	100.27%
LSE R7	103.04%
LSE S7	97.69%
LSE T7	101.50%
LSE U7	100.98%
LSE V7	100.00%
LSE W7	100.11%
LSE X7	100.00%
LSE Y7	100.00%
LSE Z7	100.00%
LSE AA7	100.00%
LSE AB7	106.99%
LSE AC7	100.00%

[1] CRR payment/hypothetical congestion charges.

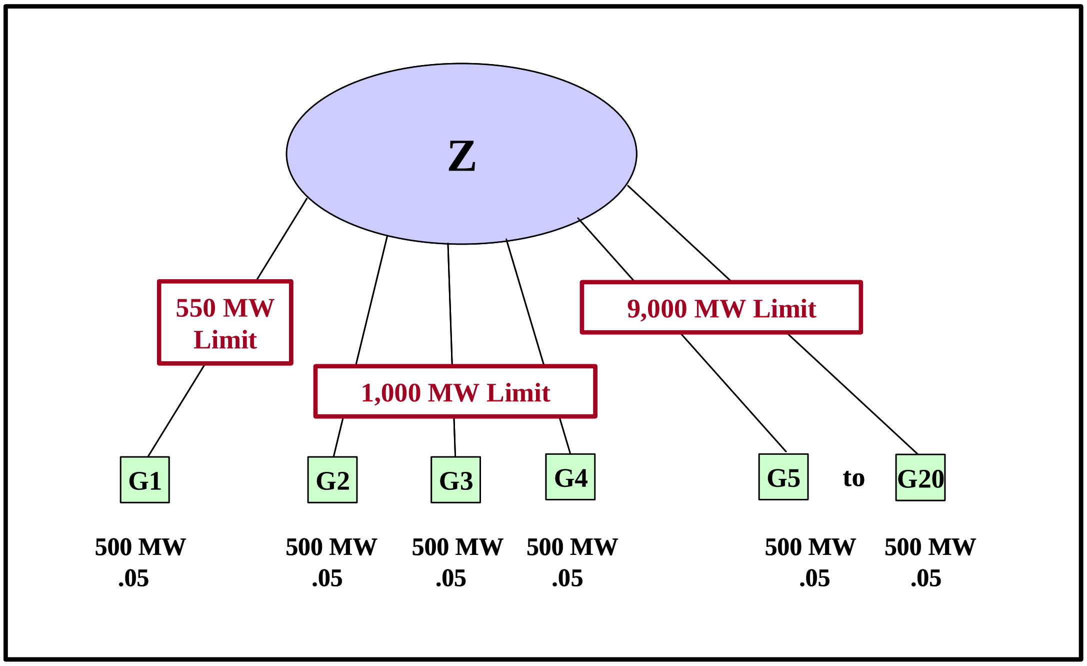
D. Discussion of Allocation Rules

Four features of the current allocation rules appear to account for the noted anomalies in CRR allocation results. First, LSEs were permitted to source CRRs from generation resources in the annual rounds up to 100% of the resource Pmax but only 75% of the transfer capability of the transmission system was available to support the award of CRRs in the annual round. This difference sometimes caused constraints to be binding on the award of CRRs out of generation pockets in the annual CRR allocation. A particular LSE could nominate all its CRRs from such a generator in its high priority nominations, in which case most or all would be awarded, some in each tier, in which case some or the nominated CRR would be awarded, or all in the later tiers, in which case none of the nominated CRRs might be awarded.

Second, once constraints become binding on the award of CRRs in the annual round from generators located in generation pockets (as a result of the combination of nominations based on

100% of pmax and 75% of the transmission system) no lower priority level CRRs can be awarded that impact those constraints. If the generation in the constrained load pocket is included in a trading hub, the constraint would prevent the award of any CRRs from the trading hub at lower priority levels, even if the generation source had a small weight in the trading hub. This potential outcome can be illustrated with a simple example. Suppose that twenty 500 MW generators comprise a trading hub. Figure 59 shows a portion of the network connecting the generators to load at Z. All generators are radial to load at Z and all of the generators have a .05 weight in the trading hub.

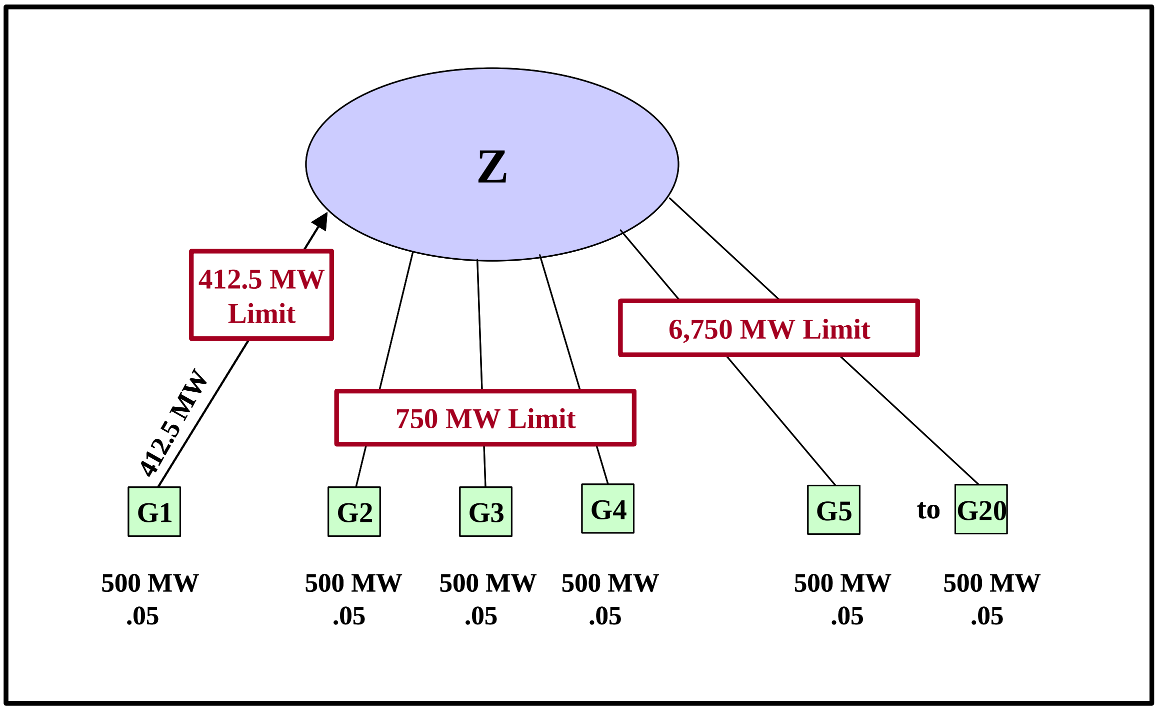
Figure 59
CRR Allocation with Trading Hubs



Since the limit on the G1-Z line is 550 MW, while the capacity of Generator G1 is only 500, the limit on G1-Z would not normally be binding in real-time operation. The constraint on deliveries from G2 to G4 would at times be binding while the constraint of deliveries from G5 to G20 would normally not be binding.

Suppose that LSE A owns Generator G1 and nominates 425 MW of CRRs from G1 to Z in a multi-priority level annual CRR allocation. The line G1-Z has a capacity of 550 MW, which can accommodate a 425 MW schedule, but the limit would be reduced to 412.5 MW in the annual allocation. The Priority 1 nomination of LSE A would therefore fully utilize the capacity of the G1-Z line in the annual allocation, as shown in Figure 60.

Figure 60
Annual CRR Allocation



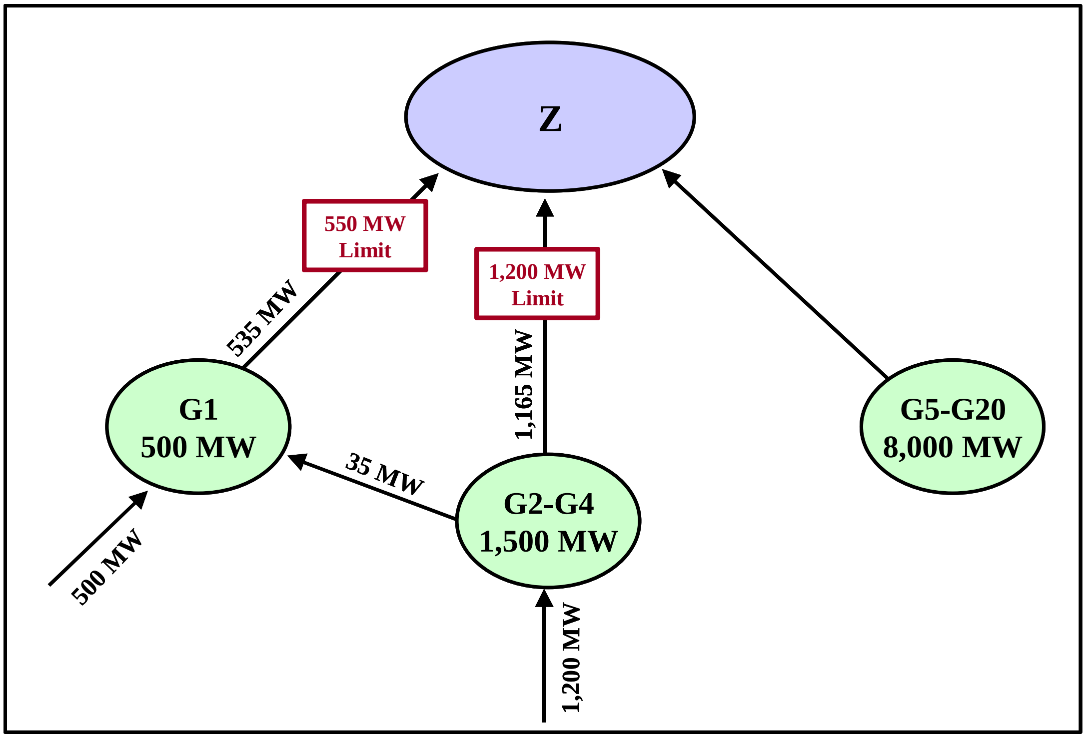
If LSE's B, C and D nominated 500 MW of CRRs sourced at the trading hub in Priority 2, none of these CRRs would be awarded because G1-Z would already be at its limit.

The interaction between the 100% pmax limit on generator source nominations and the 75% of the transmission system available in the annual CRR allocation also appears capable of resulting in unintuitive CRR proration results in scenarios in which no CRRs can be sourced from trading hubs. These outcomes arise if there are generators located in generation pockets defined by open interfaces on which generators located "outside" the pocket have small but positive effects. In this circumstance, high priority CRR nominations sourced from generators having a large impact on the constraint could fully utilize the portion of the interface available in the annual allocation, making it impossible for LSEs to source any CRRs from generators having even small positive impacts on those constraints.

This circumstance can cause potentially surprising patterns in the award and proration of CRRs that may lead to significant award differences across LSEs arising from relatively small differences in the sequencing of CRR nominations across tiers. This potential can be illustrated by continuing the previous example.

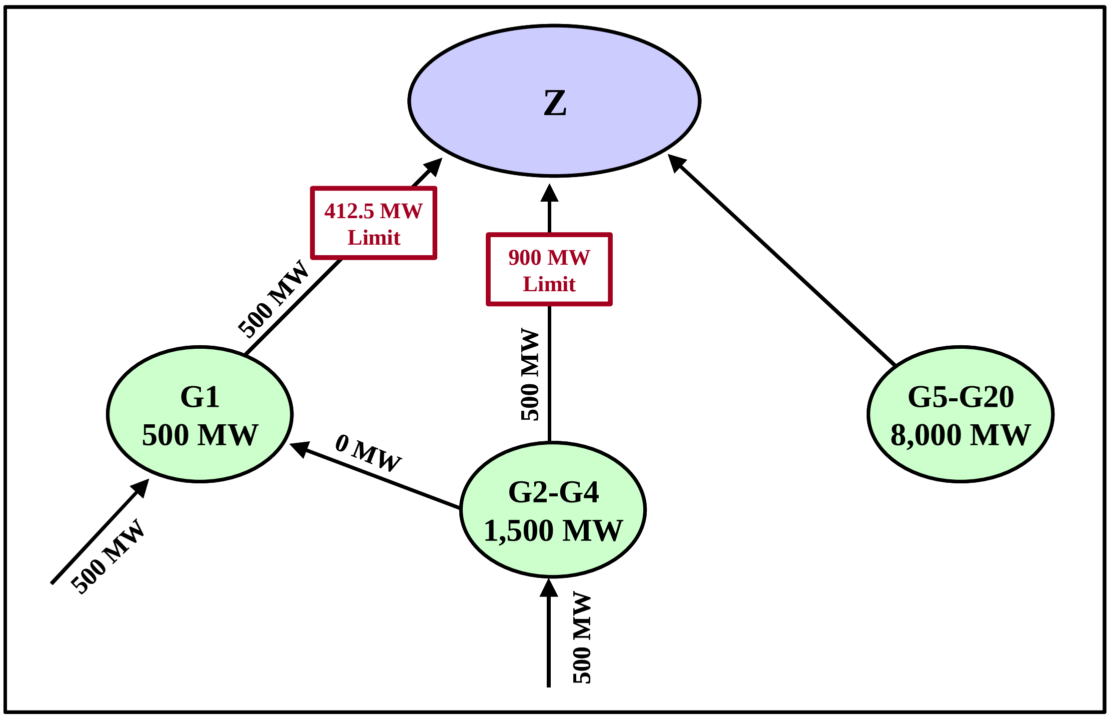
Suppose that the constraint on G1-Z is not a closed interface but instead that generation at G1 has a .95 shift factor on G1-Z while generation at G2-G4 has a .05 shift factor. In real-time operation 500 MW at G1 and 1,200 MW at G2-G4 can be dispatched without overloading G1-Z, as shown in Figure 61.

Figure 61
Real-Time Dispatch



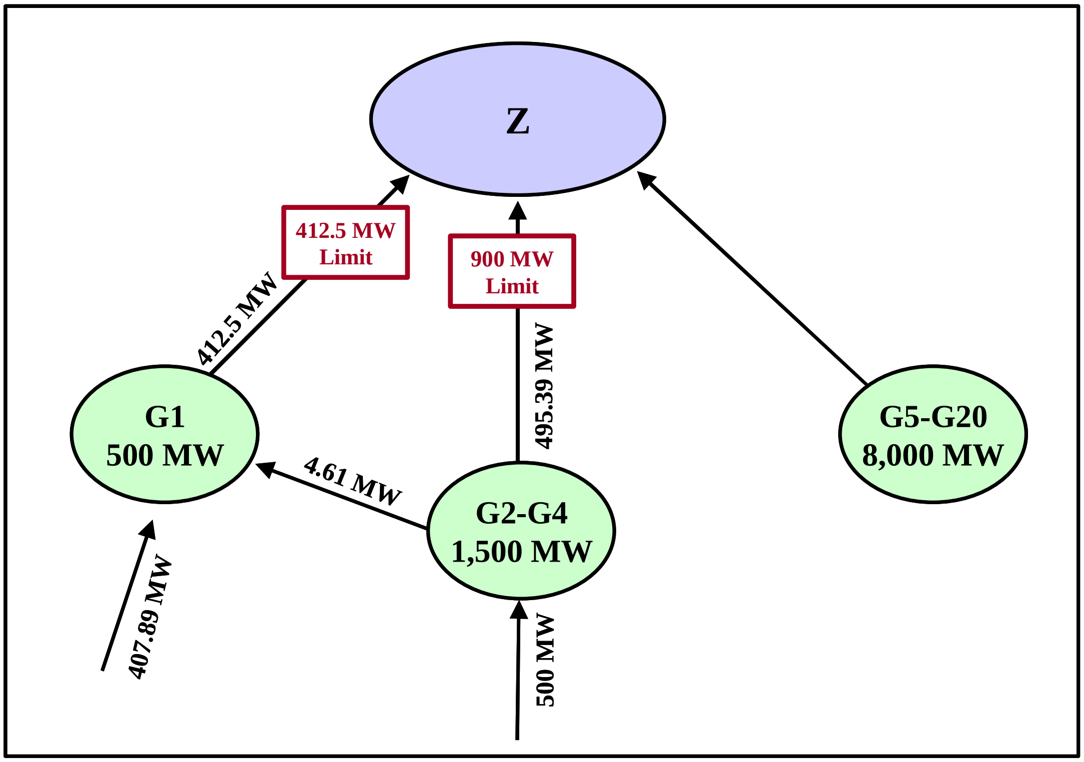
With only 75% of network capacity available for annual CRRs, only 412.5 MW of transfer capability on G1-Z is available in the annual allocation. Suppose LSE A owns generator G1 and LSE B owns G2. Both are eligible to nominate 500 MW in Priority 1 CRRs. LSEs A and B each nominate 500 MW, at G1 and G2 respectively. These nominations would overload G1-Z, while the G2-Z constraint would not be binding (see Figure 62).

Figure 62
Annual CRR Allocation Nominations



LSE A's Priority 1 nominations would be prorated back to 407.895 MW G1-Z while LSE B would be awarded all 500 MW of its Priority 1 G2-Z CRRs under the current proration rule. LSE A's awards would create 387.5 MW of flows on G1-Z (407.895 * .95). LSE B's awards would create 25 MW of flows on G1-Z (500 * .05). The flows would total 412.5 MW and the G1-Z line would be constrained.

Figure 63
Annual CRR Allocation Awards

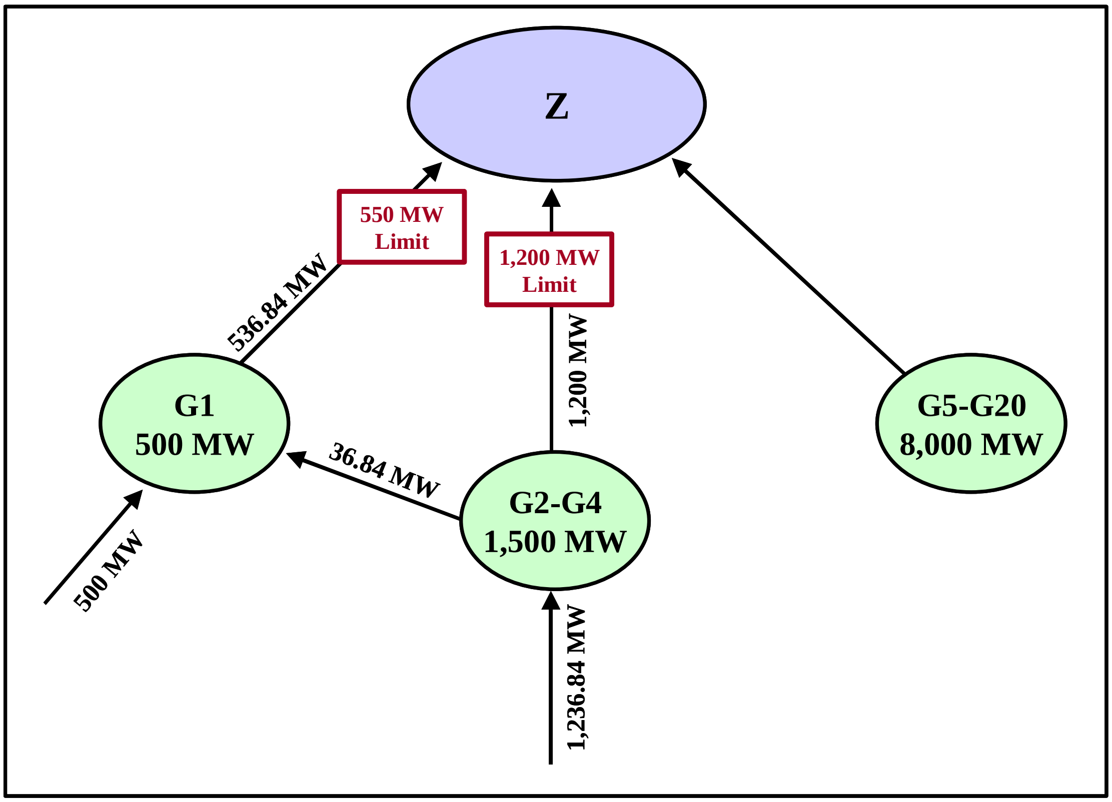


The line G2-Z would not be at its limit, but no Priority 2, 3 or 4 G2-Z CRRs could be awarded because they would impact G1-Z and it is at its limit.

CRRs not allocated in the annual allocation because of these kinds of interactions between generator nomination limits and the derated transmission system could be feasible in the monthly allocation rounds of CRR Study 2. In CRR Study 2 LSEs could renominate and be awarded in the monthly allocation the CRRs that were infeasible in the annual allocation due to these kinds of interactions between nomination limits and transmission system limits, at least to the extent that LSEs understood the reason for the proration of their requests in the annual allocation.

In the illustrative example, the LSE owning G1 could nominate an additional 87.5 CRRs from G1 to Z in the monthly allocation, while the LSEs at G2 would be able to nominate an additional 1000 CRRs from G2 to Z). All of the additional CRRs requested from G1 would be awarded in the monthly allocation, while 736.84 of the CRRs nominated from G2 would be awarded, resulting in the CRR flows portrayed in Figure 64.[85]

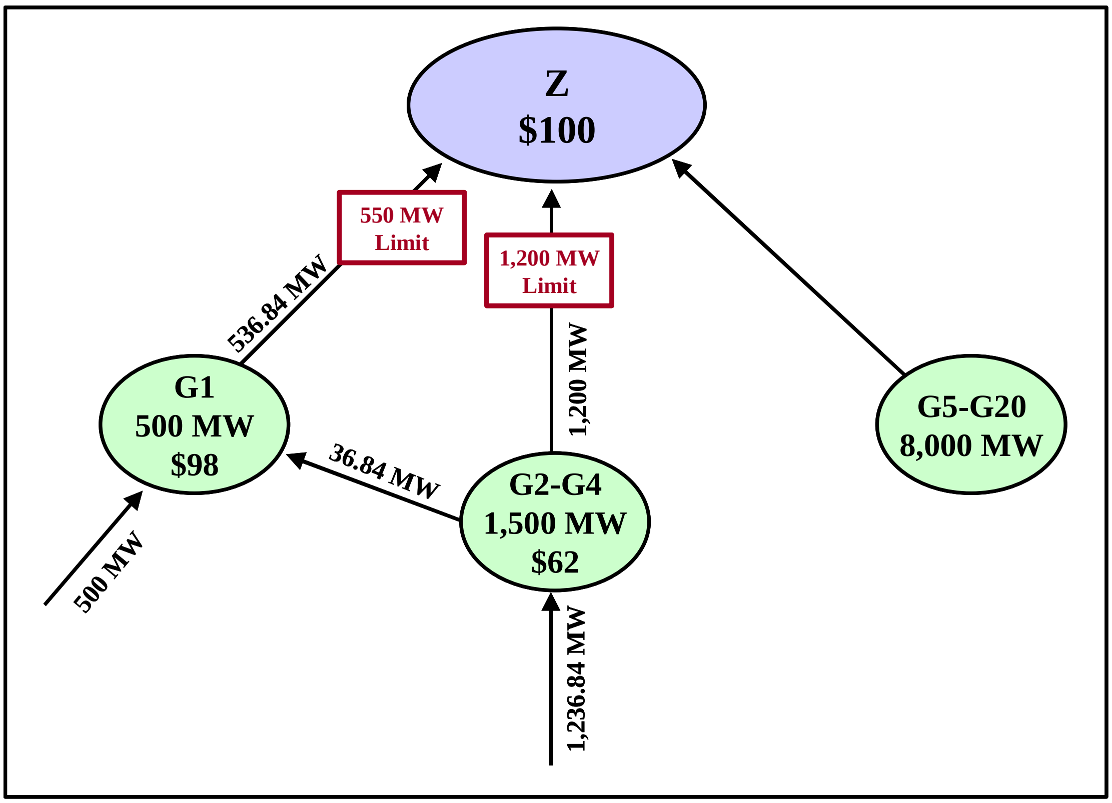
Figure 64
Combined Monthly and Annual CRR Allocation



85 The binding constraint in the monthly allocation would be the G2-Z limit and since CRRs source at G2 would have 19 times the impact on this constraint as CRRs sourced at G1, all CRRs sourced at G1 would be awarded, just the reverse of the outcome in the annual allocation in which the G1-Z constraint was binding.

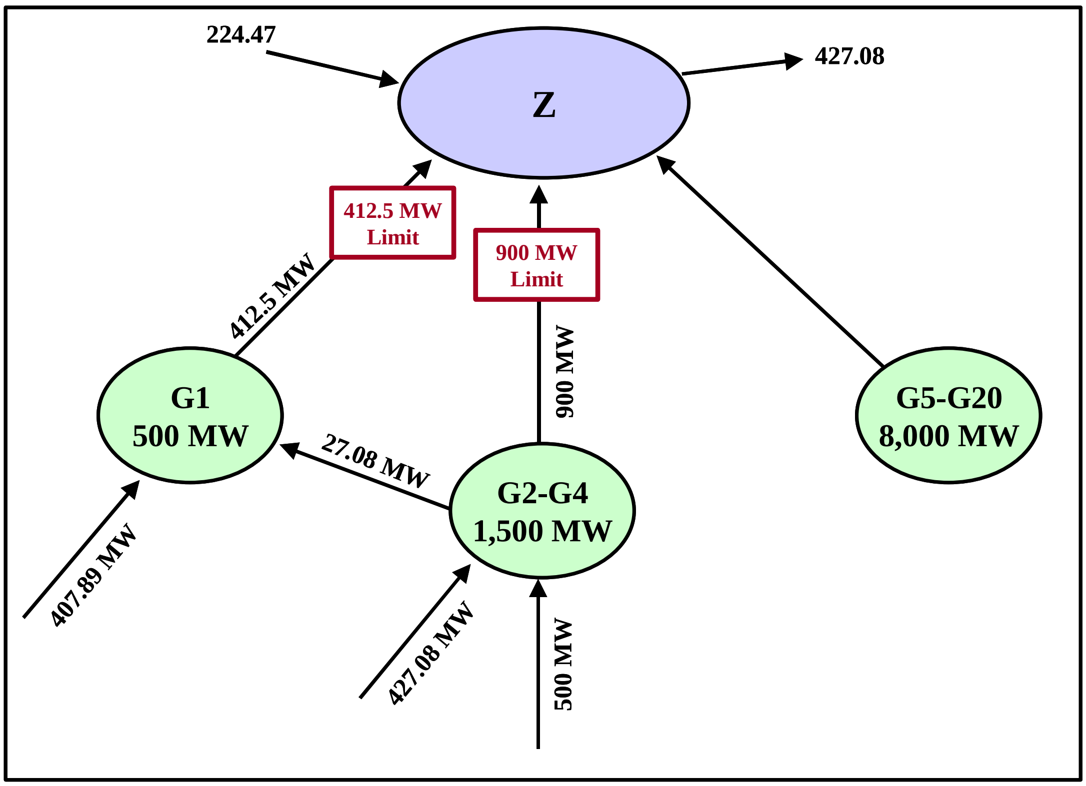
In the actual application of these CRR allocation rules, however, there would be an intervening auction in which arbitrage would potentially capture the value of the transfer capacity on the G2-Z constraint that was not awarded in the annual allocation. Suppose, for example, that in the day-ahead market that determines CRR values generation at G1 and G2 has an incremental offer price of $62, while incremental generation at Z has an offer price of $100. The LMP price at G1 would be $98 (because injections at G1 to meet load at Z have a .05 impact on the constraint with a $40 shadow price), and $62 at G2 (because injections at G2 would have a .95 impact on the G2 constraint. CRRs from G1 to Z would therefore have a $2 value, while CRRs from G2 to Z would have a $38 value.

Figure 65
Day-Ahead Dispatch



In the example above as shown in Figure 63 the G1-Z constraint would be fully allocated, but there would be considerable unallocated capacity on the G2-Z constraint. If it were recognized in the auction that the G2-Z constraint was the constraint that would be valuable in the day-ahead market, auction participants could submit combinations of CRR bids from Z to G1 and from G2 to Z that would allocate the remainder of the capacity on G2-Z in the annual allocation (up to the derated limit in the annual auction). Since every Z-G1 counterflow CRR purchased in the auction would enable the sale of 19 G2 to Z CRRs, this arbitrage would be profitable and offers could be accepted until the G2-Z constraint was binding as shown in Figure 66, with 22.47 Z to G! CRRs sold and 427.08 G2 to Z CRRs sold.

Figure 66
Annual Auction Results



In a competitive auction market, the value of the G2-Z CRRs would be reflected in the auction prices so that the value of the CRRs would flow to LSEs and the efficient mix of congestion hedges would be acquired between the auction and the allocation. The allocation of the residual annual auction revenues would potentially be different from the allocation of CRR values resulting from an allocation process that yielded the same mix of CRRs.

A third noteworthy feature of the allocation rules used in CRR Study 2 is that a proration rule which maximizes of the number of awarded CRRs will tend to favor hub awards over generation sourced awards within the same priority level, once a generation pocket constraint becomes binding.

This is because a 1 MW CRR nomination sourced at a trading hub that includes a particular generator located within a generator pocket will have less impact on the load pocket constraint than a 1 MW CRR sourced at that generator. The proration rule in CRR Study 2 seeks to maximize the number of CRRs awarded, which means that the CRRs with the largest impact on a binding constraint will be prorated first. Trading hub CRRs will have smaller impacts on constraints per CRR awarded than CRRs sourced from a particular generator so will generally be prorated only after CRRs sourced from specific generators within a given priority level.

To limit the potential impact of these kinds of interactions, consideration might be given to limiting the number of CRRs that can be sourced from a particular generator in the annual allocation to 75% of the generator pmax.

Fourth, the nomination structure in which all LSEs submitted their nominations for all four priority levels before seeing the awards for any priority level may have contributed to variations in awards across LSEs because LSEs that happened to nominate prorated CRRs in several tiers, were not able to change their source requests if awards were prorated. Fifth, the current megawatt based proration rule can lead to unusual proration patterns at the subzonal level as discussed at length in Section VIII.B above. It was observed that the pattern of subzonal priority 1 CRRs awards could be impacted by much lower priority awards because awards to all subzones are treated equally on a per megawatt basis, but this weighting may well not reflect LSE preferences. If the CRR allocation methodology awards CRRs on a subzonal basis, some mechanism needs to employed to avoid anomalous interactions among LSE CRR awards at the subzonal level.

An allocation process in which each priority of CRR request is cleared separately would likely materially reduce the potential for these kind of anomalous outcomes,[86] but it would not eliminate them. One way to further reduce the potential for anomalous subzonal awards would be to impose some kind of penalty factor favoring the award of CRRs feasible to the LAP as a whole. Applying such a penalty factor to the base case methodology would also tend to reduce the potential for revenue inadequacy. These kinds of changes in the auction software might impact the implementation timeline and would at least require additional testing to avoid further unanticipated effects.

A simpler method of achieving roughly the same outcome would be to enforce simultaneous feasibility at the LAP level in the higher priority rounds and only allow subzonal awards in the low priority rounds, assuming that the rounds are cleared separately. This approach would tend to fill the grid up to the extent possible with CRRs feasible to the LAP as a whole, with some additional subzonal CRRs awarded at the end as a bonus.

86 If the simultaneous feasibility test were applied separately to each priority of requests, the kind of interactions observed in off-peak August in which low priority CRR nominations impact the subzonal pattern of higher priority CRR awards could not occur.

Appended Tables

For CRR Study 2 Evaluation of Alternative CRR Allocation Rules

Table 67
Hours with Base Case Annual and Monthly Hourly Payout Ratio over 2.75
November 2002-October 2003, Excluding March 2003

Month	Day	Hour	Peak	Annual CRR Award Value Sensitivity 7	Annual CRR Award Value Base Case	Annual and Monthly Award Value Base Case	Annual Congestion Rent	Annual and Monthly Payout Ratio Base Case	Annual Payout Ratio Base Case	Annual Payout Ratio Sensitivity 7
7	22	10	1	6,861	6,962	10,020	3,641	2.75	2.55	2.51
12	8	7	0	74,843	74,903	98,527	35,725	2.76	2.80	2.79
12	8	11	0	108,277	108,354	142,507	51,633	2.76	2.80	2.80
12	23	12	1	10,622	10,887	14,916	5,401	2.76	2.69	2.62
7	29	10	1	29,437	30,065	42,725	15,468	2.76	2.59	2.54
12	8	6	0	55,615	55,651	73,186	26,490	2.76	2.80	2.80
12	8	13	0	113,513	113,513	149,280	54,032	2.76	2.80	2.80
12	8	14	0	112,756	112,754	148,282	53,671	2.76	2.80	2.80
12	8	10	0	72,209	72,177	94,919	34,356	2.76	2.80	2.80
12	8	16	0	81,467	81,467	107,136	38,778	2.76	2.80	2.80
12	8	8	0	72,480	72,490	95,330	34,505	2.76	2.80	2.80
12	7	5	0	56,848	56,835	74,743	27,053	2.76	2.80	2.80
12	8	9	0	106,672	106,702	140,323	50,790	2.76	2.80	2.80
12	8	15	0	110,312	110,280	145,016	52,432	2.77	2.80	2.81
5	15	22	1	204,958	204,800	275,729	99,676	2.77	2.74	2.74
12	7	6	0	55,900	55,882	73,476	26,545	2.77	2.81	2.81
12	8	12	0	110,161	110,078	144,728	52,243	2.77	2.81	2.81
7	31	20	1	10,376	10,603	15,314	5,514	2.78	2.56	2.51
9	18	16	1	62,364	63,628	85,121	30,583	2.78	2.77	2.72
9	2	14	1	49,431	49,997	67,560	24,227	2.79	2.75	2.72
8	1	17	1	29,534	30,243	44,104	15,797	2.79	2.55	2.49
12	18	18	1	26,613	26,739	31,731	11,335	2.80	3.15	3.13
11	18	14	1	14,950	14,991	19,670	6,983	2.82	2.86	2.85
12	17	22	1	12,770	12,919	17,770	6,301	2.82	2.73	2.70
8	1	14	1	241	189	274	97	2.83	2.60	3.32
10	26	22	0	37,270	37,380	44,703	15,762	2.84	3.16	3.15
10	25	21	1	67,143	67,127	84,191	29,661	2.84	3.02	3.02
6	15	8	0	265	318	491	173	2.84	2.46	2.05
10	25	22	1	53,288	53,171	66,696	23,288	2.86	3.04	3.05
12	17	11	1	20,609	20,801	25,167	8,783	2.87	3.16	3.13
11	25	13	1	1,114	1,083	1,473	510	2.89	2.83	2.91
7	19	10	1	3,553	3,406	4,828	1,664	2.90	2.73	2.85
7	23	7	1	516	503	723	249	2.90	2.69	2.76

Table 67 (continued)
Hours with Base Case Annual and Monthly Hourly Payout Ratio over 2.75
November 2002-October 2003, Excluding March 2003

Month	Day	Hour	Peak	Annual CRR Award Value Sensitivity 7	Annual CRR Award Value Base Case	Annual and Monthly Award Value Base Case	Annual Congestion Rent	Annual and Monthly Payout Ratio Base Case	Annual Payout Ratio Base Case	Annual Payout Ratio Sensitivity 7
12	17	20	1	53,855	54,386	64,656	22,223	2.91	3.26	3.23
9	18	9	1	4,676	4,651	6,342	2,167	2.93	2.86	2.88
7	12	22	1	9,135	9,733	13,919	4,728	2.94	2.74	2.58
12	17	18	1	46,505	47,026	55,594	18,873	2.95	3.32	3.29
10	20	21	1	8,568	8,598	11,817	4,007	2.95	2.86	2.85
12	17	12	1	40,678	41,134	49,605	16,680	2.97	3.29	3.25
12	6	22	1	5,367	5,291	7,082	2,380	2.98	2.96	3.01
12	17	15	1	11,504	11,543	13,966	4,648	3.00	3.31	3.30
7	31	22	1	31,791	32,670	46,284	15,384	3.01	2.83	2.76
9	25	20	1	16,994	19,948	27,130	9,016	3.01	2.95	2.51
9	2	15	1	55,777	56,179	75,608	25,120	3.01	2.98	2.96
10	7	12	1	7,579	7,656	10,605	3,513	3.02	2.91	2.88
7	31	10	1	29,170	29,494	41,575	13,751	3.02	2.86	2.83
12	17	19	1	43,452	43,923	51,943	17,175	3.02	3.41	3.37
7	19	12	1	35,792	36,048	50,526	16,675	3.03	2.88	2.86
12	17	21	1	58,303	58,872	69,534	22,924	3.03	3.42	3.39
12	18	17	1	14,286	14,416	17,388	5,700	3.05	3.37	3.34
7	13	22	0	2,502	2,418	3,349	1,095	3.06	2.95	3.05
9	29	9	1	3,501	3,572	4,875	1,582	3.08	3.01	2.95
10	22	22	1	36,113	36,170	48,796	15,768	3.09	3.06	3.05
12	17	17	1	25,245	25,476	30,474	9,779	3.12	3.47	3.44
12	16	17	1	123,628	124,898	146,723	46,986	3.12	3.54	3.51
1	29	15	1	25,603	25,876	36,406	11,515	3.16	3.00	2.96
12	17	13	1	47,139	47,682	56,928	17,929	3.18	3.55	3.51
12	16	20	1	37,870	38,263	44,914	14,133	3.18	3.61	3.57
12	16	21	1	18,953	19,129	22,548	7,030	3.21	3.63	3.59
10	25	23	0	59,272	59,263	73,764	22,973	3.21	3.44	3.44
7	8	20	1	9,038	9,366	13,697	4,262	3.21	2.93	2.83
12	18	23	0	2,346	2,335	3,229	980	3.29	3.18	3.19
1	6	20	1	41,667	41,239	59,109	17,825	3.32	3.08	3.12
9	2	9	1	16,498	16,500	22,371	6,733	3.32	3.27	3.27
8	8	10	1	4,186	4,198	6,603	1,972	3.35	2.84	2.83
9	2	7	1	4,176	4,329	5,990	1,761	3.40	3.28	3.16
2	25	12	1	100,975	103,879	145,102	40,987	3.54	3.38	3.28
10	26	24	0	10,902	10,876	13,358	3,768	3.55	3.85	3.86
12	18	14	1	1,931	1,892	2,238	627	3.57	4.02	4.10
8	8	22	1	10,833	11,123	16,868	4,678	3.61	3.17	3.09
1	28	18	1	46,331	47,028	66,647	17,996	3.70	3.48	3.43

Table 67 (continued)
Hours with Base Case Annual and Monthly Hourly Payout Ratio over 2.75
November 2002-October 2003, Excluding March 2003

Month	Day	Hour	Peak	Annual CRR Award Value Sensitivity 7	Annual CRR Award Value Base Case	Annual and Monthly Award Value Base Case	Annual Congestion Rent	Annual and Monthly Payout Ratio Base Case	Annual Payout Ratio Base Case	Annual Payout Ratio Sensitivity 7
12	22	23	0	14,188	14,709	21,122	5,699	3.71	3.44	3.32
8	13	22	1	18,498	19,090	29,645	7,994	3.71	3.18	3.09
8	13	12	1	35,437	35,829	54,038	14,292	3.78	3.34	3.31
10	25	9	1	52,165	52,223	65,473	17,250	3.80	4.04	4.03
7	4	7	0	-72	-197	-284	-75	3.80	3.51	1.29
8	6	13	1	7,408	7,491	11,361	2,981	3.81	3.35	3.31
9	5	9	1	9,552	9,693	13,125	3,401	3.86	3.80	3.74
11	7	11	1	37,824	38,067	52,001	13,225	3.93	3.84	3.81
12	13	8	1	17,322	17,501	23,376	5,773	4.05	4.04	4.00
12	19	15	1	11,631	11,970	16,161	3,847	4.20	4.15	4.03
9	3	9	1	22,824	23,489	32,093	7,602	4.22	4.12	4.00
11	25	21	1	35,433	35,465	47,159	11,068	4.26	4.27	4.27
10	26	23	0	8,014	8,098	10,080	2,364	4.26	4.57	4.52
10	1	11	1	379	301	398	91	4.35	4.39	5.53
8	13	21	1	35,532	36,213	53,550	11,746	4.56	4.11	4.03
10	29	13	1	1,092	1,213	1,691	369	4.59	4.39	3.95
1	12	12	0	209	85	95	21	4.61	5.51	13.53
12	7	21	1	5,946	5,992	8,055	1,675	4.81	4.77	4.73
8	6	21	1	4,769	4,827	7,213	1,445	4.99	4.45	4.40
1	6	19	1	25,218	25,171	36,195	7,153	5.06	4.69	4.70
8	19	22	1	17,915	18,221	27,296	5,078	5.38	4.78	4.70
8	6	17	1	1,339	1,287	1,868	344	5.42	4.98	5.18
1	5	19	0	12,241	12,621	19,097	3,364	5.68	5.00	4.85
2	3	2	0	15,733	15,986	24,484	4,199	5.83	5.08	5.00
8	13	13	1	27,310	27,893	42,074	7,114	5.91	5.23	5.12
8	16	13	1	903	920	1,384	215	6.44	5.70	5.60
6	9	2	0	-20	-74	-91	-12	7.35	8.01	2.18
2	12	7	1	4,544	4,482	4,526	145	31.25	41.26	41.84
2	12	8	1	11,043	10,953	10,953	6	1950.00	2600.00	2621.44
			Total	3,309,487	3,333,492	4,392,361	1,437,087			

Appendix A
Subzone Names in LMP Study 3b and CRR Study 2

ZIC_3B_2003.csv File	CRR2 Study
PCC_Coas	PGCC
PEB_EBay	PGEB
PF1_Fres	PGF1
PFG_Geys	PGFG
PHB_Humb	PGHB
PLP_ZP	PGLP
PNB_NBay	PGNB
PNC_NCst	PGNC
PBC_Batl	PGNV
PNV_NVal	PGNV
PP2_Pnsl	PGP2
PDE_Delt	PGSA
PSA_Sacr	PGSA
PDA_DAnz	PGSB
PME_Mtcf	PGSB
PSB_SBay	PGSB
PSF_SFrn	PGSF
PSI_Sier	PGSI
PSN_SJoa	PGSN
PST_Stk1	PGST
PST_Stk2	PGST
PVA_Vaca	PGVA
SCEC_Core	SCEC
SCEN_North	SCEN
SCES_Southwest	SCES
SCEH_HiDesert	SCHD
SCEL_LoDesert	SCLD
SDG_SDGE	SDG1

Appendix B
Block Generator Resource Matching

Block Generator	ID	Bus ID	Bus Name
5001	'1 '	24009	APPGEN1G
5001	'2 '	24010	APPGEN2G
5002	'1 '	36202	BAF COG1
5002	'1 '	36203	BAF COG2
5003	'1 '	24319	EASTWOOD
5003	'1 '	24306	B CRK1-1
5003	'2 '	24306	B CRK1-1
5003	'3 '	24307	B CRK1-2
5003	'4 '	24307	B CRK1-2
5003	'1 '	24308	B CRK2-1
5003	'2 '	24308	B CRK2-1
5003	'3 '	24309	B CRK2-2
5003	'4 '	24309	B CRK2-2
5003	'5 '	24310	B CRK2-3
5003	'6 '	24310	B CRK2-3
5003	'1 '	24311	B CRK3-1
5003	'2 '	24311	B CRK3-1
5003	'3 '	24312	B CRK3-2
5003	'4 '	24312	B CRK3-2
5003	'5 '	24313	B CRK3-3
5003	'41'	24314	B CRK 4
5003	'42'	24314	B CRK 4
5003	'81'	24315	B CRK 8
5003	'82'	24315	B CRK 8
5003	'1 '	24317	MAMOTH1G
5003	'2 '	24318	MAMOTH2G
5004	'7 '	24703	BLM E7G
5004	'8 '	24704	BLM E8G
5004	'9 '	24705	BLM W9G
5005	'1 '	31820	BCKS CRK
5005	'2 '	31820	BCKS CRK
5006	'1 '	24711	CALGEN1G
5006	'2 '	24712	CALGEN2G
5006	'3 '	24713	CALGEN3G
5007	'1 '	33850	CAMANCHE
5007	'2 '	33850	CAMANCHE
5007	'3 '	33850	CAMANCHE
5008	'1 '	31808	CRBOU2-3
5008	'2 '	31808	CRBOU2-3
5009	'1 '	31782	CRBU 4-5
5009	'2 '	31782	CRBU 4-5
5012	'1 '	38102	COLLRVL1
5012	'1 '	38104	COLLRVL2
5013	'1 '	31812	CRESTA
5013	'2 '	31812	CRESTA
5014	'31'	24718	ALTA31GT
5014	'32'	24734	ALTA32GT
5014	'3 '	24719	ALTA 3ST
5015	'41'	24720	ALTA41GT
5015	'42'	24735	ALTA42GT
5015	'4 '	24721	ALTA 4ST
5016	'1 '	38820	DELTA A
5016	'2 '	38820	DELTA A
5016	'3 '	38820	DELTA A
5016	'4 '	38815	DELTA B
5016	'5 '	38815	DELTA B
5016	'6 '	38770	DELTA C
5016	'7 '	38770	DELTA C
5016	'8 '	38765	DELTA D
5016	'9 '	38765	DELTA D

Block Generator	ID	Bus ID	Bus Name
5047	'1 '	22996	INTBST
5047	'1 '	22997	INTBCT
5048	'5 '	24173	LBEACH5G
5048	'6 '	24174	LBEACH6G
5048	'7 '	24079	LBEACH7G
5049	'1 '	24078	LBEACH1G
5049	'2 '	24170	LBEACH2G
5049	'3 '	24171	LBEACH3G
5049	'4 '	24172	LBEACH4G
5049	'8 '	24080	LBEACH8G
5049	'9 '	24081	LBEACH9G
5050	'1 '	35857	LECEFGT4
5050	'1 '	35856	LECEFGT3
5050	'1 '	35855	LECEFGT2
5050	'1 '	35854	LECEFGT1
5051	'1 '	33113	LMECST1
5051	'1 '	33112	LMECCT1
5051	'1 '	33111	LMECCT2
5052	'1 '	32456	MIDLFORK
5052	'2 '	32456	MIDLFORK
5052	'1 '	32458	RALSTON
5053	'1 '	37561	MELONE1
5053	'2 '	37562	MELONE2
5054	'1 '	32700	MONTICLO
5054	'2 '	32700	MONTICLO
5054	'3 '	32700	MONTICLO
5055	'1 '	36223	DUKMOSS3
5055	'1 '	36222	DUKMOSS2
5055	'1 '	36221	DUKMOSS1
5056	'1 '	36226	DUKMOSS6
5056	'1 '	36225	DUKMOSS5
5056	'1 '	36224	DUKMOSS4
5057	'1 '	22488	MIRAMRGT
5057	'2 '	22488	MIRAMRGT
5058	'1 '	25639	SEAWIND
5058	'2 '	28060	SEAWEST
5059	'4 '	24744	NAVYII4G
5059	'5 '	24745	NAVYII5G
5059	'6 '	24746	NAVYII6G
5060	'2 '	38365	N.HGN DM
5060	'1 '	38365	N.HGN DM
5062	'1 '	24102	OMAR 1G
5062	'2 '	24103	OMAR 2G
5062	'3 '	24104	OMAR 3G
5062	'4 '	24105	OMAR 4G
5063	'1 '	24113	PANDOL
5063	'2 '	24113	PANDOL
5064	'1 '	33846	PRDE 1-3
5064	'2 '	33846	PRDE 1-3
5064	'1 '	33848	PARDE 2
5065	'1 '	38720	PINE FLT
5065	'2 '	38720	PINE FLT
5065	'3 '	38720	PINE FLT
5066	'1 '	31802	PIT 3
5066	'2 '	31802	PIT 3
5066	'3 '	31802	PIT 3
5067	'1 '	31766	PIT 4
5067	'2 '	31766	PIT 4
5068	'1 '	31804	PIT 5 U1
5068	'2 '	31804	PIT 5 U1

Appendix B (continued)
Block Generator Resource Matching

Block Generator	ID	Bus ID	Bus Name
5016	'10'	38760	DELTA E
5016	'11'	38760	DELTA E
5016	'1 '	38750	DOS AMG1
5016	'2 '	38750	DOS AMG1
5016	'3 '	38750	DOS AMG1
5016	'1 '	38755	DOS AMG2
5016	'2 '	38755	DOS AMG2
5016	'3 '	38755	DOS AMG2
5017	'1 '	38775	BUENAVS1
5017	'2 '	38775	BUENAVS1
5017	'3 '	38775	BUENAVS1
5017	'4 '	38775	BUENAVS1
5017	'5 '	38775	BUENAVS1
5017	'6 '	38775	BUENAVS1
5017	'1 '	38780	BUENAVS2
5017	'2 '	38780	BUENAVS2
5017	'3 '	38780	BUENAVS2
5017	'4 '	38780	BUENAVS2
5017	'1 '	38785	WHLR RD1
5017	'2 '	38785	WHLR RD1
5017	'3 '	38785	WHLR RD1
5017	'4 '	38785	WHLR RD1
5017	'5 '	38785	WHLR RD1
5017	'1 '	38790	WHLR RD2
5017	'2 '	38790	WHLR RD2
5017	'3 '	38790	WHLR RD2
5017	'4 '	38790	WHLR RD2
5017	'1 '	38795	WINDGAP1
5017	'2 '	38795	WINDGAP1
5017	'3 '	38795	WINDGAP1
5017	'1 '	38800	WINDGAP2
5017	'2 '	38800	WINDGAP2
5017	'1 '	38805	WINDGAP3
5017	'2 '	38805	WINDGAP3
5017	'1 '	38810	WINDGAP4
5017	'2 '	38810	WINDGAP4
5018	'1 '	25605	EDMON1AP
5018	'2 '	25606	EDMON2AP
5018	'3 '	25607	EDMON3AP
5018	'4 '	25607	EDMON3AP
5018	'5 '	25608	EDMON4AP
5018	'6 '	25608	EDMON4AP
5018	'7 '	25609	EDMON5AP
5018	'8 '	25609	EDMON5AP
5018	'9 '	25610	EDMON6AP
5018	'10'	25610	EDMON6AP
5018	'11'	25611	EDMON7AP
5018	'12'	25611	EDMON7AP
5018	'13'	25612	EDMON8AP
5018	'14'	25612	EDMON8AP
5018	'1 '	25617	PEARBMAP
5018	'2 '	25617	PEARBMAP
5018	'3 '	25617	PEARBMAP
5018	'4 '	25618	PEARBMBP
5018	'5 '	25618	PEARBMBP
5018	'6 '	25618	PEARBMBP
5018	'7 '	25619	PEARBMCP
5018	'8 '	25619	PEARBMCP
5018	'9 '	25620	PEARBMDP

Block Generator	ID	Bus ID	Bus Name
5069	'1 '	31806	PIT 5 U2
5069	'2 '	31806	PIT 5 U2
5070	'1 '	33800	SALT SPS
5070	'2 '	33800	SALT SPS
5071	'1 '	24073	LA FRESA
5071	'2 '	24073	LA FRESA
5071	'3 '	24073	LA FRESA
5071	'4 '	24073	LA FRESA
5072	'2 '	31400	SANTA FE
5072	'1 '	31400	SANTA FE
5074	'1 '	33141	SHELL 1
5074	'1 '	33143	SHELL 3
5074	'1 '	33142	SHELL 2
5075	'1 '	38730	SANLUIS1
5075	'2 '	38730	SANLUIS1
5075	'1 '	38735	SANLUIS2
5075	'2 '	38735	SANLUIS2
5075	'1 '	38740	SANLUIS3
5075	'2 '	38740	SANLUIS3
5075	'1 '	38745	SANLUIS4
5075	'2 '	38745	SANLUIS4
5076	'1 '	32472	SPAULDG
5076	'2 '	32472	SPAULDG
5077	'1 '	38122	NEWSPICE
5079	'1 '	32922	ChevGen2
5079	'1 '	32921	ChevGen1
5080	'1 '	35075	TEXSUN2G
5080	'1 '	35074	TEXSUN1G
5081	'1 '	35004	SUNSET G
5081	'2 '	35004	SUNSET G
5081	'3 '	35004	SUNSET G
5082	'3 '	37523	SUTTER3
5082	'2 '	37522	SUTTER2
5082	'1 '	37521	SUTTER1
5083	'1 '	24143	SYCCYN1G
5083	'2 '	24144	SYCCYN2G
5083	'3 '	24145	SYCCYN3G
5083	'4 '	24146	SYCCYN4G
5084	'1 '	99001	IV GEN1
5084	'1 '	99002	IV GEN2
5084	'1 '	99003	IV GEN3
5085	'1X'	33151	FOSTER W
5085	'2X'	33151	FOSTER W
5085	'3X'	33151	FOSTER W
5086	'1 '	33822	TIGR CRK
5086	'2 '	33822	TIGR CRK
5087	'P1'	37583	TRACYPP1
5087	'P2'	37583	TRACYPP1
5087	'P3'	37583	TRACYPP1
5087	'P4'	37584	TRACYPP2
5087	'P5'	37584	TRACYPP2
5087	'P6'	37584	TRACYPP2
5089	'1 '	32910	UNOCAL
5089	'2 '	32910	UNOCAL
5089	'3 '	32910	UNOCAL
5090	'1 '	25651	WARNE1
5090	'1 '	25652	WARNE2
5091	'2 '	31404	WEST FOR
5091	'1 '	31404	WEST FOR

Appendix B (continued)
Block Generator Resource Matching

Block Generator	ID	Bus ID	Bus Name
5018	'1 '	25614	OSO A P
5018	'2 '	25614	OSO A P
5018	'3 '	25614	OSO A P
5018	'4 '	25614	OSO A P
5018	'5 '	25615	OSO B P
5018	'6 '	25615	OSO B P
5018	'7 '	25615	OSO B P
5018	'8 '	25615	OSO B P
5019	'1 '	33110	DEC CTG3
5019	'1 '	33109	DEC CTG2
5019	'1 '	33108	DEC CTG1
5019	'1 '	33107	DEC STG1
5020	'1 '	25424	ESRP P1
5020	'2 '	25424	ESRP P1
5020	'3 '	25424	ESRP P1
5020	'4 '	25424	ESRP P1
5020	'5 '	25425	ESRP P2
5020	'6 '	25425	ESRP P2
5020	'7 '	25425	ESRP P2
5020	'8 '	25425	ESRP P2
5020	'9 '	25426	ESRP P3
5020	'10'	25426	ESRP P3
5020	'11'	25426	ESRP P3
5020	'12'	25426	ESRP P3
5021	'1 '	32504	DRUM 1-2
5021	'2 '	32504	DRUM 1-2
5022	'1 '	32506	DRUM 3-4
5022	'2 '	32506	DRUM 3-4
5023	'1 '	25648	DVLCYN1G
5023	'2 '	25649	DVLCYN2G
5023	'3 '	25603	DVLCYN3G
5023	'4 '	25604	DVLCYN4G
5025	'1 '	33812	ELECTRA
5025	'2 '	33812	ELECTRA
5025	'3 '	33812	ELECTRA
5026	'1 '	35078	ELKHIL3G
5026	'1 '	35077	ELKHIL2G
5026	'1 '	35076	ELKHIL1G
5028	'1 '	33151	FOSTER W
5028	'2 '	33151	FOSTER W
5028	'3 '	33151	FOSTER W
5030	'1 '	35850	GLRY COG
5031	'1 '	35852	GROYPKR2
5031	'1 '	35851	GROYPKR1
5032	'1 '	34433	GWF_HEP2
5032	'1 '	34431	GWF_HEP1
5033	'1 '	31406	GEYSR5-6
5033	'2 '	31406	GEYSR5-6
5034	'1 '	31408	GEYSER78
5034	'2 '	31408	GEYSER78
5035	'1 '	34610	HAAS
5035	'2 '	34610	HAAS
5036	'LP'	25510	HARBORG4
5036	'HP'	24062	HARBOR G
5037	'1 '	28000	HIDEDST1
5037	'1 '	28001	HIDEDCT3
5037	'1 '	28002	HIDEDCT2
5037	'1 '	28003	HIDEDCT1
5038	'1 '	25411	EAGLEMP1
5038	'2 '	25411	EAGLEMP1
5038	'3 '	25411	EAGLEMP1

Block Generator	ID	Bus ID	Bus Name
5092	'1 '	34658	WISHON
5092	'2 '	34658	WISHON
5092	'3 '	34658	WISHON
5092	'4 '	34658	WISHON
5092	'SJ'	34658	WISHON
5093	'1 '	37549	FOLSOM1
5093	'2 '	37550	FOLSOM2
5093	'3 '	37551	FOLSOM3
5093	'1 '	37553	J.F.CARR
5093	'2 '	37553	J.F.CARR
5093	'1 '	37645	NIMBUS12
5093	'2 '	37645	NIMBUS12
5093	'1 '	37575	SHASTA1
5093	'2 '	37576	SHASTA2
5093	'3 '	37577	SHASTA3
5093	'4 '	37578	SHASTA4
5093	'5 '	37579	SHASTA5
5093	'1 '	37581	SPRINGCR
5093	'2 '	37581	SPRINGCR
5093	'1 '	37590	TRINTY12
5093	'2 '	37590	TRINTY12
5093	'1 '	37559	KESWICK1
5093	'2 '	37556	KESWICK2
5093	'3 '	37557	KESWICK3
5094	'1 '	35883	MEC STG1
5094	'1 '	35882	MEC CTG2
5094	'1 '	35881	MEC CTG1
5095	'1 '	38353	RIPN_2
5095	'1 '	38351	RIPN_1
5096	'1 '	25125	MTNVWBG1
5096	'1 '	25124	MTNVWAS1
5096	'1 '	25123	MTNVWAG2
5096	'1 '	25122	MTNVWAG1
5096	'1 '	25132	MTNVWCS2
5096	'1 '	25131	MTNVWCS1
5096	'1 '	25127	MTNVWBS1
5096	'1 '	25126	MTNVWBG2
5097	'1 '	22262	EPPCT1
5097	'1 '	22263	EPPCT2
5097	'1 '	22265	EPPST1
5098	'S2'	28055	PSTRIAS2
5098	'G3'	28054	PSTRIAG3
5098	'S1'	28053	PSTRIAS1
5098	'G2'	28052	PSTRIAG2
5098	'G1'	28051	PSTRIAG1
5099	'1 '	36865	PICOST1A
5099	'1 '	36864	PICOCT2
5099	'1 '	36863	PICOCT1
5100	'1 '	38574	WEC3
5100	'1 '	38572	WEC2
5100	'1 '	38570	WEC1
5101	'1 '	24011	ARCO 1G
5101	'2 '	24012	ARCO 2G
5101	'3 '	24013	ARCO 3G
5101	'4 '	24014	ARCO 4G
5101	'5 '	24163	ARCO 5G
5101	'6 '	24164	ARCO 6G
5102	'1 '	33463	CARDINAL
5102	'2 '	33463	CARDINAL
5103	'1 '	24022	CHEVGEN1
5103	'2 '	24023	CHEVGEN2

Appendix B (continued)
Block Generator Resource Matching

Block Generator	ID	Bus ID	Bus Name
5038	'4 '	25411	EAGLEMP1
5038	'5 '	25412	EAGLEMP2
5038	'6 '	25412	EAGLEMP2
5038	'7 '	25412	EAGLEMP2
5038	'8 '	25412	EAGLEMP2
5038	'9 '	25412	EAGLEMP2
5038	'1 '	25413	GENE P1
5038	'2 '	25413	GENE P1
5038	'3 '	25413	GENE P1
5038	'4 '	25413	GENE P1
5038	'5 '	25414	GENE P2
5038	'6 '	25414	GENE P2
5038	'7 '	25414	GENE P2
5038	'8 '	25414	GENE P2
5038	'9 '	25414	GENE P2
5038	'1 '	25415	INTAKEP1
5038	'2 '	25415	INTAKEP1
5038	'3 '	25415	INTAKEP1
5038	'4 '	25415	INTAKEP1
5038	'5 '	25416	INTAKEP2
5038	'6 '	25416	INTAKEP2
5038	'7 '	25416	INTAKEP2
5038	'8 '	25416	INTAKEP2
5038	'9 '	25416	INTAKEP2
5038	'1 '	25417	IRONMTP1
5038	'2 '	25417	IRONMTP1
5038	'3 '	25417	IRONMTP1
5038	'4 '	25417	IRONMTP1
5038	'5 '	25418	IRONMTP2
5038	'6 '	25418	IRONMTP2
5038	'7 '	25418	IRONMTP2
5038	'8 '	25418	IRONMTP2
5038	'9 '	25418	IRONMTP2
5038	'1 '	25419	JHINDSP1
5038	'2 '	25419	JHINDSP1
5038	'3 '	25419	JHINDSP1
5038	'4 '	25419	JHINDSP1
5038	'5 '	25420	JHINDSP2
5038	'6 '	25420	JHINDSP2
5038	'7 '	25420	JHINDSP2
5038	'8 '	25420	JHINDSP2
5038	'9 '	25420	JHINDSP2
5039	'1 '	31154	HUMBOLDT
5039	'2 '	31154	HUMBOLDT
5040	'1 '	38700	THERMLT1
5040	'1 '	38705	THERMLT2
5040	'1 '	38710	THERMLT3
5040	'1 '	38715	THERMLT4
5040	'1 '	38825	HYATT 1
5040	'1 '	38830	HYATT 2
5040	'1 '	38835	HYATT 3
5040	'1 '	38840	HYATT 4
5040	'1 '	38845	HYATT 5
5040	'1 '	38850	HYATT 6
5043	'1 '	22373	KEARN2AB
5043	'2 '	22373	KEARN2AB
5043	'1 '	22374	KEARN2CD
5043	'2 '	22374	KEARN2CD
5044	'1 '	22376	KEARN3CD
5044	'1 '	22375	KEARN3AB
5044	'2 '	22375	KEARN3AB
5044	'2 '	22376	KEARN3CD
5046	'8 '	24737	LUZ8 G
5046	'9 '	24738	LUZ9 G

Block Generator	ID	Bus ID	Bus Name
5104	'1 '	31856	COWCRK
5104	'2 '	31856	COWCRK
5105	'2 '	36854	CSC COG.
5105	'1 '	36854	CSC COG.
5106	'1 '	32164	CTY FAIR
5106	'2 '	32164	CTY FAIR
5107	'1 '	33161	DOWCHEM1
5107	'1 '	33162	DOWCHEM2
5107	'1 '	33163	DOWCHEM3
5108	'1 '	33840	FLOWD3-6
5108	'2 '	33840	FLOWD3-6
5108	'3 '	33840	FLOWD3-6
5108	'4 '	33840	FLOWD3-6
5108	'5 '	33840	FLOWD3-6
5109	'1 '	31870	FORKBUTT
5109	'2 '	31870	FORKBUTT
5110	'1 '	33145	CROWN.Z.
5110	'2 '	33145	CROWN.Z.
5111	'2 '	32490	GRNLEAF1
5111	'1 '	32490	GRNLEAF1
5112	'1 '	31830	HAMIL.BR
5112	'2 '	31830	HAMIL.BR
5113	'1 '	36938	HONEYLKE
5113	'2 '	36938	HONEYLKE
5114	'2 '	33171	TRSVQ+NW
5114	'1 '	33171	TRSVQ+NW
5115	'1 '	35056	TX-LOSTH
5115	'1 '	35040	KERNRDGE
5115	'2 '	35040	KERNRDGE
5116	'1 '	31828	KILRC1-2
5116	'2 '	31828	KILRC1-2
5117	'1 '	35036	MT POSO
5117	'2 '	35036	MT POSO
5118	'1 '	35064	NAVY 35R
5118	'2 '	35064	NAVY 35R
5119	'1 '	22617	RAMCO_OY
5119	'2 '	22617	RAMCO_OY
5120	'2 '	31152	PAC.LUMB
5120	'1 '	31152	PAC.LUMB
5121	'2 '	31890	PO POWER
5121	'1 '	31890	PO POWER
5122	'3 '	31433	POTTRVLY
5122	'1 '	31433	POTTRVLY
5122	'4 '	31433	POTTRVLY
5123	'2 '	31896	SPI-QUCY
5123	'1 '	31896	SPI-QUCY
5124	'1 '	34076	TULLOCH
5124	'2 '	34076	TULLOCH
5125	'1 '	34783	TEXCO_NM
5125	'2 '	34783	TEXCO_NM
5126	'1 '	33842	PATTERSN
5126	'2 '	33842	PATTERSN
5126	'3 '	33842	PATTERSN
5126	'4 '	33842	PATTERSN
5127	'1 '	33836	USWP_#4
5127	'2 '	33836	USWP_#4
5127	'3 '	33836	USWP_#4
5128	'3 '	31465	WHEELBR1
5128	'2 '	31465	WHEELBR1
5128	'4 '	31465	WHEELBR1
5128	'1 '	31465	WHEELBR1
5129	'1 '	31838	CNTRVL12
5129	'2 '	31838	CNTRVL12
5130	'1 '	31850	CEDR FL+
5130	'2 '	31850	CEDR FL+

Appendix C
Block Generator Nodal Weights

Block Generator	ID	Bus ID	Bus Name	Proportional Weights
5003				
5003	'1 '	24319	EASTWOOD	0.19221
5003	'1 '	24306	B CRK1-1	0.11328
5003	'2 '	24306	B CRK1-1	0.01625
5003	'3 '	24307	B CRK1-2	0.01597
5003	'4 '	24307	B CRK1-2	0.02322
5003	'1 '	24308	B CRK2-1	0.04578
5003	'2 '	24308	B CRK2-1	0.04569
5003	'3 '	24309	B CRK2-2	0.01468
5003	'4 '	24309	B CRK2-2	0.01449
5003	'5 '	24310	B CRK2-3	0.01570
5003	'6 '	24310	B CRK2-3	0.01746
5003	'1 '	24311	B CRK3-1	0.03157
5003	'2 '	24311	B CRK3-1	0.03157
5003	'3 '	24312	B CRK3-2	0.03157
5003	'4 '	24312	B CRK3-2	0.03770
5003	'5 '	24313	B CRK3-3	0.03389
5003	'41'	24314	B CRK 4	0.04643
5003	'42'	24314	B CRK 4	0.03900
5003	'81'	24315	B CRK 8	0.02396
5003	'82'	24315	B CRK 8	0.03594
5003	'1 '	24317	MAMOTH1G	0.08682
5003	'2 '	24318	MAMOTH2G	0.08682
5016				
5016	'1 '	38820	DELTA A	0.06010
5016	'2 '	38820	DELTA A	0.06010
5016	'3 '	38820	DELTA A	0.06010
5016	'4 '	38815	DELTA B	0.06731
5016	'5 '	38815	DELTA B	0.06010
5016	'6 '	38770	DELTA C	0.06731
5016	'7 '	38770	DELTA C	0.06731
5016	'8 '	38765	DELTA D	0.02043
5016	'9 '	38765	DELTA D	0.06731
5016	'10'	38760	DELTA E	0.06731
5016	'11'	38760	DELTA E	0.02043
5016	'1 '	38750	DOS AMG1	0.06370
5016	'2 '	38750	DOS AMG1	0.06370
5016	'3 '	38750	DOS AMG1	0.06370
5016	'1 '	38755	DOS AMG2	0.06370
5016	'2 '	38755	DOS AMG2	0.06370
5016	'3 '	38755	DOS AMG2	0.06370

Appendix C (continued)
Block Generator Nodal Weights

Block Generator	ID	Bus ID	Bus Name	Proportional Weights
5017				
5017	'1 '	38775	BUENAVS1	0.02130
5017	'2 '	38775	BUENAVS1	0.02130
5017	'3 '	38775	BUENAVS1	0.02130
5017	'4 '	38775	BUENAVS1	0.01009
5017	'5 '	38775	BUENAVS1	0.01009
5017	'6 '	38775	BUENAVS1	0.01009
5017	'1 '	38780	BUENAVS2	0.02915
5017	'2 '	38780	BUENAVS2	0.02915
5017	'3 '	38780	BUENAVS2	0.02915
5017	'4 '	38780	BUENAVS2	0.02915
5017	'1 '	38785	WHLR RD1	0.01794
5017	'2 '	38785	WHLR RD1	0.01794
5017	'3 '	38785	WHLR RD1	0.01794
5017	'4 '	38785	WHLR RD1	0.03363
5017	'5 '	38785	WHLR RD1	0.03363
5017	'1 '	38790	WHLR RD2	0.03363
5017	'2 '	38790	WHLR RD2	0.03363
5017	'3 '	38790	WHLR RD2	0.03363
5017	'4 '	38790	WHLR RD2	0.03363
5017	'1 '	38795	WINDGAP1	0.03363
5017	'2 '	38795	WINDGAP1	0.03341
5017	'3 '	38795	WINDGAP1	0.03341
5017	'1 '	38800	WINDGAP2	0.07309
5017	'2 '	38800	WINDGAP2	0.07309
5017	'1 '	38805	WINDGAP3	0.07309
5017	'2 '	38805	WINDGAP3	0.07130
5017	'1 '	38810	WINDGAP4	0.07130
5017	'2 '	38810	WINDGAP4	0.07130

Appendix C (continued)
Block Generator Nodal Weights

Block Generator	ID	Bus ID	Bus Name	Proportional Weights
5018				
5018	'1 '	25605	EDMON1AP	0.05634
5018	'2 '	25606	EDMON2AP	0.05634
5018	'3 '	25607	EDMON3AP	0.05634
5018	'4 '	25607	EDMON3AP	0.05634
5018	'5 '	25608	EDMON4AP	0.05634
5018	'6 '	25608	EDMON4AP	0.05634
5018	'7 '	25609	EDMON5AP	0.05633
5018	'8 '	25609	EDMON5AP	0.05633
5018	'9 '	25610	EDMON6AP	0.05633
5018	'10'	25610	EDMON6AP	0.05633
5018	'11'	25611	EDMON7AP	0.05633
5018	'12'	25611	EDMON7AP	0.05633
5018	'13'	25612	EDMON8AP	0.05633
5018	'14'	25612	EDMON8AP	0.05633
5018	'1 '	25617	PEARBMAP	0.01527
5018	'2 '	25617	PEARBMAP	0.01527
5018	'3 '	25617	PEARBMAP	0.00672
5018	'4 '	25618	PEARBMBP	0.00672
5018	'5 '	25618	PEARBMBP	0.01527
5018	'6 '	25618	PEARBMBP	0.01982
5018	'7 '	25619	PEARBMCP	0.01982
5018	'8 '	25619	PEARBMCP	0.01982
5018	'9 '	25620	PEARBMDP	0.01982
5018	'1 '	25614	OSO A P	0.00910
5018	'2 '	25614	OSO A P	0.00910
5018	'3 '	25614	OSO A P	0.00910
5018	'4 '	25614	OSO A P	0.00910
5018	'5 '	25615	OSO B P	0.00910
5018	'6 '	25615	OSO B P	0.00910
5018	'7 '	25615	OSO B P	0.00910
5018	'8 '	25615	OSO B P	0.00910
5023				
5023	'1 '	25648	DVLCYN1G	0.28572
5023	'2 '	25649	DVLCYN2G	0.28572
5023	'3 '	25603	DVLCYN3G	0.21428
5023	'4 '	25604	DVLCYN4G	0.21428

Appendix C (continued)
Block Generator Nodal Weights

Block Generator	ID	Bus ID	Bus Name	Proportional Weights
5038				
5038	'1 '	25411	EAGLEMP1	0.02677
5038	'2 '	25411	EAGLEMP1	0.02675
5038	'3 '	25411	EAGLEMP1	0.02675
5038	'4 '	25411	EAGLEMP1	0.02675
5038	'5 '	25412	EAGLEMP2	0.02675
5038	'6 '	25412	EAGLEMP2	0.02675
5038	'7 '	25412	EAGLEMP2	0.02675
5038	'8 '	25412	EAGLEMP2	0.02675
5038	'9 '	25412	EAGLEMP2	0.02675
5038	'1 '	25413	GENE P1	0.01984
5038	'2 '	25413	GENE P1	0.01984
5038	'3 '	25413	GENE P1	0.01984
5038	'4 '	25413	GENE P1	0.01984
5038	'5 '	25414	GENE P2	0.01984
5038	'6 '	25414	GENE P2	0.01984
5038	'7 '	25414	GENE P2	0.01852
5038	'8 '	25414	GENE P2	0.01852
5038	'9 '	25414	GENE P2	0.01852
5038	'1 '	25415	INTAKEP1	0.01984
5038	'2 '	25415	INTAKEP1	0.01984
5038	'3 '	25415	INTAKEP1	0.01984
5038	'4 '	25415	INTAKEP1	0.01984
5038	'5 '	25416	INTAKEP2	0.01984
5038	'6 '	25416	INTAKEP2	0.01984
5038	'7 '	25416	INTAKEP2	0.01852
5038	'8 '	25416	INTAKEP2	0.01852
5038	'9 '	25416	INTAKEP2	0.01852
5038	'1 '	25417	IRONMTP1	0.00952
5038	'2 '	25417	IRONMTP1	0.00939
5038	'3 '	25417	IRONMTP1	0.00939
5038	'4 '	25417	IRONMTP1	0.00939
5038	'5 '	25418	IRONMTP2	0.00939
5038	'6 '	25418	IRONMTP2	0.00939
5038	'7 '	25418	IRONMTP2	0.00939
5038	'8 '	25418	IRONMTP2	0.00939
5038	'9 '	25418	IRONMTP2	0.00939
5038	'1 '	25419	JHINDSP1	0.03704
5038	'2 '	25419	JHINDSP1	0.03704
5038	'3 '	25419	JHINDSP1	0.03704
5038	'4 '	25419	JHINDSP1	0.03704
5038	'5 '	25420	JHINDSP2	0.03704
5038	'6 '	25420	JHINDSP2	0.03704
5038	'7 '	25420	JHINDSP2	0.03704
5038	'8 '	25420	JHINDSP2	0.03704
5038	'9 '	25420	JHINDSP2	0.03704

Appendix C (continued)
Block Generator Nodal Weights

Block Generator	ID	Bus ID	Bus Name	Proportional Weights
5052				
5052	'1 '	32456	MIDLFORK	0.50340
5052	'2 '	32456	MIDLFORK	0.21794
5052	'1 '	32458	RALSTON	0.27866
5056				
5055	'1 '	36223	DUKMOSS3	0.56773
5055	'1 '	36222	DUKMOSS2	0.23853
5055	'1 '	36221	DUKMOSS1	0.19374
5093				
5093	'1 '	37549	FOLSOM1	0.04686
5093	'2 '	37550	FOLSOM2	0.04686
5093	'3 '	37551	FOLSOM3	0.04686
5093	'1 '	37553	J.F.CARR	0.06047
5093	'2 '	37553	J.F.CARR	0.06047
5093	'1 '	37645	NIMBUS12	0.00611
5093	'2 '	37645	NIMBUS12	0.00544
5093	'1 '	37575	SHASTA1	0.08492
5093	'2 '	37576	SHASTA2	0.08492
5093	'3 '	37577	SHASTA3	0.08492
5093	'4 '	37578	SHASTA4	0.08492
5093	'5 '	37579	SHASTA5	0.08492
5093	'1 '	37581	SPRINGCR	0.06794
5093	'2 '	37581	SPRINGCR	0.06794
5093	'1 '	37590	TRINTY12	0.04756
5093	'2 '	37590	TRINTY12	0.04756
5093	'1 '	37559	KESWICK1	0.02378
5093	'2 '	37556	KESWICK2	0.02378
5093	'3 '	37557	KESWICK3	0.02378

Appendix D

Infeasibility Analysis, Annual CRR Allocation
August and April Off-Peak
April On-Peak

Table D-1
Base Case LSE and CVR Annual CRRs Sinking by PG&E Subzone
August 2003 Off-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price ($) (C)
Feasible LAP CRRs[1]	6,085	6,490	0.30
Feasible Subzonal CRRs[2]			
PGCC	90	92	0.25
PGEB	0	0	0.25
PGFI	48	148	0.44
PGFG	40	17	0.26
PGHB	6	7	0.66
PGLP	466	440	0.28
PGNB	12	6	0.25
PGNC	19	14	0.31
PGNV	128	122	0.24
PGP2	114	60	0.26
PGSA	138	99	0.25
PGSB	204	114	0.26
PGSF	76	33	0.26
PGSI	74	75	0.25
PGSN	27	25	0.22
PGST	174	185	0.24
PGVA	29	21	0.25
Total Infeasible LAP CRRs[3]	1,645	1,459	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.
[2] CRRs that are feasible only to specific subzones.
[3] Base Case LAP CRRs that are not feasible to all subzones.
[4] Congestion relative to reference bus.

Table D-2
Base Case LSE and CVR Annual CRRs Sinking by SCE Subzone
August 2003 Off-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price[4] ($) (C)
Feasible LAP CRRs[1]	5,341	6,386	0.76
Feasible Subzonal CRRs[2]			
SCEC	3,595	1,908	0.75
SCEN	290	188	0.74
SCES	2,046	1,213	0.77
SCHD	179	57	0.68
SCLD	0	0	0.74
Total Infeasible LAP CRRs[3]	6,110	3,366	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.
[2] CRRs that are feasible only to specific subzones.
[3] Base Case LAP CRRs that are not feasible to all subzones.
[4] Congestion relative to reference bus.

Table D-3
Base Case LSE and CVR Annual CRRs Sinking by PG&E Subzone
August 2003 Off-Peak

	Scenario I			Scenario IV			Congestion Price
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
PGCC	290	318	28	299	336	38	0.25
PGEB	1298	1022	-276	1335	1090	-245	0.25
PGFI	1064	886	-178	1094	1041	-53	0.44
PGFG	224	216	-8	230	205	-25	0.26
PGHB	58	52	-6	60	56	-4	0.66
PGLP	1058	1298	241	1088	1328	241	0.28
PGNB	233	195	-38	239	201	-38	0.25
PGNC	80	81	2	82	81	-1	0.31
PGNV	254	328	74	261	335	74	0.24
PGP2	561	556	-5	577	531	-46	0.26
PGSA	306	379	73	315	356	41	0.25
PGSB	955	956	1	982	915	-67	0.26
PGSF	424	410	-14	436	389	-47	0.26
PGSI	163	202	39	168	212	45	0.25
PGSN	53	69	16	55	70	15	0.22
PGST	582	632	50	599	674	75	0.24
PGVA	127	129	2	131	128	-3	0.25
Total CRRs	7730	7730	0	7950	7950	0	

[A, C] Total of the subzonal feasible CRRs disaggregated by subzone using subzonal weights

[B, E] CRRs feasible only to subzones.

[C] B - A

[F] E - D

[G] Average hourly congestion relative to reference bus.

Table D-4
Base Case LSE and CVR Annual CRRs Sinking by SCE Subzone
August 2003 Off-Peak

	Scenario I			Scenario IV			
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Congestion Price
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
SCEC	5916	6354	438	5038	5207	169	0.75
SCEN	811	668	-143	691	641	-50	0.74
SCES	3978	3902	-77	3388	3432	43	0.77
SCHD	284	311	27	242	215	-27	0.68
SCLD	461	215	-246	393	257	-136	0.74
Total CRRs	11450	11450	0	9752	9752	0	

[A, C] Total of the subzonal feasible CRRs disaggregated by subzone using subzonal weights

[B, E] CRRs feasible only to subzones.

[C] B - A

[F] E - D

[G] Average hourly congestion relative to reference bus.

Table D-5
Base Case LSE and CVR Annual CRRs Sinking by SCE Subzone
April 2003 On-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price ($) (C)
Feasible LAP CRRs[1]	7,401	7,478	0.14
Feasible Subzonal CRRs[2]			
PGCC	35	36	-0.01
PGEB	0	0	0.37
PGFI	177	166	-0.08
PGFG	17	16	0.25
PGHB	8	8	0.53
PGLP	138	129	-0.09
PGNB	8	10	0.27
PGNC	8	8	0.21
PGNV	34	35	-0.05
PGP2	53	49	0.21
PGSA	44	45	0.00
PGSB	98	92	0.16
PGSF	39	36	0.27
PGSI	27	27	0.04
PGSN	8	7	-0.16
PGST	67	68	0.21
PGVA	16	16	0.14
Total Infeasible LAP CRRs[3]	777	748	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.

[2] CRRs that are feasible only to specific subzones.

[3] Base Case LAP CRRs that are not feasible to all subzones.

[4] Congestion relative to reference bus.

Table D-6
Base Case LSE and CVR Annual CRRs Sinking by SCE Subzone
April 2003 On-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price[4] ($) (C)
Feasible LAP CRRs[1]	9,477	9,558	0.78
Feasible Subzonal CRRs[2]			
SCEC	0	0	0.78
SCEN	0	0	0.73
SCES	0	0	0.79
SCHD	0	0	0.72
SCLD	0	0	0.79
Total Infeasible LAP CRRs[3]	0	0	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.
[2] CRRs that are feasible only to specific subzones.
[3] Base Case LAP CRRs that are not feasible to all subzones.
[4] Congestion relative to reference bus.

Table D-7
Base Case LSE and CVR Annual CRRs Sinking by PG&E Subzone
April 2003 On-Peak

	Scenario I			Scenario IV			Congestion Price
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
PGCC	290	297	7	292	302	10	-0.01
PGEB	1373	1242	-130	1381	1255	-126	0.37
PGFI	1181	1247	65	1188	1246	58	-0.08
PGFG	223	219	-4	224	220	-4	0.25
PGHB	56	58	3	56	59	3	0.53
PGLP	919	970	51	925	970	45	-0.09
PGNB	247	232	-16	249	236	-13	0.27
PGNC	78	79	1	79	80	1	0.21
PGNV	209	223	14	210	226	16	-0.05
PGP2	573	572	-1	576	573	-3	0.21
PGSA	391	398	7	393	402	9	0.00
PGSB	1053	1051	-2	1059	1055	-4	0.16
PGSF	497	489	-9	500	490	-10	0.27
PGSI	227	233	5	229	234	6	0.04
PGSN	52	55	3	53	55	3	-0.16
PGST	652	657	5	656	664	8	0.21
PGVA	155	156	1	156	158	2	0.14
Total CRRs	8177	8177	0	8226	8226	0	

[A, C] Total of the subzonal feasible CRRs disaggregated by subzone using subzonal weights

[B, E] CRRs feasible only to subzones.

[C] B - A

[F] E - D

[G] Average hourly congestion relative to reference bus.

Table D-8
Base Case LSE and CVR Annual CRRs Sinking by SCE Subzone
April 2003 On-Peak

	Scenario I			Scenario IV			Congestion Price
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
SCEC	4854	4854	0	4896	4896	0	0.78
SCEN	677	677	0	683	683	0	0.73
SCES	3323	3323	0	3351	3352	0	0.79
SCHD	237	237	0	239	239	0	0.72
SCLD	385	385	0	389	389	0	0.79
Total CRRs	9477	9478	0	9558	9559	0	

[A, C] Total of the subzonal feasible CRRs disaggregated by subzone using subzonal weights

[B, E] CRRs feasible only to subzones.

[C] B - A

[F] E - D

[G] Average hourly congestion relative to reference bus.

Table D-9
Base Case LSE and CVR Annual CRRs Sinking by PG&E Subzone
April 2003 Off-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price ($) (C)
Feasible LAP CRRs[1]	4,679	4,596	0.001
Feasible Subzonal CRRs[2]			
PGCC	82	95	0.000
PGEB	0	0	0.000
PGFI	324	343	0.000
PGFG	21	27	0.000
PGHB	7	10	0.047
PGLP	323	348	0.000
PGNB	20	23	0.000
PGNC	14	12	0.002
PGNV	58	64	0.000
PGP2	74	83	0.000
PGSA	59	75	0.000
PGSB	131	145	0.000
PGSF	49	62	0.000
PGSI	42	49	0.000
PGSN	21	22	0.000
PGST	98	88	0.000
PGVA	21	19	0.000
Total Infeasible LAP CRRs[3]	1,344	1,465	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.
[2] CRRs that are feasible only to specific subzones.
[3] Base Case LAP CRRs that are not feasible to all subzones.
[4] Congestion relative to reference bus.

Table D-10
Base Case LSE and CVR Annual CRRs Sinking by SCE Subzone
April 2003 Off-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price[4] ($) (C)
Feasible LAP CRRs[1]	7,751	7,838	-0.0005
Feasible Subzonal CRRs[2]			
SCEC	0	0	-0.0002
SCEN	0	0	0.0000
SCES	0	0	0.0003
SCHD	0	0	-0.0002
SCLD	0	0	-0.0002
Total Infeasible LAP CRRs[3]	0	0	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.
[2] CRRs that are feasible only to specific subzones.
[3] Base Case LAP CRRs that are not feasible to all subzones.
[4] Congestion relative to reference bus.

Table D-11
Base Case LSE and CVR Annual CRRs Sinking by PG&E Subzone
April 2003 Off-Peak

	Scenario I			Scenario IV			
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Congestion Price
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
PGCC	237	266	29	239	276	37	-0.0002
PGEB	1144	889	-255	1152	873	-278	0.0000
PGFI	687	858	171	691	867	176	-0.0001
PGFG	176	158	-19	178	162	-16	-0.0001
PGHB	55	49	-5	55	52	-3	0.0474
PGLP	700	867	167	705	882	178	-0.0001
PGNB	200	175	-24	201	175	-26	0.0002
PGNC	62	62	0	62	59	-3	0.0025
PGNV	154	178	23	155	182	26	-0.0001
PGP2	482	449	-34	485	451	-34	-0.0001
PGSA	238	244	6	239	256	17	-0.0001
PGSB	776	734	-42	781	737	-44	0.0000
PGSF	396	356	-40	399	364	-34	0.0001
PGSI	127	141	14	128	147	18	0.0004
PGSN	44	55	11	44	55	11	-0.0002
PGST	446	444	-1	448	428	-20	0.0000
PGVA	98	97	-1	99	94	-5	0.0001
Total CRRs	6022	6022	0	6061	6061	0	

[A, C] Total of the subzonal feasible CRRs disaggregated by subzone using subzonal weights

[B, E] CRRs feasible only to subzones.

[C] B - A

[F] E - D

[G] Average hourly congestion relative to reference bus.

Table D-12
Base Case LSE and CVR Annual CRRs Sinking by SCE Subzone
April 2003 Off-Peak

	Scenario I			Scenario IV			Congestion Price
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
SCEC	4026	4026	0	4071	4071	0	-0.0002
SCEN	546	546	0	552	552	0	0.0000
SCES	2678	2678	0	2708	2708	0	0.0003
SCHD	191	191	0	193	193	0	-0.0002
SCLD	311	311	0	314	314	0	-0.0002
Total CRRs	7751	7752	0	7838	7839	0	

[A, C] Total of the subzonal feasible CRRs disaggregated by subzone using subzonal weights

[B, E] CRRs feasible only to subzones.

[C] B - A

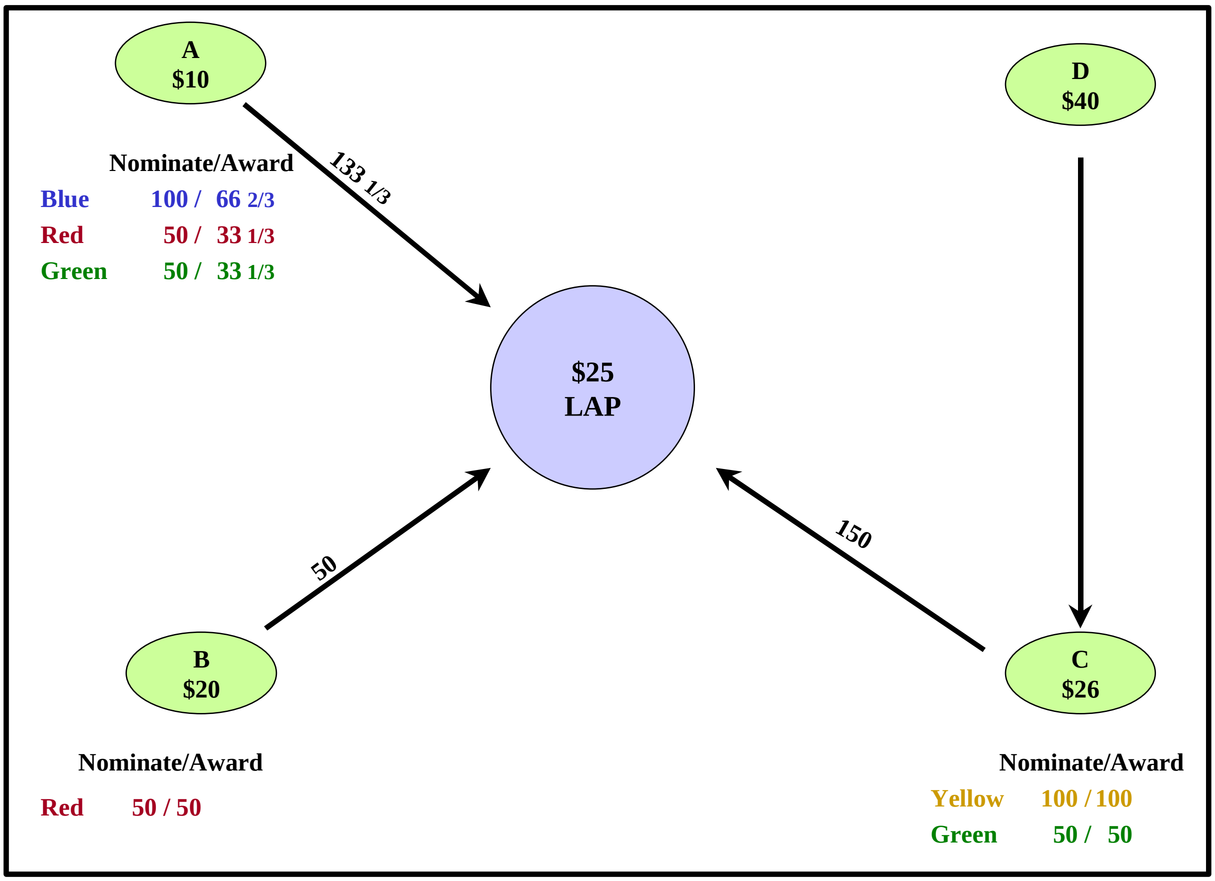
[F] E - D

[G] Average hourly congestion relative to reference bus.

Appendix E
Proration Metric Example

The application of the proration metric to CRR allocation can be illustrated using the radial system portrayed in Figure E-1 with expected LMP prices at source nodes and LAP price as shown. Suppose that the number of CRRs requested from node A exceeds system capacity so that only 2/3 of the CRR requests from A can be awarded, while all of the requests sourced at B and C are awarded.

Figure E-1
CRR Allocation



It can be seen in Column (H) of Table E-2 that there is a considerable range in the proration ratio across the four LSEs in this example (Red, Blue, Green and Yellow). Yellow LSE is awarded 100% of its requests in dollar terms, Red is awarded 75% of its requests in dollar terms, while Blue receives only 66.67% of its requests in dollar terms, and Green only 64.3%.

The proration ratio metric would therefore suggest that the allocation rules favored Yellow LSE at the expense of Green and Blue LSEs.

Table E-2
CRR Nominations, Awards and Value

	Source	Nominated	Award Ratio	CRR Value	CRR Awarded	Value of Awarded CRR	Value of Nominated CRR	Award/ Nominated Ratio	CRR Value/ MW Peak Load
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
Blue	A	100	0.66666	15	66.666	999.99	1500	0.66666	9.9999
Red	A	50	0.666666	15	33.3333	499.9995	750		
	B	50	1	5	50	250	250		
						749.9995	1000	0.7499995	7.499995
Yellow	C	100	1	-1	100	-100	-100	1	-1
Green	B	50	0.666666	15	33.3333	499.9995	750		
	C	50	1	-1	50	-50	-50		
						449.9995	700	0.6428564	4.499995

Table E-2, however, also shows in Column (F) that Blue receives the most valuable CRRs, while Yellow receives the least valuable. Since all of these LSEs pay the same LAP price for their power, Yellow ends up with a far higher cost of meeting the 100 MW of load for which each LSE nominated CRRs than Blue, or Red or Green as shown in Table E-3, suggesting that perhaps this allocation favors Blue and disfavors Yellow, rather than the reverse.

Table E-3
LSE Cost of Meeting Load

	LAP Price	MW Load	Cost
Blue	25	100	2500
	CRRs[1]		-999.99
	Surplus[2]		-117.5028
			1382.5073
Red	25	100	2500
	CRRs[1]		-749.9995
	Surplus[2]		-117.5028
			1632.4978
Yellow	25	100	2500
	CRRs[1]		100
	Surplus[2]		-117.5028
			2482.4973
Green	25	100	2500
	CRRs[1]		-449.9995
	Surplus[2]		-117.5028
			1932.4978
			7430

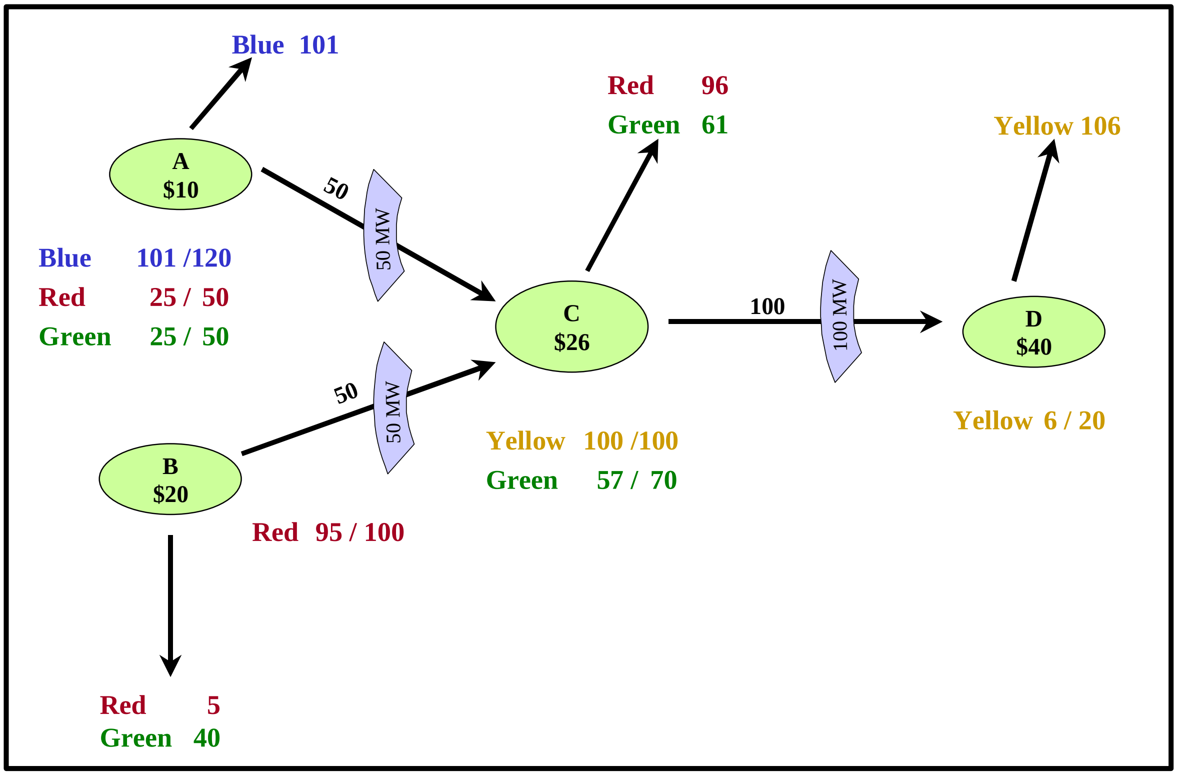
[1] Column F, Table E-2.
[2] Share of congestion rent surplus in example.

Appendix F
CRR Payment per MW Example

The example used to illustrate the application of the proration ratio metric can also be used to illustrate the CRR payments per MW of peak load metric. Assume that the expected power system dispatch underlying the CRR values in the CRR allocation example portrayed in Figure E-1 is as shown in Figure F-1.[87] Given these LMP prices, the average price is $25, consistent with the LAP price used for the example. Blue LSE's load is located at A and is served by its generation at A. On the actual transmission system, therefore, there is no congestion between Blue's generation and its load, but there is congestion between Blue's generation and the LAP which is why its CRR allocation was prorated in Table E-2. Yellow has load at D which it largely meets with lower cost generation at C, but meets at the margin with very high cost generation at D. Most of Red's load is at C, while its generation is at A and B. Green has load at B and C, while its generation is at A and C.

[87] The load at each bus is portrayed as an arrow off each bus. Generation output and capacity are also shown at each location. Transmission constraints are binding between each node. The transmission constraints in Figure F-1 may appear inconsistent with the CRRs illustrated in Figure E-1, because there is only 50 MW of transfer capability from A to C but 133 1/3 CRRs were awarded from A to the LAP. It needs to be kept in mind in thinking through LAP pricing models that the LAP and bus C are not the same location, part of the LAP load is at A. The actual line flows associated with the CRR allocation in Figure E-1 are portrayed in Figure I-1 in Appendix I. Figure E-1 shows that given the assumed nodal load weights used in allocating CRR sink quantities to the nodes, the awarded CRRs imply exactly 50 MW of flow on the A-C path.

Figure F-1
Dispatch



The figures below the nodes in Figure F-1 identify the LSE generation owner, the generation output, and the generator capacity.

Table F-2 portrays the cost for each LSE of meeting the load that would be hedged with CRRs with its physical generation, suggesting still another view of what is equitable. If Blue simply dispatches its generation to meet its load, its cost of meeting load would be only $1,000, much lower than its costs under the LAP pricing with its CRR allocation. All of the other LSEs would have higher costs of meeting their load using their own generation than under the LAP pricing. In particular, now Yellow LSEs cost of meeting load under LAP pricing given its CRR allocation (see Table E-3) looks inequitably low, not inequitably high.

Table F-2
LSE Cost of Meeting Load with Own Generation

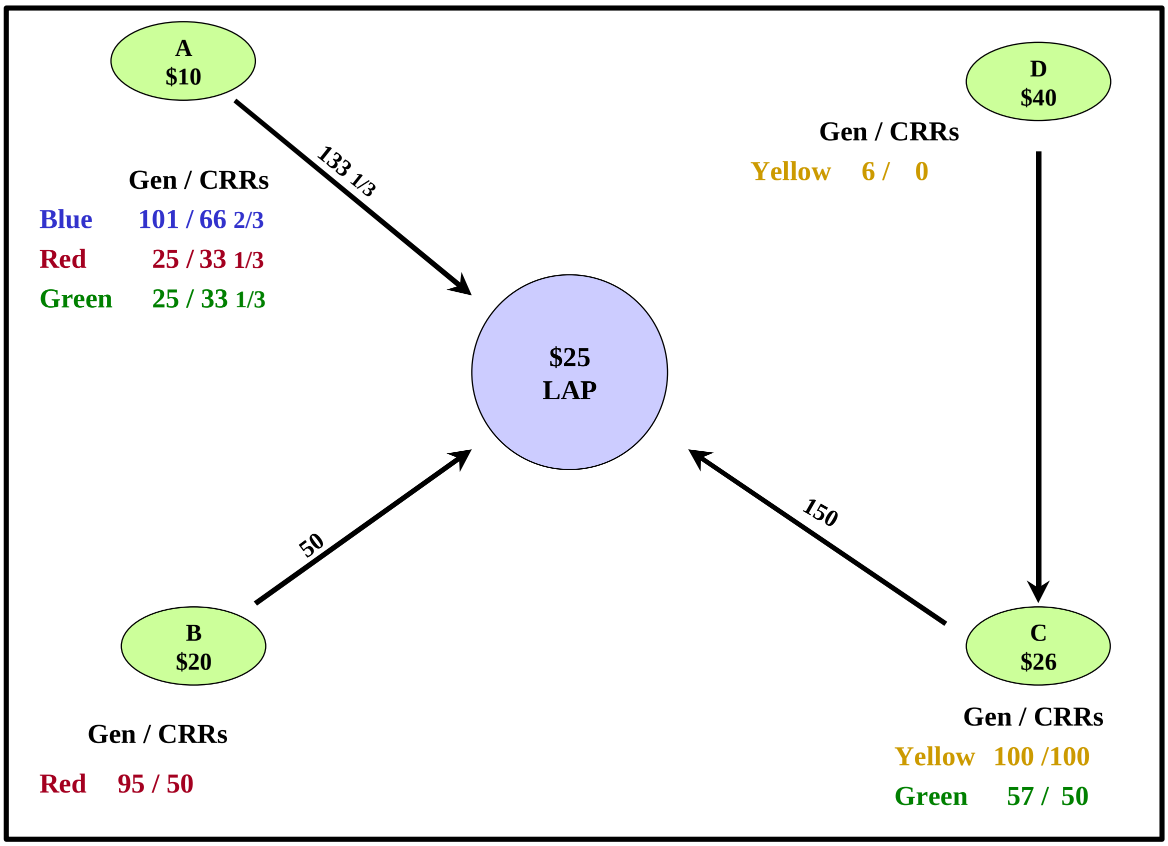
LSE	LMP $/MW	Load (MW)	Total Cost ($)	Average Cost $/MW
Blue	10	101	1010	10.00
Red	10	25	250	
	20	76	1520	
Total		101	1770	17.52
Yellow	26	100	2600	
	40	6	240	
Total		106	2840	26.79
Green	10	25	250	
	26	57	1482	
Purchased	20	19	380	
Total		101	2112	20.91
Total		409	7732	18.90

The LSEs' cost of meeting their load with their own generation is not necessarily, however, the appropriate measure of equitable cost allocation either. For example, if all of the loads at A, B, C and D had historically been within a single zone and all out-of-merit costs were paid by all zonal load in an uplift payment, then the cost of power for all LSEs would have been $18.90, and it might be argued that an equitable allocation of CRRs and congestion rent surplus should provide each LSE with an expected value of $6.10/MW.

Appendix G
CRR and Resource-Based Congestion Charge Calculation

To illustrate the application of the CRR and Resource-Based Congestion Charge Calculation, let us suppose that generation in the example in Appendix F were dispatched to meet load as portrayed in Figure G-1, which is a simplified version of Figure F-1 showing the LAP, the generation pattern, and CRR sources.

Figure G-1
Dispatch and CRR Allocation



In the first step, Blue would have 66 2/3 MWh of its generation at A meeting its load, with congestion charges of $15/MWh. Red would have 25 MWh of generation at A, also with congestion charges of $15/MWh and 50 MWh of generation at B, having congestion charges of $5/MWh. Finally, Green LSE would have 25 MWh of generation at A with congestion charges of $15/MWh. These congestion charges are summarized in Table G-2. None of the generation at C or D has been used to meet load in this step because the LMP price at C and D exceeds the LAP price.

Table G-2
CRR and Resource-Based Congestion Charge Metric
Step 1

Source	MWh	Congestion Charge ($/MWh)	Total Charge ($)
A	66.667	15	1000.005
A	25	15	375
B	50	5	250
A	25	15	375
			2000.005

At the end of Step 1, both Red and Green have additional undispatched generation at A (and the LMP at A is less than the LAP) and the generation at A counted in Step 1 is less than their CRR entitlement from A to the LAP. The second step would therefore add 8 1/3 MW of spot market purchases by both Red and Green at A, with congestion charges of $15/MWh. The total congestion charges in the second step are summarized in Table G-3.

Table G-3
CRR and Resource-Based Congestion Charge Metric
Step 2

Source	MWh	Congestion Charge ($/MWh)	Total Charge ($)
A	8.333	15	124.995
A	8.333	15	124.995
			249.99

The application of the third step can also be illustrated using the example in Figure G-1. Since all four LSEs still have unmet load at the end of Step 2, generation with costs above the LAP price is now be used to meet LSE load, up to the higher of the LSE's units capacity or CRR entitlement at each location. In the example, Yellow would have 100 MWh of generation at C with congestion charges of -$1/MWh and Green would have 50 MWh of generation at C with congestion charges of -$1/MWh. The total congestion charges in the third step are summarized in Table G-4, and it can be seen that they are all negative, which will necessarily be the case since the source LMP by definition exceeds the LAP price.

Table G-4
CRR and Resource-Based Congestion Charge Metric
Step 3

Source	MWh	Congestion Charge ($/MWh)	Total Charge ($)
C	100	-1	-100
C	50	-1	-50
			-150

At the end of Step 3, all four LSEs still have unmet load, so the calculation in the example would proceed to the fourth step. In this step, Green has an additional 7 MWh of generation at C (whose LMP price exceeds the LAP price) that is dispatched, while Yellow has an additional 6 MWh of generation at D that is dispatched. These additional congestion charges, also all negative are shown in Table G-5.

Table G-5
CRR and Resource-Based Congestion Charge Metric
Step 4

Source	MWh	Congestion Charge ($/MWh)	Total Charge ($)
D	6	-15	-90
C	7	-1	-7
			-97

Table G-6 summarizes the application of the CRR and Resource Based Approach, showing that in the example the Blue and Red LSEs have CRR payment to congestion charge ratios that are close to one because their generation is all dispatched to use their CRRs to meet their load. Green has a ratio slightly above 1 because of the counterflow payments attributable to the 7 MW dispatched at C in excess of its CRR allocation. The metric is not very meaningful for Yellow because all of its CRRs are counterflow CRRs with negative values, as are all of its congestion charges to the LAP. The metric indicates an equitable CRR allocation for this load pattern.[88]

Table G-6
CRR and Resource-Based Congestion Charge Metric

	Source	MWh	Congestion Charge ($/MWh)	Total Charge ($)	Total CRR Value ($)	CRR Value/ Charges
Blue	A	66.667	15	1000.005	1000	1.000
Red	A	25	15	375		
	B	50	5	250		
	A	8.333	15	124.995		
	Total	83.333	35	749.995	750	1.000
Green	A	25	15	375		
	A	8.333	15	124.995		
	C	50	-1	-50		
	C	7	-1	-7		
	Total	90.333	28	442.995	450	1.016
Yellow	C	100	-1	-100		
	D	6	-15	-90		
	Total	106	-16	-190	-100	0.526
					2100	

88 It needs to be kept in mind that this metric only measures the equity of the CRR allocation, given the number allocated. Because CRRs are allocated to the LAP and the proration is based on applying the simultaneous feasibility test, the limit on the award of A to LAP CRRs, means that the B-C and C-D lines are not fully allocated in terms of CRR flows, as shown in Figure I-1 in Appendix I. The CRR payment to total congestion rent collections for this base dispatch is only 84%.

If the CRR and Resource Based Approach were applied to a different load pattern in which the CRRs do not provide as good a hedge for the actual dispatch, the statistics could be different. Figure G-7 portrays a different physical dispatch in which load is lower at every location. Moreover, load is low enough at D that the constraint between C and D is not binding, so the price at D falls to $26/MWh.

Figure G-7
Low Load Dispatch – Nodal Representation

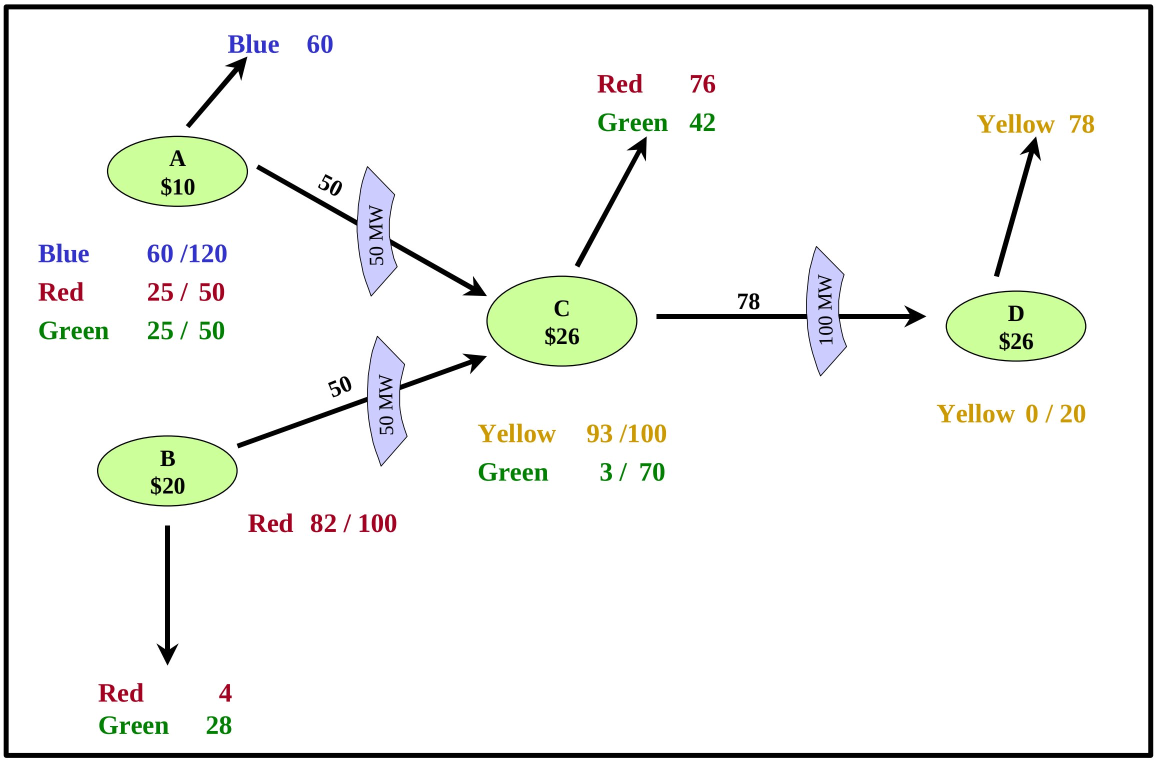


Figure G-8 portrays the generation dispatch and CRR allocations relative to the LAP for this same dispatch. First, note that the LAP price has fallen to $21.25 because of the large drop in the LMP price at D.

Figure G-8
Low Load Dispatch and CRR Allocation

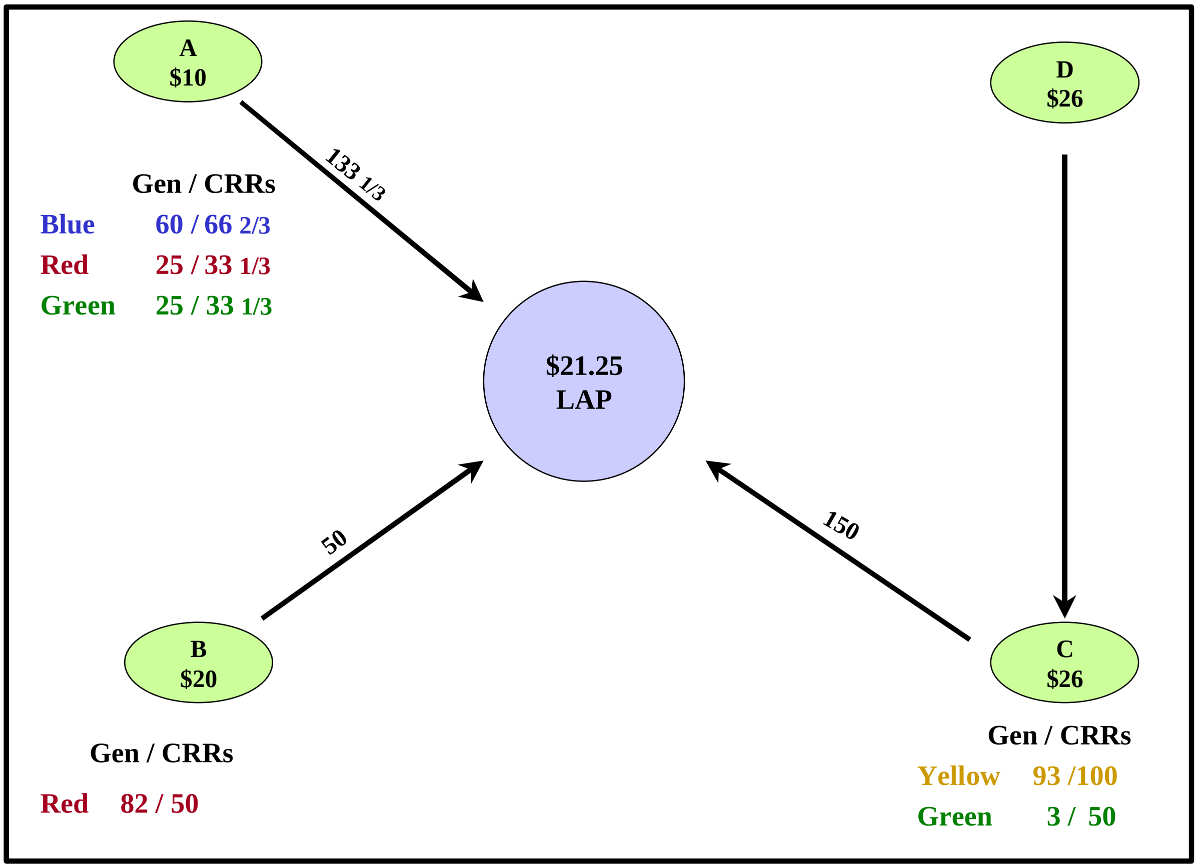


Table G-9 applies the proposed CRR and resource-based congestion charge calculation methodology to the new demand pattern. There are a few differences from the first example. First, because the Blue LSE's load is only 60, congestion charges are calculated only for the first 60 MW of its generation, Similarly, since Red LSEs load is only 80 MW, congestion charges are calculated only for the first 80 MW of its generation. Since Green LSEs load is only 70 MW, congestion charges are calculated only for 36.667 of capacity at C (33 1/3 MW from A plus 36 2/3 MW at C = 70 MW). Finally, since Yellow has load of only 78 MW, congestion charges are calculated for only 78 MW of its generation at C, the rest of its generation at C is assumed to be sold into the spot market.

Table G-9
CRR and Resource-Based Congestion Charge Metric -- Low Load

	Source	MWh	Congestion Charge ($/MWh)	Total Charge ($)
Step 1				
Blue	A	60	12	720
Red	A	25	12	300
Red	B	50	2	100
Green	A	25	12	300
Total				1420
Step 2				
Red	A	5	12	60
Green	A	8.333	12	99.996
Total				159.996
Step 3				
Yellow	C	78	-4	-312
Green	C	36.667	-4	-146.668
Total				-458.668

Table G-10 shows that for the low load conditions, the proposed hedging statistic has a value of 111% for Blue and 108% for Red, indicating that the CRR payments exceed the congestion charges the LSEs pay. This outcome makes sense for Red as it actually has distant generation supported by CRRs (83.33 MW) that exceeds its load (80 MW). This outcome is artifact of LAP pricing for Blue, however, as its generation is actually at the same location as its load, but it needs CRRs to hedge itself against the LAP price which is higher than its nodal price. When Blue's load is lower than its CRR allocation, however, Blue receives CRR payments on its full CRR allocation, but the payments now exceed its congestion payments.

Table G-10
CRR and Resource-Based Congestion Charge Metric -- Low Load

	Source	MWh	Congestion Charge ($/MWh)	Total Charge ($)	Total CRR Value ($)	CRR Value/ Charges
Blue	A	60	12	720	800.0004	1.111
Red	A	25	12	300		
	B	50	2	100		
	A	5	12	60		
	Total	80	26	460	499.996	1.087
Green	A	25	12	300		
	A	8.333	12	99.996		
	C	36.667	-4	-146.668		
	Total	70		253.328	199.996	0.789
Yellow	C	78	-4	-312	-400	1.282

Green LSE, on the other hand, recovers only about 79% of its congestion charges in its CRR revenues, largely because it has a number of counterflow CRRs to the LAP that are not used to hedge generation. This is also an artifact of LAP pricing because the undispatched generation at C is actually at the same location as Green's physical load; Green only needs to be hedged to the LAP because of the LAP price aggregation.

Appendix H
Resource-Based Congestion Charge Calculation

The operation of the Resource-Based Congestion Charge Calculation can be illustrated by applying it to the same example used to illustrate the operation of the resource and CRR-based congestion rent calculation. In the first step, generation owned or under contract to the LSE that is dispatched in the simulation would be used to meet the LSE's load without regard to CRR ownership. This step is shown in Table H-1 and it can be seen that additional Blue generation at A and Red Generation at B would be used in comparison with the resource-band CRR-based methodology. All of Blue and Red's load can be met with this generation.

Table H-1
Resource-Based Congestion Charge Metric
Step 1

	Source	MWh	Congestion Charge ($/MWh)	Total Charge ($)
Blue	A	101	15	1515
Red	A	25	15	375
Red	B	76	5	380
Green	A	25	15	375
Total				2645

In the second step, undispatched low-cost generation would be used to meet remaining LSE load, again without regard to CRR allocations. Table H-2 shows that 25 additional MW of Green's generation at A would be used to meet Green's load in this step.

Table H-2
Resource-Based Congestion Charge Metric
Step 2

	Source	MWh	Congestion Charge ($/MWh)	Total Charge ($)
Red	A	0	15	0
Green	A	25	15	375
Total				375

In the third step, generation operating at high LMP locations would be used to meet remaining LSE load, without regard to CRR allocations. These results are shown in Table H-3.

Table H-3
Resource-Based Congestion Charge Metric
Step 3

	Source	MWh	Congestion Charge ($/MWh)	Total Charge ($)
Yellow	C	100	-1	-100
Yellow	D	6	-15	-90
Green	C	51	-1	-51
Total				-241

Table H-4 shows the resource based congestion charge metric calculated for the LSEs using this methodology. The metric indicates that Blue LSE receives CRRs for only 2/3 of its congestion charges, Green receives CRRs hedging about 64% of its congestion charges, while Red is hedged for 99% of its congestion charges. The metric for Yellow is again not meaningful because the congestion charges and CRR values are both negative. The metric is not meaningful for the overall level of hedging because the total congestion charges over the four LSEs ($2,779), exceeds the total congestion rents collected by the ISO, which are only $2,493. Thus, while we know that the CRR allocation in the example only awards 84% of the congestion rents, using the resource based congestion charge metric to measure the overall adequacy of the CRR allocation would provide meaningless results because of the likelihood that the calculated congestion charges would exceed total congestion rents collected by the ISO.

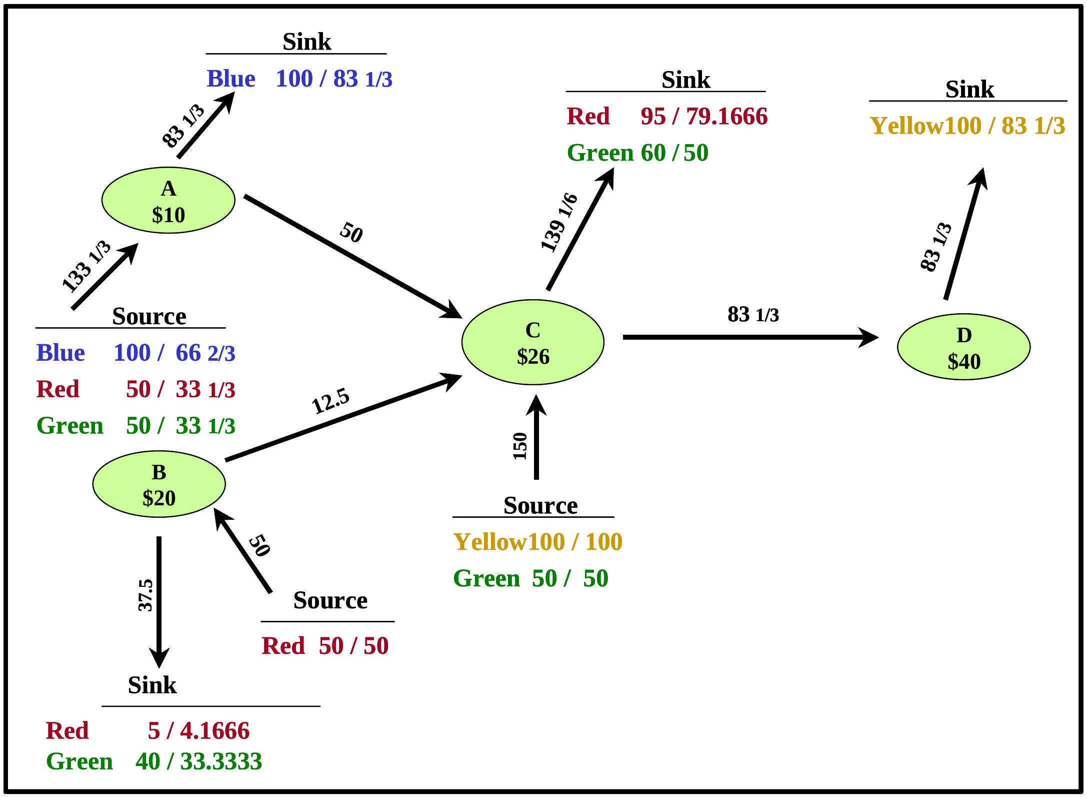
Table H-4
Resource-Based Congestion Charge Metric

	Source	MWh	Congestion Charge ($/MWh)	Total Charge ($)	Total CRR Value	CRR Value/ Charges
Blue	A	101	15	1515	1000	0.660
Red	A	25	15	375		
	B	76	5	380		
	A	0	15	0		
	Total	101	35	755	750	0.993
Green	A	25	15	375		
	A	25	15	375		
	C	51	-1	-51		
	Total	101	29	699	450	0.644
Yellow	C	100	-1	-100		
	D	6	-15	-90		
	Total	106	409	-190	-100	0.526
				2779	2100	

Appendix I
Simultaneous Feasibility Test for CRR Nominations and Awards

The generation source to LAP CRRs in the example in Appendices E through H satisfy a simultaneous feasibility test. Figure I-1 portrays the power flows associated with these CRRs and the nominated and awarded CRRs sourced and sinking at each location.

Figure I-1
CRR Flows
Nominated/Awarded



One of the features of CRRs sinking at a LAP is that proration of CRRs from a particular source results in proration at all locations in proportion to the load weights used to define the LAP. Thus, the 200 MW of CRRs nominated from A to the LAP would overload the A-C line by 50 MW, 200 MW generation – 100 MW load at A = 100 MW flows on A-C. The simultaneous feasibility test requires that the CRRs sourced from A be prorated back to 133 1/3, rather than merely 150, because as the CRRs are prorated back, the LAP load is prorated back as well and part of the LAP load is at A. This proration process also causes the C-D constraint to not be fully utilized in the CRR allocation, as seen in Figure I-1, because part of the load that is prorated back is located at D.

With a multi-round CRR nomination process, Red could nominate CRRs from B to the

LAP and Green from C to the LAP and when these CRRs were awarded, the increase in load at A (because part of the LAP is at A) would enable additional CRRs to be feasible from A to the LAP. The transmission system portrayed in Figure I-1 is underallocated in the example, because of the proration of the A-LAP CRRs, causing the CRR payments to be less than the congestion rent collected by the CAISO. This under allocation could be avoided if LSEs nominated CRRs from appropriate sources, but multiple allocation rounds would be needed to accomplish this. Moreover, market participants might not designate the counterflow CRRs needed to fully allocate the system. For example, had Yellow and Green not nominated the counterflow CRRs from C to the LAP, substantially few CRRs could have been defined from A to the LAP, because Yellow and Green's failure to designated those counterflow CRRs would have reduced LAP load, part of which would be at A.

Appendix J

Infeasibility Analysis Monthly and Annual CRR Allocation
August and April Off-Peak, April On-Peak

Table J-1
Base Case LSE and CVR CRRs Sinking by PG&E Subzone
Monthly and Annual
August 2003 Off-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price ($) (C)
Feasible LAP CRRs[1]	8,356	8,969	0.30
Feasible Subzonal CRRs[2]			
PGCC	153	159	0.25
PGEB	0	0	0.25
PGFI	86	253	0.44
PGFG	54	40	0.26
PGHB	11	17	0.66
PGLP	837	706	0.28
PGNB	17	19	0.25
PGNC	27	30	0.31
PGNV	234	220	0.24
PGP2	161	156	0.26
PGSA	245	209	0.25
PGSB	291	289	0.26
PGSF	103	79	0.26
PGSI	125	135	0.25
PGSN	50	45	0.22
PGST	256	318	0.24
PGVA	42	46	0.25
Total Infeasible LAP CRRs[3]	2,693	2,721	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.
[2] CRRs that are feasible only to specific subzones.
[3] Base Case LAP CRRs that are not feasible to all subzones.
[4] Congestion relative to reference bus.

Table J-2
Base Case LSE and CVR CRRs Sinking by SCE Subzone
Monthly and Annual
August 2003 Off-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price[4] ($) (C)
Feasible LAP CRRs[1]	9,505	12,490	0.76
Feasible Subzonal CRRs[2]			
SCEC	3,594	1,908	0.75
SCEN	290	188	0.74
SCES	2,046	1,213	0.77
SCHD	179	57	0.68
SCLD	0	0	0.74
Total Infeasible LAP CRRs[3]	6,109	3,366	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.

[2] CRRs that are feasible only to specific subzones.

[3] Base Case LAP CRRs that are not feasible to all subzones.

[4] Congestion relative to reference bus.

Table J-3
Base Case LSE and CVR CRRs Sinking by PG&E Subzone
Monthly and Annual
August 2003 Off-Peak

	Scenario I			Scenario IV			Congestion Price
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
PGCC	415	467	52	439	496	56	0.25
PGEB	1855	1403	-452	1963	1506	-457	0.25
PGFI	1521	1237	-284	1609	1488	-121	0.44
PGFG	320	295	-24	338	300	-38	0.26
PGHB	83	74	-9	88	85	-3	0.66
PGLP	1512	1980	469	1599	1933	334	0.28
PGNB	332	269	-64	352	289	-63	0.25
PGNC	114	113	-1	120	122	2	0.31
PGNV	363	509	146	384	515	131	0.24
PGP2	802	768	-34	849	807	-42	0.26
PGSA	437	576	138	463	564	101	0.25
PGSB	1365	1324	-41	1444	1397	-48	0.26
PGSF	607	562	-45	642	572	-70	0.26
PGSI	233	301	69	246	324	77	0.25
PGSN	76	107	31	81	107	26	0.22
PGST	832	885	53	880	993	113	0.24
PGVA	182	179	-3	192	194	1	0.25
Total CRRs	11049	11049	0	11690	11690	0	

[A, C] Total of the subzonal feasible CRRs disaggregated by subzone using subzonal weights

[B, E] CRRs feasible only to subzones.

[C] B - A

[F] E - D

[G] Average hourly congestion relative to reference bus.

Table J-4
Base Case LSE and CVR CRRs Sinking by SCE Subzone
Monthly and Annual
August 2003 Off-Peak

	Scenario I			Scenario IV			Congestion Price
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
SCEC	8066	8505	438	8192	8361	169	0.75
SCEN	1106	963	-143	1123	1073	-50	0.74
SCES	5425	5348	-77	5509	5552	43	0.77
SCHD	387	415	27	394	367	-27	0.68
SCLD	629	383	-246	639	503	-136	0.74
Total CRRs	15614	15614	0	15857	15857	0	

[A, C] Total of the subzonal feasible CRRs disaggregated by subzone using subzonal weights

[B, E] CRRs feasible only to subzones.

[C] B - A

[F] E - D

[G] Average hourly congestion relative to reference bus.

Table J-5
Base Case LSE and CVR CRRs Sinking by PG&E Subzone
Monthly and Annual
April 2003 On-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price ($) (C)
Feasible LAP CRRs[1]	9,368	9,719	0.14
Feasible Subzonal CRRs[2]			
PGCC	95	86	-0.01
PGEB	0	0	0.37
PGFI	529	454	-0.08
PGFG	32	31	0.25
PGHB	13	15	0.53
PGLP	412	353	-0.09
PGNB	14	15	0.27
PGNC	18	15	0.21
PGNV	84	74	-0.05
PGP2	93	91	0.21
PGSA	102	93	0.00
PGSB	177	173	0.16
PGSF	56	51	0.27
PGSI	64	58	0.04
PGSN	24	20	-0.16
PGST	138	120	0.21
PGVA	36	29	0.14
Total Infeasible LAP CRRs[3]	1,885	1,680	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.

[2] CRRs that are feasible only to specific subzones.

[3] Base Case LAP CRRs that are not feasible to all subzones.

[4] Congestion relative to reference bus.

Table J-6
Base Case LSE and CVR CRRs Sinking by SCE Subzone
Monthly and Annual
April 2003 On-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price[4] ($) (C)
Feasible LAP CRRs[1]	14,244	14,095	0.78
Feasible Subzonal CRRs[2]			
SCEC	0	0	0.78
SCEN	0	0	0.73
SCES	0	0	0.79
SCHD	0	0	0.72
SCLD	0	0	0.79
Total Infeasible LAP CRRs[3]	0	0	

1 Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.

2 CRRs that are feasible only to specific subzones.

3 Base Case LAP CRRs that are not feasible to all subzones.

4 Congestion relative to reference bus.

Table J-7
Base Case LSE and CVR CRRs Sinking by PG&E Subzone
Monthly and Annual
April 2003 On-Peak

	Scenario I			Scenario IV			
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Congestion Price
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
PGCC	399	427	28	404	431	27	-0.01
PGEB	1889	1573	-317	1914	1632	-282	0.37
PGFI	1626	1882	256	1647	1858	211	-0.08
PGFG	306	287	-20	310	296	-15	0.25
PGHB	77	76	0	78	81	4	0.53
PGLP	1265	1465	200	1282	1446	164	-0.09
PGNB	341	297	-43	345	309	-36	0.27
PGNC	108	108	0	109	108	-1	0.21
PGNV	287	323	36	291	322	31	-0.05
PGP2	789	750	-39	799	773	-26	0.21
PGSA	538	551	12	545	558	13	0.00
PGSB	1449	1383	-66	1467	1424	-43	0.16
PGSF	684	625	-59	693	642	-51	0.27
PGSI	313	324	11	317	328	11	0.04
PGSN	72	84	11	73	83	9	-0.16
PGST	898	885	-13	910	895	-14	0.21
PGVA	213	213	0	216	213	-3	0.14
Total CRRs	11253	11253	0	11400	11400	0	

[A, C] Total of the subzonal feasible CRRs disaggregated by subzone using subzonal weights

[B, E] CRRs feasible only to subzones.

[C] B - A

[F] E - D

[G] Average hourly congestion relative to reference bus.

Table J-8
Base Case LSE and CVR CRRs Sinking by SCE Subzone
Monthly and Annual
April 2003 On-Peak

	Scenario I			Scenario IV			
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Congestion Price
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
SCEC	7295	7296	0	7219	7219	0	0.78
SCEN	1018	1018	0	1007	1007	0	0.73
SCES	4994	4994	0	4942	4942	0	0.79
SCHD	357	357	0	353	353	0	0.72
SCLD	579	579	0	573	573	0	0.79
Total CRRs	14244	14244	0	14095	14095	0	

[A, C] Total of the subzonal feasible CRRs disaggregated by subzone using subzonal weights

[B, E] CRRs feasible only to subzones.

[C] B - A

[F] E - D

[G] Average hourly congestion relative to reference bus.

Table J-9
Base Case LSE and CVR CRRs Sinking by PG&E Subzone
Monthly and Annual
April 2003 Off-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price ($) (C)
Feasible LAP CRRs[1]	6,337	6,968	0.001
Feasible Subzonal CRRs[2]			
PGCC	175	178	0.000
PGEB	0	0	0.000
PGFI	661	656	0.000
PGFG	59	43	0.000
PGHB	19	17	0.047
PGLP	695	667	0.000
PGNB	49	29	0.000
PGNC	29	22	0.002
PGNV	122	125	0.000
PGP2	189	136	0.000
PGSA	125	137	0.000
PGSB	319	243	0.000
PGSF	127	93	0.000
PGSI	80	86	0.000
PGSN	44	42	0.000
PGST	206	153	0.000
PGVA	46	34	0.000
Total Infeasible LAP CRRs[3]	2,945	2,661	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.

[2] CRRs that are feasible only to specific subzones.

[3] Base Case LAP CRRs that are not feasible to all subzones.

[4] Congestion relative to reference bus.

Table J-10
Base Case LSE and CVR CRRs Sinking by SCE Subzone
Monthly and Annual
April 2003 Off-Peak

	Scenario I (MW) (A)	Scenario IV (MW) (B)	Congestion Price[4] ($) (C)
Feasible LAP CRRs[1]	12,016	11,987	-0.0005
Feasible Subzonal CRRs[2]			
SCEC	0	0	-0.0002
SCEN	0	0	0.0000
SCES	0	0	0.0003
SCHD	0	0	-0.0002
SCLD	0	0	-0.0002
Total Infeasible LAP CRRs[3]	0	0	

[1] Feasible LAP CRRs are CRRs that are feasible to the LAP as a whole.
[2] CRRs that are feasible only to specific subzones.
[3] Base Case LAP CRRs that are not feasible to all subzones.
[4] Congestion relative to reference bus.

Table J-11
Base Case LSE and CVR CRRs Sinking by PG&E Subzone
Monthly and Annual
April 2003 Off-Peak

	Scenario I			Scenario IV			
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Congestion Price
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
PGCC	365	424	59	379	453	74	-0.0002
PGEB	1763	1204	-559	1830	1324	-506	0.0000
PGFI	1059	1383	325	1099	1451	352	-0.0001
PGFG	272	245	-27	282	247	-35	-0.0001
PGHB	84	76	-8	87	80	-8	0.0474
PGLP	1079	1432	352	1120	1477	357	-0.0001
PGNB	308	259	-48	319	260	-59	0.0002
PGNC	95	94	-1	99	93	-6	0.0025
PGNV	238	284	46	247	303	56	-0.0001
PGP2	743	697	-46	771	694	-77	-0.0001
PGSA	367	375	9	380	412	32	-0.0001
PGSB	1196	1135	-60	1240	1141	-99	0.0000
PGSF	610	544	-67	633	551	-82	0.0001
PGSI	196	214	18	204	234	30	0.0004
PGSN	67	90	23	70	93	23	-0.0002
PGST	687	675	-12	713	669	-44	0.0000
PGVA	151	149	-2	157	148	-9	0.0001
Total CRRs	9282	9282	0	9630	9630	0	

[A, C] Total of the subzonal feasible CRRs disaggregated by subzone using subzonal weights

[B, E] CRRs feasible only to subzones.

[C] B - A

[F] E - D

[G] Average hourly congestion relative to reference bus.

Table J-12
Base Case LSE and CVR CRRs Sinking by SCE Subzone
Monthly and Annual
April 2003 Off-Peak

	Scenario I			Scenario IV			Congestion Price
	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	Subzonal CRRs Required for LAP Feasibility	Feasible Subzonal CRRs	Difference	
	(MW)			(MW)			($)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
SCEC	6241	6241	0	6226	6226	0	-0.0002
SCEN	846	846	0	844	844	0	0.0000
SCES	4151	4151	0	4141	4141	0	0.0003
SCHD	297	297	0	296	296	0	-0.0002
SCLD	481	481	0	480	480	0	-0.0002
Total CRRs	12016	12016	0	11987	11988	0	

[A, C] Total of the subzonal feasible CRRs disaggregated by subzone using subzonal weights

[B, E] CRRs feasible only to subzones.

[C] B - A

[F] E - D

[G] Average hourly congestion relative to reference bus.

Appendix K
GENERAL OVERVIEW OF OPERATING CONSTRAINTS, OUTAGES AND CONTINGENCY ANALYSIS FOR CRR STUDY 2

In the “CRR Study 2 Final Scenario Assumptions” document, the CAISO indicated that it would investigate the use of constraints and contingencies in the simultaneous feasibility test and would explain the methodology for calculating the constraints used in CRR Study 2. The general methodology for calculating the constraints is described below, along with a description of how outages were determined. Information concerning the CAISO’s investigation of the use of contingency analysis is also mentioned.

Background

CRR Study 2 is comprised of two studies – CRR allocation market runs and the determination of locational marginal prices (LMP Study 3B). These two studies dovetail in CRR Study 2 and provide an indication of not only the quantity of CRRs that might clear under MRTU but also the extent to which these CRRs offer a financial hedge against congestion charges in the Day Ahead market. The 2006 full network model (FNM) used for the study is based on the WECC 2006 Grid Planning Model.

Operating Constraints

A key step necessary for conducting CRR Study 2 was to determine the operating constraint definitions and limits to use in the Study. This section describes how the definitions were determined and the process and assumptions for establishing the operating constraint limits for running the markets that make up the Study.

Operating Constraint Definitions

The ISO tried to be consistent with LMP Study 3b when conducting the CRR Study. For this reason, consistency between the operating constraint definitions for the LMP Study and CRR Study was maintained.

Operating Constraint Limits

Operating constraints can be broken down into two categories – individual line limits and generalized group constraint limits. These constraints are described below.

Individual Line Limits

The individual line limits are established for transmission lines and transformers. These thermally based limits include two types – one for normal operations and the other for emergency conditions.

The normal operating limits that were used in LMP Study 3b were also used when conducting market runs for CRR Study 2. These limits are constant and do not vary by season or time of use period (i.e., peak, off-peak). The Summer thermal limits are used for CRR Study 2 because they are more conservative than the Winter thermal limits.

For CRR Study 2, the CRR software enforced individual line limits for all transmission lines and transformers where the voltage on both ends equaled or exceeded 115 kV. This is consistent with the way line limits were handled in LMP Study 3b.

Generalized Group Constraint Limits

The second category of operating constraints – generalized group constraints – can be broken down into two subgroups. These subgroups include branch groups and nomograms.

Branch Groups

A branch group consists of single or multiple transmission lines and transformers having a single aggregate limit. The limit established for the branch group is set to prevent not only thermal overloads, but also other adverse system conditions including voltage collapse and transient instability.

For CRR Study 2, the starting point to determine the branch group limits was a review of the limits used for the LMP Study. Since the LMP Study utilized a one-hour time step, constraint limits could vary by hour if desired. However, for purposes of CRR allocations in CRR Study 2, a single constraint limit had to be determined that would serve as the limit for the entire one-month term of the CRR by time-of-use.

Southern PTOs. For those branch groups associated with the transmission turned over to the CAISO by the Southern Participating Transmission Owners, but which lie outside of the CAISO control area, the CAISO did not enforce any of these constraint values and only monitored them. No market participant, other than the converted rights holders, requested CRRs on this transmission outside of the CAISO control area.

Non-Variable Constraint Limits. Some branch group limits were constant for every month and time-of-use period. These non-variable constraint limits were consistent with the non-variable limits used in the LMP Study.

Variable Constraint Limits. Some constraint limits used in the Study varied by month and time-of-use period. As a starting point to determine these constraint values, the CAISO reviewed the historical operating transfer capability (OTC) for each branch group over the time period November 2002 through October 2003. OTC data for Nov 2002 and Dec 2002 were analyzed and related to Nov 2003 and Dec 2003. The CAISO derived a total of 24 different sets of variable OTC constraint values. For the majority of these constraints, the CAISO reviewed the OTC values over each month and time-of-use period and developed a duration curve. The value used for the constraint limit was the limit that fell into the 50 to 60 percent segment of the duration curve. Specifically the hourly average OTC MW value for each month and TOU of the OTC duration curve were analyzed, and the constraint limit chosen was equal to the value which, for 50%-60% of the time, the value is equal to or greater than this limit. This range of time was chosen because it is the significant range where this condition would occur.

The limits on some constraints were changed to reflect the 2006 conditions. For example, for Path15 upgrade, the historical hourly OTC MW flow limit on this path in a South to North direction was increased by 1,500 MW to reflect the path rating upgrade.

Nomograms

The second subgroup of generalized group constraints is the nomogram. Nomograms consider multiple system parameters simultaneously and may represent complex relationships between these parameters. This complexity must be modeled using the flow weighted sum as shown below in the equation. Due to the software that was utilized in the Study, nomograms are limited to a representation of weighted MW flows as shown below:

$$\sum_i \alpha_i F_i \leq \text{Limit}^{1},$$

where α_i is a flow weighting factor and F_i is the MW value of flow

For purposes of the Study, the CRR Team reviewed the ISO Operating Procedures and determined how best to represent each nomogram. The CRR Study 2 Team worked with CAISO operating engineers to derive appropriate branch limits based upon certain assumptions concerning system operations.

Outages

For the long-term market runs, all lines in the full network model were assumed to be in service. This base case topology was based on the 2006 FNM and was consistent with the same model used in LMP Study 3B. However, for the short-term market runs, the ISO considered line outages. Taking certain lines out of service before conducting the market runs is intended to minimize the chance of over-allocating CRRs using capacity in the transmission system that may not exist, thus resulting in possible revenue inadequacy problems. On the other hand, assuming too many lines will be out of service in order to be conservative can result in an insufficient number of CRRs

[1] In actual use, the parameters used in the nomograms are generally generation, load and flow. Other parameters that may be used are voltage and inertia.

allocated to Market Participants, resulting in lost opportunities for congestion hedging. This section describes the process used by the ISO to determine which transmission lines and transformers to take out of service for the short-term market runs.

The starting point for determining which lines to outage was to review all of the outages identified in LMP Study 3B. These outages were ones that occurred in the year 2003. Only outages at 230 kV and above were considered. CAISO staff then carefully reviewed each line outage and noted the duration of these outages by month. Unlike LMP Study 3B, with a one-hour time step and the opportunity to outage different lines on an hourly basis, the CRR Study requires the determination of a single set of line outages for each month for the short-term market runs.

For purposes of the short-term runs, it was decided that lines would be outaged in the full network model if they were out of service for greater than or equal to 11 days during any month in 2003. This criteria did not require the out-of-service days to be consecutive. This 11-day criteria, although somewhat subjective, considers a reasonable number of assumed line outages in the opinion of ISO staff.

If the outaged line was not part of a generalized branch group, the line was simply taken out of service in the full network model. If the outaged line was part of a generalized branch group, then the line was taken out of the full network model and the limit of the generalized branch group was reduced appropriately to reflect the missing line. Operating Procedures were used to determine the proper impact to the constraint limit.

Contingency Analysis

Contingency analysis considers system impacts when specific transmission lines are outaged. The software used to run the CRR Studies has the capability to conduct such an analysis. The CAISO considered whether contingency analysis was appropriate as a part of the market runs. After discussions with CAISO operating engineers, a decision was made against the use of contingency analysis. The main reason for this decision is that many contingencies involve the use of remedial action schemes (RAS) that cannot be properly modeled by the CRR software. Furthermore, the constraints that were used have in general, already taken contingencies into consideration as previously discussed.

Attachment F

California Independent System Operator

CRR Study 2
Addendum

Prepared by
Scott M. Harvey and Susan L. Pope

LECG

Table of Contents

CRR Study 2
Addendum

Scott M. Harvey and Susan L. Pope[1]

I. INTRODUCTION

II. OUT-OF-CONTROL AREA LOAD CRR ALLOCATION

To help stakeholders assess the implications of awarding CRRs through the CRR allocation process to entities serving load external to the CAISO control area, the CAISO analyzed an additional sensitivity case to CRR Study 2. For this analysis, the CAISO requested CRR nominations from loads external to the ISO control area that seek to receive CRRs through the allocation process rather than purchasing them in CRR auctions. These CRR nominations by external loads were included in reruns of the base case CRR allocation process, using the same CRR nominations submitted for CRR Study 2 by LSEs internal to the CAISO control area. The allocation process was carried out only for Scenarios IV, V and VI, the scenarios permitting CRRs to be sourced at the trading hub.

Table 68 shows that the award of CRRs to external loads slightly increased the number of CRRs awarded to LSEs serving load internal to the CAISO. This result implies that the CRRs awarded to external LSEs provided counterflow over constraints that were binding in the CRR allocation process.

[1] Scott Harvey is a director with LECG. Susan Pope is a principal with LECG. Dmitri Perekhodstev, Daniel Basoli and Joel Niamien provided research assistance in the preparation of this report.

Table 68
Base Case Proration Ratio Metric with Out-of-Control Area Load CRRs
Awarded MW/Nominated MW for Internal LSEs

	Scenario IV[1] (D)	Scenario V[2] (E)	Scenario VI[3] (F)
Internal Load Only	Trading Hubs		
Base Case – Annual Allocation			
Average – All LSEs & LAPs	83.73%	49.45%	77.81%
Low LSE	50.00%	20.79%	44.63%
High LSE	98.82%	69.14%	97.85%
Out-of-Control Area Load Alternative 1 -			
Base Case -- Annual Allocation[4]			
Average – All LSEs & LAPs	85.71%	57.65%	85.78%
Low LSE	50.00%	21.00%	50.00%
High LSE	98.82%	69.89%	97.85%
Out-of-Control Area Load Alternative 2 –			
Base Case -- Annual Allocation[5]			
Average – All LSEs & LAPs	85.09%	48.74%	79.91%
Low LSE	50.00%	20.94%	50.00%
High LSE	98.82%	69.99%	97.85%

[1] CVR and TOR are options.

[2] All CRRs are options.

[3] ETC reservations modeled as options.

[4] Participants were permitted to nominate CRRs sinking outside of the CAISO control area. The nomination upper bound was based on the 0.5% duration curve of the participants' usage of the ISO grid

[5] Participants were permitted to nominate CRRs sinking outside of the CAISO control area. The nomination upper bound was based on the participants' average usage of the ISO grid

Table 69 shows that the award of CRRs to external loads also very slightly increased the value of the CRRs awarded to LSEs internal to the CAISO control area in Scenarios IV and VI.

Table 69
Base Case Proration Ratio Metric with Out-of-Control Area Load CRRs
Awarded Value/Nominated Value for Internal LSEs

	Scenario IV[1] (D)	Scenario V[2] (E)	Scenario VI[3] (F)
Internal Load Only		Trading Hubs	
Base Case – Annual Allocation			
Average – All LSEs & LAPs	89.60%	72.80%	80.91%
Low LSE	39.08%	23.45%	27.23%
High LSE	99.11%	84.99%	98.97%
Out-of-Control Area Load Alternative 1 -			
Base Case -- Annual Allocation[4]			
Average – All LSEs & LAPs	89.75%	57.65%	85.78%
Low LSE	49.16%	21.74%	33.79%
High LSE	98.83%	85.22%	99.35%
Out-of-Control Area Load Alternative 2 –			
Base Case -- Annual Allocation[5]			
Average – All LSEs & LAPs	89.94%	58.83%	84.76%
Low LSE	45.67%	22.11%	30.80%
High LSE	98.83%	84.99%	98.97%

[1] CVR and TOR are options.
[2] All CRRs are options.
[3] ETC reservations modeled as options.
[4] Participants were permitted to nominate CRRs sinking outside of the CAISO control area. The nomination upper bound was based on the 0.5% duration curve of the participants' usage of the ISO grid
[5] Participants were permitted to nominate CRRs sinking outside of the CAISO control area. The nomination upper bound was based on the participants' average usage of the ISO grid

These results reflect the fact that the particular CRRs requested by the external loads in CRR Study 2 provided counterflow on constraints that were binding in the allocation of CRRs to LSEs. The inclusion of these counterflow CRRs awarded to external LSEs allowed the award of additional CRRs to CAISO LSEs. Table 70 shows the value of the CRRs awarded to internal and external LSEs. The CRRs awarded to external loads are positively valued in aggregate.

Table 70
Congestion Rent and CRR Valuation:
Original Base Case Compared to Out-of-Control Area Load

	Scenario IV[1] Base Case (A)	Scenario IV[1] Out-of-Control Area Load Alternative 1[4] (B)	Scenario IV[1] Out-of-Control Area Load Alternative 2[5] (C)	Scenario V[2] Base Case (D)	Scenario V[2] Out-of-Control Area Load Alternative 1[4] (E)	Scenario V[2] Out-of-Control Area Load Alternative 2[5] (F)	Scenario VI[3] Base Case (G)	Scenario VI[3] Out-of-Control Area Load Alternative 1[4] (H)	Scenario VI[3] Out-of-Control Area Load Alternative 2[5] (I)
Congestion Rent (100%)	$150,987,086	$150,987,086	$150,987,086	$150,987,086	$150,987,086	$150,987,086	$150,987,086	$150,987,086	$150,987,086
Congestion Rent (75%)	$113,240,314	$113,240,314	$113,240,314	$113,240,314	$113,240,314	$113,240,314	$113,240,314	$113,240,314	$113,240,314
Annual CRR Values									
Internal LSEs	$116,740,964	$116,906,449	$117,113,509	$103,143,177	$101,101,815	$102,685,478	$111,121,681	$116,457,863	$115,341,837
External LSEs	-	$657,623	$351,225	-	$485,539	$307,742	-	$670,646	$361,407
All LSEs	$116,740,964	$117,564,072	$117,464,734	$103,143,177	$101,587,354	$102,993,220	$111,121,681	$117,128,509	$115,703,245

1 CVR and TOR are options.
2 All CRRs are options.
3 ETC reservations modeled as options.
4 Participants were permitted to nominate CRRs sinking outside of the CAISO control area. The nomination upper bound was based on the 0.5% duration curve of the
5 Participants were permitted to nominate CRRs sinking outside of the CAISO control area. The nomination upper bound was based on the participants' average usage of the ISO grid

The increase in the value of the CRRs awarded to internal CRRs reflects a mixture of negatively and positively valued CRRs. In many months, the value of the additional CRRs awarded was negative for internal LSEs and positive for external or vice versa, as shown in Table 71.

Table 71
Out-of-Control Area Load, Alternative 1, Scenario II

Month	Peak	Incremental CRRs Awarded to Internal LSEs, MW	CRRs Awarded to External LSEs, MW	Incremental Value of CRRs Awarded to Internal LSEs	Value of CRRs Awarded to External LSEs
1	0	451	143	11,401	1,094
1	1	578	532	-4,273	1,635
2	0	119	117	38	1,892
2	1	737	495	77,865	12,762
3	0	379	117	6,913	16,009
3	1	-79	491	-5,392	108,905
4	0	424	112	38,036	1,770
4	1	462	406	48,357	-3,037
5	0	165	126	-63	2,065
5	1	790	479	50,490	-3,240
6	0	370	182	191,369	3,521
6	1	336	654	40,962	-18,486
7	0	407	214	25,477	-4,676
7	1	1,239	537	-218,152	272,625
8	0	562	187	19,505	398
8	1	916	554	-125,299	38,122
9	0	452	201	51,745	1,853
9	1	839	461	-82,574	62,636
10	0	464	134	11,063	19,145
10	1	71	506	2,449	89,978
11	0	93	126	1,319	-3,714
11	1	91	554	26,754	48,112
12	0	107	134	422	372
12	1	647	541	-2,927	7,881

In some months, most of the value of the CRRs awarded to external loads was attributable to CRRs that do not appear to provide counterflow but are simply on constraints not fully allocated to internal LSEs.

III. ADDITIONAL TABLES

The discussion in stakeholder meetings since the Final CRR Study 2 Report was released have suggested that a number of additional tabulations based on the CRR Study 2 results might be helpful to stakeholders in assessing alternative approaches to CRR allocation.

First, in view of the consideration of tiering mechanisms for CRR allocation, it may be helpful for stakeholders to review data on the proration ratios in each tier of the CRR Study 2 annual CRR allocation. These ratios are reported in Tables 72 and 73 for Scenario I. Table 72 shows that the megawatt proration ratios are very high on average for priority 1 and 2 awards for either the base case or Sensitivity 5, exceeding 90%. Proration of CRR awards due to transmission constraints increased markedly for Priority 3, with the average proration ratio falling and some LSEs having very low proration ratios.

Table 72
Scenario I[1] Proration Ratio Metric by Priority
Awarded MV/Nominated MV

Awarded MW/Nominated MW				
	Priority 1	Priority 2	Priority 3	Priority 4
Base Case – Annual Allocation				
Average – All LSEs & LAPs	97.90%	93.86%	81.24%	74.85%
Low LSE	95.87%	77.22%	13.89%	0.00%
High LSE	100.00%	100.00%	100.00%	97.13%
Sensitivity Case 5 - Annual Allocation[2]				
Average – All LSEs & LAPs	97.89%	92.61%	71.40%	60.82%
Low LSE	95.84%	72.63%	7.35%	0.00%
High LSE	100.00%	100.00%	100.00%	91.91%

[1] CVR and TOR are options.
[2] Simultaneous feasibility test applied at LAP level.

Table 73
Scenario I[1] Proration Ratio Metric by Priority
Awarded Value/Nominated Value

	Priority 1	Priority 2	Priority 3	Priority 4
Base Case – Annual Allocation				
Average – All LSEs & LAPs	98.99%	94.70%	80.96%	68.96%
Low LSE	98.52%	58.47%	-57.56%	0.00%
High LSE	100.00%	104.74%	105.51%	329.69%
Sensitivity Case 5 - Annual Allocation[2]				
Average – All LSEs & LAPs	98.99%	94.27%	69.41%	58.66%
Low LSE	98.52%	57.40%	-56.10%	0.00%
High LSE	100.00%	104.01%	117.55%	709.01%

[1] CVR and TOR are options.
[2] Simultaneous feasibility test applied at LAP level.

Similar data are reported for Scenario IV in Table 74, which shows generally the same pattern.

Table 74
Scenario IV[1] Proration Ratio Metric by Priority
Awarded MW/Nominated MW

	Priority 1	Priority 2	Priority 3	Priority 4
Base Case – Annual Allocation				
Average – All LSEs & LAPs	98.38%	94.40%	76.39%	64.51%
Low LSE	97.05%	80.12%	0.00%	0.00%
High LSE	100.00%	100.00%	98.58%	98.26%
Sensitivity Case 5 - Annual[2]				
Average – All LSEs & LAPs	98.38%	93.58%	69.22%	58.31%
Low LSE	97.03%	80.12%	0.00%	0.00%
High LSE	100.00%	100.00%	100.00%	98.26%

[1] CVR and TOR are options.
[2] Simultaneous feasibility test applied at LAP level.

These annual data can potentially mask differences in monthly proration outcomes, so monthly priority specific proration ratios are reported in Table 75.

Table 75
Scenario I Proration Ratio Metric by Priority, Month and Time of Use
Base Case Annual Allocation LSE CRRs Sinking at LAPs
Awarded MW/Nominated MW

Month	Time of Use	Priority 1	Priority 2	Priority 3	Priority 4
January	Off-Peak	100.00%	86.66%	55.85%	85.53%
February	Off-Peak	98.37%	88.17%	69.71%	79.24%
March	Off-Peak	100.00%	86.27%	72.23%	78.70%
April	Off-Peak	99.24%	86.61%	75.01%	85.10%
May	Off-Peak	97.27%	93.47%	81.70%	73.28%
June	Off-Peak	96.29%	97.46%	63.36%	78.71%
July	Off-Peak	95.10%	90.51%	73.91%	59.03%
August	Off-Peak	96.54%	95.18%	72.65%	61.22%
September	Off-Peak	92.35%	89.57%	63.12%	79.64%
October	Off-Peak	100.00%	96.13%	78.54%	79.62%
November	Off-Peak	96.03%	85.44%	83.49%	73.14%
December	Off-Peak	96.05%	87.23%	72.27%	84.64%
January	On-Peak	100.00%	96.94%	88.92%	84.63%
February	On-Peak	100.00%	96.85%	89.28%	76.72%
March	On-Peak	100.00%	100.00%	99.77%	92.85%
April	On-Peak	100.00%	99.98%	97.66%	87.01%
May	On-Peak	99.94%	97.17%	92.47%	71.57%
June	On-Peak	97.96%	99.51%	81.71%	64.47%
July	On-Peak	97.52%	97.39%	93.94%	48.80%
August	On-Peak	97.56%	93.88%	64.84%	50.72%
September	On-Peak	95.49%	94.24%	91.96%	48.89%
October	On-Peak	98.70%	91.07%	95.08%	66.35%
November	On-Peak	99.69%	97.30%	94.98%	91.55%
December	On-Peak	100.00%	98.31%	91.45%	87.25%

Second, a number of stakeholders have requested information regarding the relative level of congestion rents and loss charges in LMP Study 3b. The total marginal loss charges for the LMP Study 3b period were $405,884,273. These charges were calculated as the product of the net injections at each pricing location times the marginal cost of losses at that location. The cost of losses was $291,189,429. The cost of losses was calculated as the difference between gross injections (generation) and gross withdrawals (load) times the price at the reference bus. The loss residual simulated in LMP Study 3b was therefore $114,694,844, compared to total congestion rents of $150,987,086.[2] It is noteworthy that the ratio of actual losses to marginal loss charges was considerably above the 50% level.

As discussed in CRR Study 2, the prices and congestion rents simulated in LMP Study 3b are a simulation of a particular outcome based on historical bid data and a particular methodology. Actual realizations may be substantially different. Indeed, the congestion hedges provided by CRRs are important precisely because the level of congestion costs can be hard to predict and actual congestion costs in any day, month or year may differ substantially from the expected level.

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2 These figures are calculated for the same subset of hours analyzed in CRR Study 2 so the figures are comparable. A small number of hours are excluded as discussed in CRR Study 2 (see Section VII.B.4, p. 57).

IV. ERRATA

A few typos or calculation errors have been identified in tables in the final report "CRR Study 2: Evaluation of Alternative CRR Allocation Rules," dated August 24, 2005. First, four LSEs were not correctly accounted for in the megawatt-based proration ratio calculations of one or both of the option scenarios (II and V). These errors affected the values reported in Tables 47, 50 and 53. The impact of these errors was to understate the level of proration applied to the CRR nominations of these LSEs. The error had very little impact on the average proration ratio but overstated the range of proration outcomes portrayed in Table 47. Corrected tables are included as Tables 47R, 50R and 53R.

Table 47R
Proration Ratio Metric (November 2002-October 2003)
Awarded MW/Nominated MW

	Scenario I[1] (A)	Scenario II[2] (B)	Scenario III[3] (C)	Scenario IV[1] (D)	Scenario V[2] (E)	Scenario VI[3] (F)
	No Trading Hubs			Trading Hubs		
Base Case – Annual and Monthly Allocation[4]						
Average – All LSEs & LAPs	83.53%	35.89%	76.19%	81.49%	36.75%	76.17%
Low LSE	43.90%	9.69%	35.03%	27.27%	13.45%	27.51%
High LSE	98.48%	68.03%	94.35%	98.67%	74.05%	96.69%
Base Case – Annual and Monthly Allocation[5]						
Average – All LSEs & LAPs	90.98%	49.24%	86.20%	90.96%	50.13%	88.28%
Low LSE	60.43%	15.88%	50.95%	37.50%	21.45%	37.75%
High LSE	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Base Case – Annual Allocation						
Average – All LSEs & LAPs	87.45%	48.25%	81.69%	83.73%	49.45%	77.81%
Low LSE	49.35%	16.52%	39.57%	50.00%	20.79%	44.63%
High LSE	99.28%	78.15%	99.00%	98.82%	69.14%	97.85%
Sensitivity Case 5 - Annual Allocation[6]						
Average – All LSEs & LAPs	81.49%	48.82%	74.82%	80.23%	49.55%	72.05%
Low LSE	44.99%	17.46%	34.82%	50.00%	22.10%	39.12%
High LSE	97.98%	83.44%	97.71%	96.81%	65.67%	94.65%
Sensitivity Case 7 – Annual Allocation[7]						
Average – All LSEs & LAPs	87.45%	48.25%	81.69%	83.73%	49.45%	77.81%
Low LSE	49.35%	16.52%	39.57%	50.00%	20.79%	44.63%
High LSE	99.28%	78.15%	99.00%	98.82%	69.14%	97.85%

[1] CVR and TOR are options.
[2] All CRRs are options.
[3] ETC reservations modeled as options.
[4] Proration ratio is calculated as (MW of annual and monthly awards)/(MW of annual and monthly nominations)
[5] Proration ratio is calculated as (MW of annual and monthly awards)/(MW of annual awards and monthly nominations)
[6] Simultaneous feasibility test applied at LAP level.
[7] CRR awards valued at subzone prices for the subzone to which they are feasible.

Table 50R
Scenario II LSE-LAP Specific Equity Measures
Base Case Annual and Monthly CRR Allocation

LSE-LAP	Value Based Proration Ratio (%)[1]	Value Based Proration Ratio Adjusted (%)[2]	MW Based Proration Ratio (%)[3]	MW Based Proration Ratio Adjusted (%)[4]	CRR Value per MW ($)[5]
A2	84.36%	91.31%	47.66%	60.53%	4,485
B2	65.46%	98.51%	65.03%	66.19%	7,572
C2	61.48%	100.00%	62.36%	100.00%	4,452
D2	60.54%	72.86%	50.51%	60.74%	2,062
E2	53.07%	100.00%	51.56%	100.00%	5,007
F2	51.27%	60.89%	49.69%	65.84%	4,959
G2	51.09%	85.51%	48.78%	81.37%	9,939
H2	50.84%	64.55%	48.27%	62.97%	2,022
I2	48.19%	61.88%	51.47%	54.52%	3,701
J2	47.39%	59.59%	42.04%	56.02%	3,997
K2	45.99%	53.67%	51.12%	64.25%	267
L2	41.99%	46.47%	49.68%	68.16%	3,204
M2	41.39%	51.17%	46.99%	60.30%	1,352
N2	40.45%	100.00%	36.77%	100.00%	979
O2	40.13%	42.62%	27.96%	29.20%	1,401
P2	39.03%	52.38%	36.87%	50.26%	2,313
Q2	37.86%	50.27%	38.63%	49.51%	2,656
R2	37.77%	51.98%	39.63%	53.66%	787
S2	37.03%	51.13%	42.61%	54.56%	1,272
T2	36.44%	50.09%	36.44%	50.09%	0
U2	35.07%	36.40%	55.16%	64.72%	1,089
V2	33.84%	49.03%	31.70%	46.82%	3,022
W2	32.06%	46.67%	29.57%	45.19%	1,485
X2	28.53%	40.98%	26.30%	40.19%	869
Y2	27.83%	43.10%	40.54%	58.34%	718
Z2	25.25%	27.27%	68.03%	77.64%	451
AA2	24.52%	33.91%	30.24%	35.66%	1,762
AB2	20.76%	40.78%	32.85%	60.68%	282
AC2	19.56%	28.68%	26.54%	37.58%	823
AD2	14.43%	22.98%	9.69%	15.88%	369

[1] Dollar value of annual and monthly CRR awards per dollar value of annual and monthly CRR nominations (%)

[2] Dollar value of annual and monthly CRR awards per dollar value of annual CRR awards and monthly CRR nominations (%)

[3] MW of annual and monthly CRR awards per MW of annual and monthly CRR nominations (%)

[4] MW of annual and monthly CRR awards per MW of annual CRR awards and MW of monthly CRR nominations (%)

[5] Dollar value of annual and monthly CRR awards per MW of LSE peak load in 2003 ($)

Different LSE identifier codes have been assigned to each LSE in Tables 49 through 54.

Table 53R
Scenario V LSE-LAP Specific Equity Measures
Base Case Annual and Monthly CRR Allocation

LSE-LAP	Value Based Proration Ratio (%)[1]	Value Based Proration Ratio Adjusted (%)[2]	MW Based Proration Ratio (%)[3]	MW Based Proration Ratio Adjusted (%)[4]	CRR Value per MW ($)[5]
A5	76.14%	86.56%	44.67%	57.76%	3,830
B5	68.81%	77.17%	52.79%	70.86%	2,155
C5	66.56%	98.90%	74.05%	98.69%	3,920
D5	66.20%	100.00%	66.73%	100.00%	4,793
E5	64.04%	84.30%	45.39%	58.94%	3,331
F5	60.76%	72.97%	50.48%	60.88%	2,070
G5	57.42%	100.00%	56.66%	100.00%	5,417
H5	51.31%	62.97%	44.15%	57.95%	4,019
I5	46.54%	61.17%	52.55%	66.67%	3,664
J5	46.30%	55.19%	29.16%	31.97%	583
K5	45.58%	59.97%	48.76%	63.09%	2,185
L5	45.30%	55.64%	55.62%	72.76%	1,505
M5	44.34%	66.25%	48.94%	69.03%	1,019
N5	41.62%	100.00%	39.50%	100.00%	1,007
O5	40.21%	42.93%	55.49%	67.64%	2,878
P5	39.59%	52.84%	37.79%	51.11%	2,333
Q5	38.57%	51.94%	41.58%	53.14%	2,760
R5	38.48%	44.16%	53.97%	67.24%	2,103
S5	37.11%	50.75%	42.79%	54.88%	1,294
T5	36.21%	61.10%	34.08%	51.49%	1,255
U5	35.51%	52.41%	36.35%	50.79%	844
V5	35.19%	44.44%	49.47%	62.02%	1,174
W5	30.49%	48.61%	29.75%	44.75%	704
X5	29.02%	55.87%	43.95%	63.16%	565
Y5	24.56%	30.00%	55.67%	71.19%	724
Z5	24.48%	33.76%	30.81%	40.04%	1,758
AA5	22.34%	31.93%	22.34%	31.93%	0
AB5	20.91%	43.69%	32.57%	60.30%	277
AC5	19.50%	28.67%	25.92%	36.71%	818
AD5	17.27%	27.29%	13.45%	21.45%	440

[1] Dollar value of annual and monthly CRR awards per dollar value of annual and monthly CRR nominations (%)
[2] Dollar value of annual and monthly CRR awards per dollar value of annual CRR awards and monthly CRR nominations (%)
[3] MW of annual and monthly CRR awards per MW of annual and monthly CRR nominations (%)
[4] MW of annual and monthly CRR awards per MW of annual CRR awards and MW of monthly CRR nominations (%)
[5] Dollar value of annual and monthly CRR awards per MW of LSE peak load in 2003 ($)
Different LSE identifier codes have been assigned to each LSE in Tables 49 through 54.

Second, a review of the calculations underlying Table 58 determined that the original calculations did not always correctly dispatch generation using the CRRs to meet load in the hypothetical dispatch. In most cases, the corrected ratios are not materially different than those originally reported, however, in the case of three LSEs – A-7, P-7 and T-7 – the correction resulted in substantial quantities of negatively valued CRRs not being dispatched to meet load, significantly reducing counterflow payments in the hypothetical dispatch and reducing the calculated hedge ratio. The corrected table is included as Table 58R. Table 58R also includes the hedge ratio for one LSE that was omitted from the original table.

Table 58R
CRR – Congestion Charge Ratio

	Hedge Ratio[1]
LSE A7	-449.01%
LSE B7	94.57%
LSE C7	92.46%
LSE D7	101.19%
LSE E7	105.24%
LSE F7	103.84%
LSE G7	126.76%
LSE H7	108.42%
LSE I7	122.43%
LSE J7	100.00%
LSE K7	100.00%
LSE L7	100.00%
LSE M7	111.12%
LSE N7	100.20%
LSE O7	99.92%
LSE P7	51.52%
LSE Q7	103.12%
LSE R7	100.30%
LSE S7	100.72%
LSE T7	64.07%
LSE U7	98.89%
LSE V7	100.08%
LSE W7	100.00%
LSE X7	100.46%
LSE Y7	100.00%
LSE Z7	100.00%
LSE AA7	100.00%
LSE AB7	100.00%
LSE AC7	101.59%
LSE AD7	100.00%

[1] CRR payment/hypothetical congestion charges.