

Opinion on Congestion Revenue Rights Auction Efficiency, Track 1B

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1. Introduction and Summary of Recommendations

1.1 Background

The California Independent System Operator (CAISO) has proposed major revisions to its process for auctioning Congestion Revenue Rights (CRRs) preceding its auction of annual CRRs to be held in July 2018.¹ As we discussed in our Opinion on the Track 1A proposal,² the proposal follows a year-long exploration of several concerns with the California CRR system as it is currently constructed. The CAISO and its Department of Market Monitoring (DMM) have highlighted, in particular, the fact that CRRs have, on average, sold at auction prices substantially below the value of the revenue streams associated with them. From 2009 through 2017, payouts to auctioned CRRs have exceeded \$1.4 billion while auction revenues for those CRRs was just over \$740 million, a difference of close to \$700 million.³

The DMM and some load-serving entities (LSEs), who are the residual claimants on congestion revenues if they were not sold at auction, have characterized the auctions as unwilling sales of future revenue streams that are fated to be sold below value due to fundamental flaws in the CRR process. At the same time, CRRs have long been held to be useful, if not

¹ Track 1A proposals are documented in: California ISO, “Congestion Revenue Rights Auction Efficiency, Track 1 Draft Final Proposal,” February 8, 2018, www.caiso.com/Documents/DraftFinalProposal-CongestionRevenueRightsAuctionEfficiency-Track1.pdf, and its Addendum, March 8, 2018, www.caiso.com/Documents/DraftFinalProposalAddendum-CongestionRevenueRightsAuctionEfficiency-Track1.pdf. Track 1B proposals, which are the focus of this Opinion, are contained in: California ISO, “Congestion Revenue Rights Auction Efficiency, Track 1B Draft Final Proposal,” May 11, 2018, www.caiso.com/Documents/DraftFinalProposal-CongestionRevenueRightsAuctionEfficiencyTrack1B.pdf and its Addendum, May 25, 2018, www.caiso.com/Documents/DraftFinalProposalAddendum-CongestionRevenueRightsAuctionEfficiencyTrack1B.pdf.

² J. Bushnell, S. Harvey, and B.F. Hobbs, CAISO Market Surveillance Committee, “Opinion on Congestion Revenue Rights Auction Efficiency,” March 15, 2018.

³ “Problems in the performance and design of the congestion revenue right auction,” CAISO Department of Market Monitoring, November 27, 2017.

critical, instruments for hedging the risk of congestion prices in transmission networks. The development of the paradigm of financial transmission rights (or CRRs) was a fundamental step in shifting US power markets away from inefficient physical transmission rights as a means of providing open access to transmission systems. If significant value is placed upon CRRs as a hedging tool, especially by parties who do not receive allocated CRRs, then market design changes that eliminate or substantially reduce access to them raise potential concerns about market efficiency and competitiveness.

The CAISO Track 1A and 1B proposals attempt to balance these concerns with those of DMM and the investor-owned utilities who have argued that CRRs sales are costing their ratepayers an average of about \$75 million per year. The Track 1A proposal would alter outage reporting and make other process changes, and would also restrict the types of CRRs available for auction by limiting the sources and sinks of the CRRs that would be eligible for sale in the auction. These changes would alter the amounts and types of CRRs that then would be eligible for settlements in the integrated forward market (IFM). The Track 1B proposal instead addresses the CRR settlements. Presently, CRRs are fully funded, in that CRRs are settled for their MW amount times the difference in the congestion component between the sink and source of the CRR, without regard to congestion rent collections. Track 1B would eliminate the assurance of full funding by reducing payments on binding transmission constraints if the target CRR payout for individual constraints exceeds the congestion rents collected in the day-ahead market (i.e., where the net flows implied by the awarded CRRs exceed the net day-ahead market flows on the constraint). This limitation on CRR payouts would guarantee revenue adequacy (congestion revenues being sufficient to cover CRR payouts), and if payouts are reduced more (in dollar terms) than CRR auction revenues, then the gap between CRR payouts and auction revenues will be reduced.

While the Track 1B proposals were originally motivated by an initiative directed at auction revenue shortfalls, it is important to recognize the 1B is addressing related, but distinct issues from those raised with the auction. Stakeholder concerns about the auction center around the perception that existing transmission capacity is being sold at prices lower than its ex-post valuation. In other words, the auction shortfall amounts to selling an asset at a discount. The revenue inadequacy problem equates to selling an asset that doesn't actually exist. While auction revenue shortfalls do not, of themselves, require uplift payments, revenue inadequacy does. Importantly, it is possible that a significant share, possibly a majority, of the revenue inadequacy arises from allocated, rather than auctioned CRRs. Therefore, these issues require attention regardless of the status of the auction.

The CAISO Market Surveillance Committee (MSC) has been asked by the CAISO to provide an Opinion on the Track 1B proposal. Previous to the recent discussions of CRR auction issues, the MSC wrote several opinions on CRR auctions and allocation as a part of the MRTU design process.⁴ Recently, the causes of shortfalls in the CAISO's CRR auctions along with possible remedies have been previously discussed at three MSC meetings. These include

⁴ See Track 1A Opinion, Footnote 5 for a summary of those opinions.

meetings on Feb. 3, 2017, when the MSC discussed possible analyses to understand the reasons for the revenue shortfalls and to quantify the uses of auctioned CRRs for hedging and trading purposes;⁵ and Feb. 2, 2018, when the CAISO's Track 1A proposal was first publicly discussed. During the April 5, 2018 meeting, the CAISO presented its Track 1B proposal, and MSC members discussed several technical, institutional, and legal issues associated with alternative proposals for reform. Examples of those issues included outage modeling, the need in some proposals for exact matches of locations between bids and offers of CRRs, and potentially weak incentives for regulated owners of congestion revenue rights to sell them to market parties who might value them more.

1.2 Summary of Recommendations

In this subsection, we summarize our major conclusions from our previous Opinion on the CAISO's Track 1A proposal together with our recommendations on Track 1B, which are detailed in the following sections of this Opinion.

In our Opinion on the CAISO's Track 1A proposal, we expressed support for continuing the ISO's role as a provider of CRRs backed by congestion revenues through allocation and auction processes. This provision of rights is an important component of the open transmission access that underlies organized electricity markets. We do not support the elimination of the auction of CRRs that are backed by network capability that remains after the free allocation of allowances to load serving entities. We also supported the proposed changes to the CRR auction, stating that we believed that they were likely to reduce the auction revenue shortfall without substantially harming market efficiency. The changes would also provide some evidence of how auction modifications impact the relationship between auction value and CRR payouts. However, we anticipated that further changes will be necessary, such as those considered in Track 1B and, eventually, in Track 2. Whatever further changes are made should continue to support the ability of small and non-LSEs to access a market for ISO-backed CRRs.

In the Opinion on Track 1A, we made four specific suggestions, and we reiterate here our support for them. First, we recommended that a wider range of alternatives for reducing the difference between CRR auction prices and expected day-ahead market payouts be considered. One alternative should include establishing a minimum price or per unit fee for auctioned CRRs. Our second suggestion was that careful analyses be made of potential CRR auction revenues relative to payouts, categorized by source-sink pair, under alternative auction designs for the 2014-2017 period. Third, we recommended that the CAISO analyze the extent to which there is a general under-valuation of hedging CRRs in CAISO markets, rather than simply a low valuation of CRRs that have little value as congestion hedges. The final suggestion was that, as the Track 1 changes are implemented, the CAISO should assess the extent to which these changes have been effective in reducing the payout to CRRs whose shift factors and day-ahead market payouts are inflated by outages, and consider

⁵ S. Harvey, Briefing on Analyzing Congestion Revenue Rights Auction Valuation, MSC Meeting, February 3, 2017, www.caiso.com/Documents/BriefingonAnalyzingCongestionRevenueRightsAuctionValuation-MSCHarvey-Feb2017.pdf

whether changes in the way CRRs are settled might contribute to improved outcomes. The Track 1B proposal that we address in this Opinion represents such a change in settlements.

In this Opinion, we first summarize the issues that the CAISO is addressing in the tracks of its CRR initiative (Section 2). Then in Section 3 we summarize the specific objectives of Track 1B's modifications of CRR settlements and possible design options (Section 3.1), and then make recommendations on those options (Section 3.2). In Section 4, we discuss additional CRR auction options that are not the subject of Track 1B, but should be considered in Track 2. In the remainder of this section, we summarize the major recommendations contained in those sections.

First, we acknowledge the goal of shifting the cost consequences of revenue inadequacy away from transmission ratepayers to CRR holders. It is reasonable, and consistent with the policies of some other ISOs, to reduce CRR payments when congestion charges in the day-ahead market are inadequate to fully fund the target payments to CRR holders. Going forward, we recommend that the CAISO explore the option of allocating some of these shortfalls to the owners of the transmission experiencing the outages. We also note that there are important trade-offs to the targeting of payment reductions among CRR holders.

Second, targeting reductions, as the CAISO proposes, to CRRs that hold rights on constraints that become infeasible in market runs will allocate the burden of transmission outages to holders of rights on those specific constraints. We expect this would be relatively more effective at deterring strategies to acquire CRRs designed to receive inflated payments in the day-ahead market than would a policy that would share the CRR payout reductions proportionally across all CRRs. However, the proposed CAISO approach also increases the uncertainty of CRR payouts and would degrade the congestion hedging value of all CRRs distributed via an auction or allocation process. In the absence of simulation analysis of the impacts of the proposed changes on past CRRs, we are unable to determine how significant this degradation could be. The inclusion of guardrails against extreme outcomes would be helpful, but these guardrails would not preclude substantial reductions in the hedging value of CRRs. Stronger guardrail measures would better preserve the hedging value of CRRs but would also undermine the goal of reducing the payouts to CRRs designed to receive inflated payouts in the day-ahead market. We also recommend that the CAISO be prepared to change its CRR shortfall allocation strategy if signs emerge that this approach is significantly degrading the value of all CRRs

Lastly, we continue to recommend that the CAISO explore other options that directly target the auction revenue shortfall, including a minimum sale price for CRRs in the auction and a reduction of the quantity of CRRs sold in the annual and monthly auctions. We therefore support the ISO's proposal⁶ to reduce to 65% the amount of system capacity released in the annual allocation and auction process.

⁶ CAISO, "Congestion Revenue Rights Auction Efficiency Track 1B Draft Final Proposal Second Addendum", June 11, 2018, www.caiso.com/Documents/DraftFinalProposalSecondAddendum-CongestionRevenueRightsAuctionEfficiencyTrack1B.pdf

2. Summary of Identified Issues with CRRs and the CRR Auction

There are several sets of issues that have been identified by the CAISO as needing attention. These include reporting of outages (addressed in part in Tracks 0 and 1A); design of the CRR auction, such as what network information is made available to bidders and what bus pairs can be bid for (the latter being the focus of Track 1A); settlements of CRRs, including whether they will be fully funded and, if not, how payments will be reduced (the subject of Track 1B); and other issues, such as the possibility of making PTOs explicitly responsible fully or partially for revenue inadequacies (deferred to Track 2). In this section, we first review general issues associated with the purposes of CRRs, the implications of those purposes for full funding of CRRs, and how much and which types should be made available in auctions (Section 2.1). In Section 2.2, we discuss the relationship of the problems of revenue inadequacy (when CRR payouts exceed congestion revenues in the day-ahead market) and auction revenue shortfalls (when those payouts exceed CRR auction revenues); they share some common causes and therefore measures aimed at correcting one may help with the other. The CAISO history of very high revenue inadequacy (well in excess of that experienced at other ISOs, in percentage terms) suggests that addressing the causes of that problem might also help correct the auction revenue shortfall issue.

2.1 General Issues

As we noted in our previous opinion on Congestion Revenue Rights, CRRs were envisioned as a means to provide the financial equivalent of firm transmission service, in the sense that they entitle the holder to use of the transmission network without paying congestion charges.⁷ We interpret the principal role of CRRs as providing physical network users with a longer-horizon ability to access an ISO/RTO network at a predetermined cost. However, we do not agree with the position that open access requires all possible source and sink pairs be made available as CRRs. Physical transmission rights were not generally awarded between nodes that were not physically consistent with the supply and consumption of power. Physical transmission rights could only be used to support the physical delivery of power from a generator to load. This was intrinsic in the physical nature of these transmission rights.

We also disagree with the view that the short-term nondiscriminatory access provided by ISOs through their day-ahead markets or market-based real-time dispatch is sufficient to provide open access to the transmission grid. Limiting open access to participation in the day-ahead market or real-time market-based dispatch would not provide a mechanism for entities other than the transmission provider to enter into forward contracts that would be hedged against future changes in congestion costs. The reliability, efficiency, and competitiveness of wholesale power markets is dependent upon robust, and ideally liquid, forward

⁷ FERC "Order Conditionally Accepting Tariff and Market Rules..." Docket Nos ER97-1523-000; OA97-470-000 and ER97-4234-000, January 27, 1999 86 FERC ¶61,062, footnote 13, page 6. The FERC's primary concern with TCCs in that order was the absence of rights longer than six months. The NYISO subsequently revised its proposal to include auctions of both 6 month and longer-term TCCs.

trading. Financial transmission rights, such as the CAISO's CRRs, therefore fill an important role bridging the gap between the daily open access provided by the CAISO short-term markets and the ability of both load serving entities, and those they contract with, to participate in forward markets and be able to hedge the congestion costs associated with forward contracts. Enabling load serving entities to enter into forward contracts with a wide variety of potential suppliers, not just the transmission provider or the transmission provider's load-serving affiliate, at a variety of trading points is important both for load serving entities to have access to competitive supply options and to be able to hedge the cost of serving their retail load against uncertain future market prices.

Given our belief that (congestion revenue backed) CRRs are important for supporting electricity forward markets, an additional question is whether an auction that limits the capacity backed by congestion revenues to the levels awarded in the allocation phase would be sufficient. This approach has been called the "willing-buyer, willing-seller" (WB-WS) framework.⁸ We agree with the CAISO management position that this approach would be overly restrictive for several reasons. First, as we noted in our previous opinion, this approach effectively freezes the set of CRRs for a given period to be those established in the allocation process. However, the allocation process was not designed to be a stand-alone mechanism for distributing congestion revenue-backed CRRs. The allocation process places restrictions on what types of CRRs can be awarded to which firms. One implication of this is that some types of CRRs (such as those that source at generator nodes and sink at trading hubs) cannot be defined in the allocation process. If the sale of CRRs in the auction is limited to those feasible based on the transfer capability of CRRs awarded in the allocation process, a firm cannot willingly sell CRRs that would use transfer capability not assigned in the allocation process because CRRs using that transfer capability could not be designated in the allocation process. Second, even though regulated LSEs that currently receive the bulk of the CRRs awarded in the allocation process may be willing to sell certain CRRs, they may be unable to or discouraged from doing so because of their regulatory oversight, even if the value of those CRRs to others is greater than their value to the regulated LSE. Third, CRRs that could be awarded in the allocation process may not be allocated if LSEs eligible for such an allocation cannot foresee the need of suppliers for particular hedges. Fourth, it cannot be taken for granted that the regulated LSEs who receive the bulk of the CRRs awarded in the allocation process would be willing sellers of CRRs that could be used to facilitate sales to CCAs competing for the retail load of the regulated LSEs. Both DMM and the LSEs have noted the complicated set of incentives created by the regulatory authority that can discourage participation by regulated LSEs in the auction.

There remain difficult tradeoffs between the goal of enabling the sale of CRRs in an auction process in order to support forward trading, and the goal of minimizing the costs that a poorly functioning auction may impose on transmission customers (mostly load within the CAISO) that pay the embedded cost of the transmission system. In our previous opinion,

⁸ DMM Proposal, Market Alternatives to the Congestion Revenue Rights Auction, November 27, 2017. www.caiso.com/Documents/DMMWhitePaper-Market_Alternatives_CongestionRevenueRightsAuction-Nov27_2017.pdf; SCE Proposal, www.caiso.com/Documents/SCEComments-CRR AuctionAnalysisReport.pdf, posted on December 11, 2017.

we explained how the CAISO – and indirectly transmission ratepayers who are the ultimate claimants to congestion revenues – are in a unique position to sell CRRs in a way that reduces risk. This is because the CAISO (and transmission ratepayers) are collecting an uncertain stream of congestion payments, and by selling CRRs that are unelected in the allocation process, they can convert uncertain systemwide congestion revenues into a predetermined auction payment. Thus, the selling of unallocated CRRs that do not match the positions of LSEs does not increase risk to ratepayers.⁹ If the CRRs awarded in the allocation process and sold in the auction are revenue adequate, then the CAISO (and its ratepayers) are assured that the settlements for those CRRs are consistent with and do not exceed the congestion payments received in settling the day-ahead market. In contrast, financial firms are not in a position to offer the equivalent of CRRs without increasing their risk. This is why we view access to CAISO (e.g., transmission ratepayer backed) CRRs to be important for all market participants. We are not confident that third parties stand ready to provide equivalent instruments at reasonable prices.

However, the ability of an ISO to sell CRRs without taking on additional risk is limited by the feasibility of the network capacity underlying those CRRs. If the set of CRRs that has been distributed has become revenue inadequate, for any of the reasons described below, then the CAISO has taken on an obligation to distribute more congestion revenues than it is actually collecting. This places it in a position similar to other purely financial providers of CRRs. We view the spirit of the current CAISO proposal in this light. The spirit of open access argues for distributing CRRs whose payout can be supported by the congestion rents collected in the day-ahead market, but not for selling CRRs whose payout would require funding from more network capacity than actually exists.

Because of the dynamic nature of the transmission network, it is extremely difficult to anticipate what transfer capability will or will not be feasible months or years in advance. The network and its available transfer capability changes constantly because of, e.g., upgrades, forced outages, maintenance, loopflows, and dynamic ratings in response to weather and modelled contingencies. This variability over time in the available transfer capability forces a trade-off between providing high-quality forward access (via CRRs) and limiting the risk exposure of transmission ratepayers who are currently the residual claimants to those CRR payments. In general, the tradeoff can be resolved either by releasing relatively fewer, high quality (e.g., firm) CRRs, or by releasing relatively more CRRs but followed by ex-post adjustments to their payouts in the event they become infeasible, thereby decreasing the quality of the CRRs.

⁹ This point applies to CRRs that do not match the physical transactions of LSEs. The allocation process is intended to allow LSEs to elect and acquire those CRRs that match their physical transactions; meanwhile, the auction was intended as a means for distributing capacity that remains unused after the allocation process and as a mechanism for realignment of allocated CRRs. We note that the allocation process itself creates incentives for LSEs to target high-payout CRRs over CRRs that match their physical position and could be contributing to a sub-optimal disposition of CRRs. Concerns such as these motivated the restrictions on the allocation process discussed above. We strongly recommend that a Track 2 process on CRRs take a holistic look at the efficiency of both the allocation and auction process.

In addition to the “quantity vs. quality” tradeoff described in the previous paragraph, the CAISO Track 1B proposal raises another question about the role of CRRs: what kinds of risks are they intended to hedge? Should CRRs be designed in a way that provides a hedge only against nodal price fluctuations, or should it also provide some hedge against uncertainty in the transfer capability of the network itself? By proposing in Track 1B to reduce payments to CRRs that hedge congestion on specific constraints, the CAISO is limiting CRRs to provide a hedge only to the extent the congestion charges are hedged by the transfer capability of the available transmission network. The proposal raises questions about the proper disposition of risk in the network itself. As we discuss below, we believe there is an argument for distributing that risk more broadly amongst both CRR holders and the Transmission Owners.

2.2 Revenue Inadequacy

CRR revenue inadequacy, often referred to as congestion rent shortfalls, is a distinct concept from auction revenue shortfalls. Revenue inadequacy concerns whether the congestion rents collected by the CAISO in settling the day-ahead market are sufficient to cover the payments due to CRR holders without drawing upon other sources of revenue to fund the payments. On the other hand, auction revenue shortfalls concern whether auction prices appropriately value the payments made to CRRs sold in the annual and monthly auction process.

While CRR revenue inadequacy and auction revenue shortfalls are distinct concepts, there is a potential for them to be related if some of the factors that contribute to high levels of CRR revenue inadequacy also contribute to auction revenue shortfalls.

Under the assumptions applied in the mathematical formulations of LMP pricing the day-ahead market congestion rents would be sufficient to fully fund payments to CRR holders.¹⁰ In actual electricity markets, however, there are a variety of factors that contribute to congestion rent shortfalls in the day-ahead market. These factors include differences between the CRR auction model and the day-ahead market model relating to the network model,¹¹ the modeling of transmission outages or deratings, dynamic line ratings as a function of weather, constraints and contingencies that are enforced or modeled, loopflows, load weights used for zonal load modeling, loss flows, and phase angle regulator (PAR) schedules. Congestion rent shortfalls can also arise from the solution methods for the market

¹⁰ See for example, W.W. Hogan, "Contract Networks for Electric Power Transmission," *Journal of Regulatory Economics*, September 1992, Vol. 4(3); W.W. Hogan, "Financial Transmission Right Formulations," March 31, 2002.

¹¹ Including constraints that are not modeled because it is assumed congestion will be managed through line switching but give rise to congestion rent shortfalls when they must be managed through out-of-merit generation dispatch.

model, such as shift factor truncation and market solutions that have not fully converged to the actual optimum.¹²

These are not problems that are unique to CRR systems, as analogies to congestion rent shortfalls exist in traditional physical transmission right systems. In physical systems, factors such as transmission outages, deratings, loopflows, changes in PAR flows and other differences between the grid model used to analyze the award of firm transmission service and real-time flows could lead to the curtailment of firm transmission service by the transmission provider or could require the transmission provider to provide out of market dispatch to support the provision of firm transmission service.

It was anticipated in implementing LMP electricity markets that these congestion rent shortfalls would be a minor factor. This has proved to not necessarily be the case. The level of revenue inadequacy depends in part on the factors contributing to congestion rent shortfalls described above and also in part on the proportion of the transfer capability of the transmission system that is made available to transmission customers through CRR allocation and auction processes.

The proportion of the transfer capability of the transmission system that is made available to transmission customers through CRR allocation and auction processes is to a large degree controlled by the CAISO, through its decisions regarding the flow limits enforced and outages modeled in the allocation and auction simultaneous feasibility test. However, the transfer capability needed to support payments to awarded CRRs is also partially a function of the source and sink nominations in the CRR allocation and auction processes. There is a potential for transmission customers to nominate (in an allocation process) or purchase (in an auction process) CRR source-sink pairs that do not reflect the actual use of the transmission system in the day-ahead market or in real-time operations but are instead designed to create additional entitlements to CRRs on constraints that may bind in the day-ahead market. These designations can magnify the target payout to CRR holders,¹³ while not providing congestion hedges for day-ahead market transactions that would be valuable to suppliers, traders or load serving entities.

Congestion rent shortfalls in the California ISOs day-ahead market have been relatively large, averaging a little under \$141 million a year over the period 2014 through 2017.

¹² See for example, Scott Harvey, "Sources of Congestion Rent Shortfalls in the Day-Ahead Market, California ISO, Market Surveillance Committee, October 15, 2014. California ISO, CRR Auction Analysis Report, November 21, 2017 pp 43-44. Due to the need for timely solutions, a finite "MIP" (mixed integer programming) gap is necessarily present in the market solution as is incomplete iteration in AC power flow solutions. Finally, a potentially important new source of network changes will arise if dispatching transmission (line switching) is implemented as part of the market scheduling process, as is being considered by some other ISOs. (E.B. Fisher, R.P. O'Neill, and M.C. Ferris, "Optimal transmission switching," *IEEE Transactions on Power Systems*, 23(3), 2008, 1346-1355. At least two ISOs are undertaking tests of the feasibility and benefits of including transmission switching as an option in market software.)

¹³ "Target payout" is defined as the payout that would be made if the rights were fully funded.

Day-ahead congestion rents averaged slightly less than 69% of the target CRR payout over this period, despite the fact that the California ISO releases only 75% of transmission system transfer capability in the annual auction and allocation process, and the available capacity is capped at 82.5% in the monthly allocation and auction process (with less potentially released depending on what outages are modeled in the monthly auction).¹⁴

The levels of revenue inadequacy experienced by the CAISO are much higher, at least on a percentage basis, than other ISOs experience. In the New York ISO, in contrast to the CAISO, day-ahead market congestion rents averaged slightly over 88% of the target TCC (CRR) payout over the period 2012-2016, despite the decision of New York transmission owners to generally not model outages in TCC auctions.¹⁵ Day-ahead market congestion rents have been around 100% of the target FTR payout in MISO and PJM in recent years, in part reflecting the conservative assumptions made in making capacity available in their auctions.¹⁶

It is likely that one reason for the high congestion rent shortfalls in the California ISO has been the failure of the California ISO to model many constraints that bound in the day-ahead market in either the monthly or annual auction and allocation process.¹⁷ If a constraint is not modeled in the auction, there is a potential for the CRR flows on the constraint to exceed the transfer capability that will be available in the day-ahead market, leading to target CRR payouts that exceed congestion rent collections in the day-ahead market. It is also possible that the high level of congestion rent shortfalls is in part due to the auction of non-delivery CRRs that receive inflated CRR payments in the day-ahead market if the non-delivery CRRs were selected for purchase because they would be impacted by outages that would increase their shift factor on binding constraints in the day-ahead market.

The Track 0 changes proposed by the CAISO will tend to reduce congestion rent shortfalls, and likely improve CRR auction valuation by improving the modeling of transmission outages or deratings, constraints enforced or modeled, and loopflows in the auction model. The Track 1A changes proposed by the CAISO are also intended to reduce congestion rent shortfalls, and likely improve CRR auction valuation by reducing the award of non-delivery CRR source-sink pairs that magnify payouts to CRR holders relative to the auction valuation and also contribute to congestion rent shortfalls.

¹⁴ California ISO, CRR Auction Analysis Report, November 21, 2017 pp. 44-45; California ISO, Congestion Revenue Rights Auction Efficiency, Track 1B Draft Final Proposal Addendum, May 25, 2018 pp. 17-22

¹⁵ See Potomac Economics, "State of the Market Report for the New York ISO Markets, 2016," May 2017, Figure 8, p. 38; ____, "State of the Market Report for the New York ISO Markets, 2014," May 2015, Figure 9, p. 37; and ____, "State of the Market Report for the New York ISO Markets, 2013," May 2014, Figure 10, p. 38.

¹⁶ See Monitoring Analytics, "2016 State of the Market Report for PJM," Table 13-37, p. 561; Potomac Economics, "2016 State of the Market Report for the MISO Electricity Market," June 2017, Figure A83, p. 89.

¹⁷ This can be seen in the discussion in Section 7 of the California ISO's "CRR Auction Analysis Report" (November 21, 2017, Tables 7, 11, 15, 19, 23, 27, 31, 35, 39, 43, www.caiso.com/Documents/CRR Auction Analysis Report.pdf). These tables only show the CRR payouts to auctioned CRRs so do not show the impact of payouts to allocated CRRs on constraints that were not enforced in the allocation process.

We believe that that Track 1B changes will also further reduce congestion revenue shortfalls. In particular, the past high level of congestion rent shortfalls in the CAISO has the implication that the proration of CRR payments proposed by the California ISO in Track 1B could materially reduce the value of CRRs as a congestion hedge if the California ISO Track 0 and Track 1A reforms do not materially improve the relationship between the target level of CRR payouts and congestion rent collections. An average 69% funding level implies the potential for some CRR holders to receive an even lower level of payments on the particular CRRs they hold.

Of course, by lowering the value of the hedge, the willingness to pay for those hedges, as expressed by bids in the CRR auction, and in turn auction revenues, would also decrease. Nevertheless, the reduction in payouts resulting from the Track 1B proposal would also likely tend to lower the payout deficit by decreasing payouts more than CRR auction revenues are reduced for CRRs sold at very low auction prices, as the auction revenues from these CRR sales are already relatively small compared to the expected payout. However, if the potential reduction in payouts materially reduces the hedging value of CRRs sold at higher prices in the auction, the auction revenues from the sale of these CRRs might possibly fall more than the reduction in the expected payout. There has not been enough analysis of auction results carried out for us to make an assessment of the likely overall impacts. The proration would also reduce the value of the hedges assigned to load serving entities at zero cost in the allocation process.

3. The CAISO Track 1B Proposal: Overview and Discussion

3.1 Overview

As the Track 1B proposal explains, all other ISOs, except the NYISO and (for CRRs involving a resource node) ERCOT, payments to all CRRs are reduced by the same proportion if there is revenue inadequacy. The NYISO takes a different approach by fully funding CRRs like the CAISO, but allocating revenue shortfalls to transmission owners (PTOs) rather than to CAISO load and exports. As described in Section 3.2, below, allocating a portion of the congestion rent shortfalls to PTOs responsible for outages that cause the shortfalls is believed to provide an incentive to manage transmission outages to minimize congestion costs. In ERCOT, CRRs involving one or more resource nodes have their payments trimmed on a constraint-by-constraint basis, broadly similar to the approach proposed by the CAISO in Track 1B, summarized below. Other ERCOT rights, however, have their payments proportionally reduced, as in most other ISOs.

Thus, in its Track 1B proposal, the CAISO proposes to switch from its present unique system of fully funding CRRs by charging any revenue shortfalls to load, to a system of adjusting payments to all CRRs on a constraint-by-constraint basis, which resembles aspects of ERCOT's system. In particular, the CAISO proposes to reduce payments to CRR holders based on their constraint effectiveness (i.e., flows implied by the CRR source/sink pair using the day-ahead shift factors) for those transmission constraints that are responsible for congestion revenue shortfalls. These are the constraints for which the total flow (net of

counterflow) implied by the full set of allocated and auctioned CRRs is more than the constraint for those constraints that were binding and had a nonzero shadow price in the day-ahead solution.

There are several specific design features that have to be decided upon in implementing a CRR settlement system that reduces payouts when there is revenue inadequacy:

1. *To what extent should CRRs be fully or partially funded? If revenue inadequacy is allowed to persist (as would be the case under full funding), should consumers or transmission owners make up the difference?*
2. *Should payouts be reduced on a constraint-by-constraint basis or by the same proportion for all CRRs in the market (or by the same proportion within each service territory or other zonal definition)?* Track 1B, as mentioned, opts for the former.
3. *Should allocated and auctioned rights be treated consistently or differently, for instance by only subjecting auctioned rights to payment reduction, or calculating payment reductions separately for each class?* Track 1B recommends the former.
4. *Over what time period should revenue surpluses and shortfalls be cumulated so that shortfalls in one subperiod can be compensated by surpluses in others? This could be as short as a settlement interval, the entire day-ahead market, a month (as proposed by the Track 1B draft final proposal), or a much longer period, such as a season or year.*
5. *Should reductions in payouts be calculated ex post (after running the markets, based on the realized LMPs and payouts), or ex ante (before running the markets, by reducing CRRs on constraints that are oversubscribed, in terms of CRR net flows relative to the magnitude of the constraint)?* In Track 1B, the CAISO recommends that, like all other ISOs, an ex post system be used.
6. *Should rights in the direction of prevailing flow be treated differently than rights in the counterflow direction?* Prevailing flow rights are CRRs whose flows on the day-ahead market transmission grid would exacerbate congestion on a given constraint and result in higher payments, if the constraint is binding and has a non-zero shadow price. Other ISOs generally treat prevailing flow and counterflow rights symmetrically, but the ISO in Track 1B proposes to only prorate payments to prevailing flow CRRs.
7. *If a constraint-by-constraint approach to CRR payment proration is adopted, should constraints be aggregated prior to calculation of curtailments of payouts, and should CRRs be aggregated by CRR holder before that calculation? Should constraints be placed on the overall change in CRR payouts?* Various aggregations of constraints and CRRs could change which CRRs are subject to payout reduction, and lower the magnitude of those reductions. Also, if revised payouts (based on constraint-by-constraint calculations) for particular CRRs are judged unreasonable (e.g., changing a positive payout to a negative payout, or increasing a positive payout beyond the target), they could be subjected to adjustments after the calculation. The proposal does not propose any such aggregation or adjustments of CRR payouts.

In the next subsection, we make recommendations for each of the design features with respect to a number of design objectives. In evaluating alternatives for those design features,

the ISO considered the first three of the following objectives. The additional five objectives might also be viewed as important, and are implied by some of the stakeholder comments.

1. *Potential to equitably allocate revenue shortfalls.* By reducing payouts to CRRs with target payouts that exceed the congestion rents collected in the day-ahead market, the ISO hopes to reduce inflated payouts to CRRs that target constraints that are not modeled in the allocation/auction process or with payouts that are inflated by differences between auction and day-ahead market shift factors.¹⁸ In addition, by eliminating the socialization of outage costs across the CAISO transmission system, the Track 1B design may incent the PTOs to better minimize the cost of transmission outages within their service territory. On the other hand, “socialization” of revenue inadequacies by reducing all payouts proportionally would dilute that incentive, and could result in cross-subsidies of some regions or classes of market parties by others. These cross-subsidies could be viewed as an acceptable pooling of the risk of individual transmission outages--or as an unacceptable reward for the acquisition (via auction or allocation) of a particular CRR with high ex post pay outs.
2. *Potential to improve auction efficiency* (reduce the amount by which payouts exceed auction revenues). By reducing payouts, as long as auction revenues are not reduced dollar-for-dollar, auction efficiency with respect to the relationship between CRR auction value and expected payouts may be improved. But alternatives that make returns less predictable, for example because of their complexity, would be expected to reduce CRR bidder willingness to pay (and thus auction revenues) perhaps by more than reduction in CRR payouts. For instance, asymmetric treatment of prevailing flow vs counterflow might result in more unpredictability of payouts to a particular right, and so depress auction prices proportionally more than the diminishment in payouts. As another example, constraint-by-constraint reductions of payouts would likely increase uncertainty of payouts, and thus might reduce auction revenues by an amount greater than the payout reduction for all CRRs.¹⁹
3. *Implementable in time for 2019 congestion revenue rights settlement.* This objective would preclude implementation of approaches that would prorate payments prior to the day-ahead market, which could instead be considered in Track 2.
4. *Minimization of curtailment of CRRs.* If this is an objective, then complete preservation of counterflow rights (as in the ISO’s Track 1B addendum) could result in an

¹⁸ This feature of Track 1B supplements the Track 0 and Track 1A changes intended to address these inflated payouts. To the extent that the Track 0 and Track 1A reforms are effective, less proration of CRR payments will be required. However, it may not be feasible to model all day-ahead market constraints on an auction grid with a different configuration. Also, the limitation of CRRs to delivery pairs will likely not completely eliminate the ability of allocation and auction participants to acquire CRRs targeting constraints not modeled in the auction or receiving inflated payments in the day-ahead market due to differences between allocation/auction and day-ahead market shift factors. The Track 1B changes would provide an additional limit on excess payouts due to inflated shift factors or auction flows in excess of the day-ahead market transmission limit.

¹⁹ A proportional reduction in payouts and auction revenues will reduce the payout gap, because the latter are smaller; so it is possible that even if the proportional reduction in auction revenues is greater than in payouts, the gap may be reduced.

ability to accommodate more prevailing flow rights. However, asymmetric settlement of prevailing flow and counterflow CRRs would have the outcome that prevailing flow CRRs would have an expected value that would be less than the expected cost of the corresponding counterflow CRR, which could drastically reduce or eliminate the sale of pure counterflow CRRs in the auction,²⁰ and might reduce the willingness of market participants to hold CRRs with any material counterflow impacts on potential day-ahead market constraints. This objective would also potentially be in conflict with the second objective above.

5. *Simplicity of implementation and predictability of payout outcomes.* The constraint-by-constraint approach is less attractive by this objective than the proportional payout (socialization) approach.
6. *Preservation of the hedging value of CRRs.* The constraint-by-constraint approach will likely result in lower and more variable payouts relative to congestion charges than would an approach based on socialization of payout reductions (proportional reduction of all rights). Lower and more variable payouts relative to congestion charges, all else being equal, mean less effective hedges. Because the CAISO has not carried out any simulations of the overall impact of the 1B proration design on CRR settlements, we cannot assess the magnitude of these impacts.
7. *Maximization of liquidity of CRR secondary markets.* This would argue in favor of symmetric treatment of allocated and auctioned rights, so that they could be traded on a 1:1 basis, without uncertainty about their relative payouts. This objective also supports symmetric treatment of prevailing flow and counterflow rights. For instance, with symmetric treatment, A to B rights would have the opposite payout of B to A rights, so that if a market party wanted to zero out a position, it could buy equal amounts of opposing rights and be assured of zero net payout; this would not be the case for asymmetric treatment.
8. *Avoid anomalous changes in CRR payouts.* These could include the following. Because the CAISO has not carried out any simulations of the application of the 1B design to historical auction and allocation rights, we cannot assess the likelihood of these outcomes.
 - a. *Avoid increasing payouts to any CRR with a positive payout.* If negative payouts (i.e., payment obligation for a counterflow) are curtailed in a constraint-by-constraint system, it is then possible for the revised net payment to increase beyond the target for some CRRs receiving positive payments. That is, they would be paid more than the congestion component difference times the MW quantity of the right. This is viewed by some stakeholders as a priori undesirable because it

²⁰It is not clear that this should be a material concern given the overall low valuation of CRRs in the CAISO auctions. CAISO data shows that CRR auction valuation is in aggregate well below the CRR payout. Market participants would not offer to buy counterflow CRRs at a price that was materially less than the expected payout. However, it is not known how general the under-valuation of CRRs acquired as hedges is. For example, no analysis has been carried out comparing the value of allocated CRRs at monthly auction prices to the payout on those CRRs.

increases rather than reduces the hedge and exacerbates revenue inadequacies.²¹

- b. *Avoid reducing payments due from a CRR such that a CRR with a negative target payout receives a positive CRR payment.* This outcome is a possibility if payments due from a CRR providing counterflow were prorated down but the payments received by the CRR on other constraints were not prorated down.
- c. *Avoid reducing payments to a CRR with a positive target payout to such an extent that the CRR holder is required to make a payment to the CAISO.* This outcome is a possibility if a CRR had both prevailing flow and counterflow impacts on constraints that bound in the day-ahead market and the payments due to the CRR for the prevailing flow impacts were prorated down while the counterflow charges were not.²² While the impact of this kind of anomaly would likely average out for the large regulated LSEs holding many CRRs from many sources to the relevant DLAP or CLAP, these impacts might not average out for smaller LSEs holding CRRs on a limited number of paths.

These objectives can be in conflict. The ISO's proposal constraint-by-constraint proposal in which only prevailing flow rights are curtailed can be viewed as emphasizing the first four objectives at the expense of the latter four. On the other hand, some stakeholders who are concerned with predictability, simplicity, preservation of hedging values, and maximization of liquidity tend to prefer simple constant proportion-based proration of payments to all CRRs. Other stakeholders are focused on reducing the gap between payouts and auction revenues, and recommend elimination of the auction of ISO-backed rights altogether.

In the following subsections, we discuss some of our recommendations concerning choices in the design of the Track 1B CRR settlement, based on these objectives. In Section 4, we consider other possible reforms to the CRR process as well, especially assigning responsibility for revenue shortfalls and full funding of CRRs.

²¹ Appendix, "Comments of Pacific Gas & Electric Company Congestion Revenue Rights Auction Efficiency, Track 1B, Draft Final Proposal," www.caiso.com/Documents/PG_EComments-CongestionRevenueRightsAuctionEfficiencyDraftFinalProposalTrack1B.pdf. For instance, in a constraint-by-constraint calculation, consider a CRR that on net has a positive target payout which is the net effect of a positive flow on binding constraint and a counterflow on another. It could experience either of the following effects. If, on one hand, the second constraint is oversubscribed, then the counterflow's payment obligation could be reduced, increasing the net payout to the CRR to more than the target. If on the other hand, the first constraint is oversubscribed, then the positive portion of the CRR payout might be reduced so far that the counterflow payment obligation winds up being bigger in magnitude, changing the overall CRR payout from positive to negative.

²² This is not the same as the situation in which a CRR that is expected to receive a payment has a negative value in the day-ahead market. When the target value of the CRR in the day-ahead market reverses from what the owner of the right expected, the nodal pricing-based charge for the underlying transaction also reverses so there is not impact on entities using the CRR as a hedge. However, in the case considered here in which the payout is changed from the target value, the CRR holder still has to pay congestion charges, but not only is it not hedged against those congestion charges, it has to pay for counterflow impacts of the CRR. There is no analogy to this outcome with physical transmission rights. While the holder of a physical transmission right could have its right curtailed, it would not also be charged for failing to provide the counterflow.

Ideally, conclusions concerning the impacts and desirability of design choices would be based on in-depth analysis using multiple years of CRR auction results to explore the effects on hedging value, distribution of impacts among various market parties, and possible unintended effects. As we recommended in our Opinion on Track 1A, such analyses are also desirable to better understand the impacts of alternative auction designs as well, such as a minimum fee or price on CRRs. Any such simulations would be limited by their inability to represent how bidding behavior in the CRR auction would change, and thus would present an incomplete picture of changes in payouts minus auction revenues. Nevertheless, such simulations would help build understanding of the possible direction and magnitude of effects and the potential for unintended consequences. Thus, our conclusions in this Opinion about the impact of the Track 1B proposal are necessarily limited by our lack of insight into the likelihood or potential magnitude of some of the potential effects.

3.2 Discussion of Design Alternatives

3.2.1 To what extent should CRRs be fully or partially funded? If revenue inadequacy is allowed to persist, should consumers or transmission owners make up the difference?

We support, as an interim measure, eliminating full funding of CRRs in favor of partial funding, consistent with what most ISOs do. The magnitude of revenue inadequacy in the CAISO, as well as the persistent gap between payouts and auction revenues, both need to be reduced. Some MSC members believe that partial funding will go some way towards doing so.

However, eliminating full funding necessarily reduces the value of CRRs as a hedge. Moreover, the application of constraint-by-constraint payment proration has the potential to introduce a great deal of uncertainty into the value of CRRs as congestion hedges. Because the CAISO has not been able to carry out simulations of the impact of the Track 1B design on CRR payouts, we cannot assess the magnitude of the likely reduction in hedging value.

We hope that it will be possible to restore full funding if the fundamental problems can be resolved that have led to the large revenue inadequacies and payout-auction revenue gap. The reforms of Tracks 0 and 1A are intended to address part of those problems. We also believe that a design that makes PTO shareholders and rate payers responsible for congestion revenue shortfalls due to transmission outages the PTO schedules (analogous to the NYISO design), rather than socializing these costs over all CAISO load, will also be helpful, as we discuss below. Finally, use of shift factors for the auction's network model to settle congestion revenue rights, rather than the shift factors from the day-ahead market, could also significantly reduce revenue inadequacy due to network changes, although such a design change would also reduce the hedging value of CRRs.

We now further discuss the possibility of assigning responsibility for congestion revenue inadequacy to PTOs. Even though this is not possible to implement in time for the 2019 CRR auctions, it is a possibility that should begin to be considered now and then considered fully in the Track 2 process. Its implementation would mean that the Track 1B partial funding proposal would represent only a temporary suspension of full funding.

While the CAISO controls the degree to which transmission outages and deratings are modeled in the seasonal and monthly CRR allocation process, the duration and scheduling of transmission outages and deratings is primarily determined by the responsible transmission owner. There is a potential to reduce congestion rent shortfalls by providing stronger incentives for transmission owners to incur costs in order to carry out transmission maintenance on a faster time line or to be more flexible by adjusting schedules of work on short notice to take advantage of favorable weather and load conditions. This would be a long-range change that could not be implemented in the time frame of the Track 0, 1A or 1B changes. However, it has a potential to somewhat decrease congestion due to outages, thereby reducing hedging risks and improving system efficiency. Furthermore, an added benefit of lowered congestion is that CRR payouts would be reduced, potentially reducing the extent to which payouts exceed auction revenues.

The New York ISO implemented a design in 2004 that allocates congestion rent shortfalls in the day-ahead market to the responsible transmission owner.²³ These outage costs are passed through to transmission customers in the FERC transmission access charge. However, the rate design for retail customers served by the state jurisdictional load serving entities can provide incentives for the transmission owners to attempt to minimize outage costs. The allocation process also identifies the source of large congestion rent shortfalls, potentially allowing the cause to be addressed or the impact reduced in future periods. There is no public data or analysis available to confirm that these incentives have reduced congestion and shortfalls. Nevertheless, there is anecdotal evidence that this is the case in the NYISO, and their stakeholders have been sufficiently satisfied with the results such that there have been no changes made in the design over the past decade.²⁴

Any improvement in outage duration or timing would benefit ratepayers. But any such improvements would unlikely to be so large as to eliminate most of the high level of congestion rent shortfalls in the CAISO. Since this transmission outage cost design has been in operation in the New York ISO for almost 15 years, it has proven to be a workable design, but as explained above it would be a long-term change and would not eliminate the need to implement the Track 0 and Track 1A changes. As noted above, a secondary impact of the Track 1B constraint-by-constraint proration of CRR payments would be that it would eliminate the socialization of outage costs across the CAISO transmission grid and tend to assign outage costs to entities serving load within the territory of each PTO, which might incent the PTOs to reduce outage costs.

²³ See New York ISO March 17, 2006 filing in Docket ER06-769; October 16, 2003 filing in Docket ER04-54; NYISO OATT, Attachment N.

²⁴ Some changes were made in 2006 in the original design that was implemented in 2004. The 2006 changes in part reflected process improvements developed through the initial application of the design. In addition, the implementation of the design in 2004 led almost immediately to the identification of data base and auction implementation errors that were contributing materially to congestion rent shortfalls in the NYISO settlements and the 2006 filing include tariff changes needed to account for how these errors were handled.

An alternative approach to full funding of CRRs would be a partial funding system that would have PTOs pay only some portion of the of the congestion revenue shortfalls due to network outages, while curtailing CRRs to make up for the rest. This would then retain incentives (albeit diluted) to the TSO better manage outages, but also would lessen the impact of CRR bidders in the auction who are targeting for speculation reasons the acquisition of low-priced CRRs on constraints that may be subject to outages.

3.2.2 Should payouts be reduced on a constraint-by-constraint basis or by the same proportion for all CRRs in the market?

Although we generally support the idea of diminishing incentives for CRR holders to acquire CRRs that target constraints that are not modeled or would receive inflated payments when outages are modeled in the day-ahead market, we are concerned that constraint-by-constraint reduction of payouts could significantly erode the hedging value of CRRs. Absent simulations of the payout consequences of constraint-by-constraint basis, we are unable to assess its impact on the hedging role of CRRs and also may not be able to identify potential unintended effects. Since Track 1B is intended to be potentially interim in nature, pending possible Track 2 reforms, we believe that proportional payout reduction for all CRRs (so-called “socialization”) because of its simplicity, would produce less unpredictable but possibly less desirable results. Ideally, changes as complex as the current 1B proposal would be accompanied by substantial quantitative analysis that can provide stakeholders with a more complete picture of the expected impacts. It appears that such analysis will not be possible until Track 2 changes are considered. As we discuss below, the addition of guardrails that limit the magnitude of the clawback paid by any individual CRR is an alternative to socialization to at least partially bound the uncertainty.

3.2.3 Should allocated and auctioned rights be treated consistently or differently?

Without separation of auctioned and allocated rights, the allocated rights could end up subsidizing the shortfall of the auctioned ones under a pure socialization approach, if the auctioned rights are responsible for a disproportionate share of that shortfall. On the other hand, there has been no analysis of the whether the award of allocated CRRs has targeted constraints that are not modeled in the allocation model or CRRs that would have inflated impacts on day-ahead market constraints.

We conclude that transmission access requires a transparent and liquid CRR market, and that creating two classes of rights with different payouts would interfere with that goal. Such a design would diminish the incentive of LSEs to sell unneeded CRRs in the auction as they would become much less valuable as hedges, given present levels of revenue inadequacy. It would also discriminate against small LSEs that want to use forward markets at trading hubs to hedge, as sellers of power at the hubs could not get as good a hedge as the large LSEs getting allocated CRRs from the generator. If the proration is substantial the discrimination would be material and might effectively eliminate hedges at the hubs. Making it impossible or very expensive for small LSEs to hedge their energy costs in high cost hours (e.g., hours 14-22) would not be a good step.

3.2.4 Over what time period should revenue surpluses and shortfalls be cumulated so that shortfalls in one subperiod can be compensated by surpluses in others?

In order to improve the value of CRRs as a hedge, it is reasonable to allow surpluses in some periods to offset congestion revenue shortfalls in others. The ISO has indicated that tracking surpluses and shortages for particular constraints or CRRs over periods longer than a month poses some practical problems of implementation; it is reasonable therefore to start with an averaging period that corresponds with billing cycles, and then lengthen it at some later point to a full season or even a year, if it judged to be worth the trouble. If a month has an overall congestion revenue surplus, it could be carried over to the next month and used to offset later congestion revenue shortfalls. Another possibility is that it could also be used to offset shortfalls in prior months of the CRR year.

On the other hand, any shifting of congestion rents between months of shortfall and months of surplus risks undermining one of the intended impacts of the track 1B changes, in that it would reverse the limit on the payout to constraints in months in which the payout to CRRs is inflated by constraints that were not modeled or whose outages had large impacts.

3.2.5 Should reductions in payouts be calculated ex post or ex ante?

We agree with the ISO that the practical details of implementing ex ante reductions in CRR entitlements mean that it should not be implemented at this time. Further consideration should be given in Track 2 to whether ex ante or ex post is preferable in the long term.

3.2.6 Should rights in the direction of “prevailing flow” be treated differently than rights in the counterflow direction?

As noted above, a constraint-by-constraint discounting of CRRs that only reduces payouts to prevailing flow rights while leaving counterflow rights unchanged would allow more of the CRRs to be preserved, which may enhance their value as hedges. However, this would only be the case to the extent that the asymmetric settlement, and hence asymmetric auction value, does not largely eliminate the award of counterflow CRRs. In addition, by breaking the ability to perfectly offset A to B rights with an equal MW quantity of B to A rights introduces uncertainty in financial exposure and the value of hedges. This would lower market liquidity in part because the net position resulting from a bundle of multiple hedges would become difficult or impossible to assess. The MSC cannot make a confident recommendation at this time in the absence of simulations of the impact of alternative designs based on historical patterns of CRR bidding and awards, and in the absence of analysis of the auction valuation and CRR payout to hedging CRRs such as those awarded in the allocation process.

3.2.6 *If a constraint-by-constraint approach is adopted, should constraints be aggregated prior to calculation of curtailments of payouts, and should CRRs be aggregated by party before that calculation? Should constraints be placed on the overall change in CRR payouts?*

A fundamental principle of locational marginal pricing is the relationship between nodal price differences, shift factors, and shadow prices on constraints. In particular, in a linearized DC network without losses, the difference in price between two nodes (and thus the value of a CRR obligation between the nodes) equals the sum (across all network constraints) of the product of the relevant shift factors for that pair of nodes with the constraint shadow prices. It is reasonably argued that most load serving entities and suppliers selling power to load serving entities that purchase CRRs as a congestion hedge are interested in hedging differences in prices at different nodes, not in constraint shadow prices per se, which is why financial transmission rights are based on trading point-to-point rights rather than flowgate rights.²⁵

Stakeholders have argued that some aggregation of constraints (cancelling out deficits and surpluses of congestion revenues relative to payouts) therefore makes sense if a constraint-by-constraint approach to CRR payment proration is adopted; for instance, aggregating across multiple constraints that result for a transmission element from considering multiple N-1 contingencies.²⁶ If this is done for a constraint-by-constraint system in which counterflow payments are not adjusted, then such an aggregation cannot lower payouts to CRRs and might increase them. By themselves, such aggregations won't result in violation of revenue adequacy, rather they will generally reduce the revenue surplus that results from constraint-by-constraint curtailment of payouts.

However, this kind of aggregation would have the potential to unwind the impact of the Track 1B reform in reducing payouts on constraints with inflated payouts, which is the point of the 1B changes.

In addition, even if it were reasonable to implement in an interim system if it were not too complex, such a design has the potential to in fact be very complex to implement. The aggregation of additional constraints beyond contingencies poses conceptual problems. In particular, if two or more transmission elements have shortfalls while two or more others have surpluses, and are affected differently by different CRRs, then which sets of constraints are aggregated for settlements will affect the relative payouts.²⁷ Arbitrary decisions can have significant distributional consequences. Rather than have a complicated set

²⁵ The "flowgate rights vs. point-to-point rights" debate occurred early in the intellectual development of the financial transmission right idea (see, e.g., R.P. O'Neill, U. Helman, B.F. Hobbs, W.R. Stewart, and M.H. Rothkopf. "A joint energy and transmission rights auction: Proposal and properties," *IEEE Transactions on Power Systems*, 17(4), 2002, 1058-1067).

²⁶ See E. Wolfe, "Comments on ISO CRR Auction Efficiency Track 1B Draft Final Proposal," Western Power Trading Forum, June 7, 2018

²⁷ If in the extreme case all constraints are combined, then the result is the "socialization" policy that we recommended in Section 3.2.2, above.

of rules to aggregate constraints that would no doubt engender extensive stakeholder debate, we would recommend that if some form of aggregation over constraints is implemented, the following interim approach be used: any congestion revenue surplus that results from constraint-by-constraint curtailment of payments would be allocated to CRRs whose payouts have been reduced, in proportion to the amount of reduction. This would probably best be done on a monthly basis. But even aggregating on a monthly basis would tend to unwind the potential benefits of the 1B approach, while likely reducing any adverse impact of 1B on CRR hedging value.

If a constraint-by-constraint design is adopted, as the ISO proposes, it has been argued that aggregation of CRRs on a market party basis would also be fairer, in that someone who owns an equal amount of A to B rights and B to A rights could net them out and be exposed to no reductions in payout or increase in liability. On the other hand, this would mean that a given right would have a different payout depending on who owns it. This could result in unintended consequences concerning CRR bidding incentives and risk hedging, and possibly bestow financial advantages on larger entities who would naturally have more rights to offset each other than smaller market parties. Because there has not been an opportunity to analyze these implications with market simulations, we recommend that aggregation by market party not be part of an interim system, if the ISO chooses to go with a constraint-by-constraint system.

However, we are supportive of some “guard rails” on changes in CRR payouts in a constraint-by-constraint system. Some options include:

- (1) If a constraint-by-constraint procedure increases the payout of a positive CRR beyond its target value, the payout should be reduced to the target.²⁸ The resulting revenue surplus could be refunded to rate payers or redistributed among other CRRs whose payouts were reduced.
- (2) If a constraint-by-constraint procedure instead reverses the sign of a payout from positive to negative,²⁹ then instead a payment of zero could be made. This would increase the potential revenue inadequacy problem, but eliminate the risk that the procedure would turn a hedge against positive congestion charges into a liability while those hedged congestion charges would themselves remain a liability.³⁰

²⁸ See Note 22, *supra*, for an example of how this can happen. This can occur only if only payments by prevailing flows are reduced, without changing counterflows.

²⁹ *Ibid.*

³⁰ It is possible that in the presence of this guardrail that an owner of a CRR from A to B with a net positive payout would be better off (increase their payout) by instead owning separate CRRs (A to C, and C to B), each with positive payouts. This can occur if the A to B payout would remain positive after constraint-by-constraint reduction of payouts, but (for instance) the C to D payout would go negative in the absence of this guardrail. (E.g., the A to B target payout is \$10/MWh, but is reduced to \$6; A to C's target is \$7 and would be unaffected; and finally C to B's target is \$3, and would be reduced to -\$1 without a guardrail. With a guardrail, C to B would be reduced only to \$0, so the actual payoff for holding A to C together with C to B would be

A stronger version of (2) would ensure that payouts are reduced by no more than some percentage. E.g., since auction revenues were historically 69% of payouts to auctioned rights, a floor of 50% (representing roughly double the percentage gap) might be imposed. This would ensure that hedging rights would retain at least some of their value. Such a floor could increase revenue inadequacy, if many CRRs would otherwise be reduced below that level.³¹ A concern with this proposal is that like the aggregation of shortfalls over constraints, such a design would have the potential to unwind the impact of the Track 1B reform in reducing payouts on constraints with inflated payouts, which is the major point of the 1B changes.

The MSC supports both (1) and a version of (2), without recommending a particular level of the floor for payouts to CRRs with positive payouts under (2). We anticipate that collaring payouts in this manner would reduce, at least slightly, the uncertainty concerning how payouts would change for CRRs, and make them easier to evaluate.

4. Additional Auction Changes

We interpret the current CAISO proposal as targeting the auction revenue shortfall problem as much as it is the revenue inadequacy issue. To the extent the two issues are distinct, this CAISO approach risks applying a suboptimal solution to both problems by trying to deal with them through one mechanism. We acknowledge that the current CAISO proposal would on its own, be more likely reduce auction revenue shortfall than the alternative we proposed above. This is why we also recommend the adoption of other measures more directly targeted at the auction revenue shortfall, in addition to the proposed changes that would address revenue inadequacy.

4.1 Reduce Capacity Available in the Annual Auction

A first recommendation for phase 1B would be to reduce, slightly, the available capacity sold in the annual auction. This is the most straightforward change that would both reduce the risk of auction revenue shortfalls while maintaining the quality of CRRs that are distributed. The ISO has calculated how much a given reduction in capacity would have reduced shortfalls in the past, under the assumption that bids would not have changed. While not definitive,³² since bidding behavior is likely to change, such calculations inform where to

\$7+\$0, which exceeds the A to B payout of \$6.) Without further analyses, it is unclear whether such situations would occur frequently or only very rarely.

³¹ A similar constraint could be placed on movement of negative payout CRRs, ensuring that would remain at least some minimum level of obligation to pay for counterflow.

³² The CAISO evaluated the annual capacity release level at which a majority of monthly infeasibilities would have been prevented over a recent outage season (October 2017 through December 2017). After reducing the amount of system capacity released in the annual process by 10% to 65%, the CAISO observed a 57% reduction in infeasibilities.

set a new capacity limit. We suggest that a modest reduction to 65-70% in the annual process and 70-75% overall be considered as a step toward reducing the risk of revenue shortfalls while the impact of the other Track 0, 1A and 1B changes is assessed. At the same time, this reduction would likely lessen the amount by which CRR hedging values would be reduced by the ISO's proposed constraint-by-constraint payout reductions.

We see the reduction in the auctioned capacity as a reasonable compromise between the status quo, and proposals that would effectively set the limit of additional capacity sold in the auction to zero.³³

4.2 Introduce a Minimum Purchase Price for CRRs

A second recommendation for either Track 1B or later would be to establish a minimum sale price for CRRs sold at auction. The CAISO analysis of the CRR auction has shown that there are both a large number of CRRs that sell for zero or very small prices and that CRRs that sell for zero or low prices are responsible for a non-trivial amount of the auction revenue shortfall. One explanation for these facts is that bidders are taking a large number of low-cost speculative positions on CRRs in the expectation that at least some of them will yield surprisingly high congestion payouts. A minimum sale price would both discourage such strategies and, at a minimum, increase the revenues collected in the event bidding behavior did not change. The minimum sale price approach has the appeal of having little impact on high value CRRs for which bidders are already willing to offer significant prices for, while targeting only the CRRs that current results imply hold less value for market participants.

The minimum sale price also represents a compromise between the status quo and the position of SCE and others who argue that the current auction represents a forced sale of CRRs at unreasonably low prices. We note that the practice of auctioning collectively or publicly owned resources is relatively common. Such mechanisms can be effective when ownership of resources is diffuse or difficult to define, and the value of the resources is contingent up on the bundles or combinations that are purchased. Congestion revenue rights share all these characteristics. Market prices for federal forest and mineral rights are frequently determined in this manner. However, it is also common for such auctions to set a reservation prices to ensure against public resources selling at unreasonably low prices.

A minimum price could be implemented through the auction process itself or simply as a fee imposed on all MWh of CRR sold through the auction. While quantitative analysis of historic bidding could inform the extent to which particular minimum price levels might reduce auction revenue shortfalls, an administrative basis for the fee, such as a fraction of TAC would be a reasonable approach that we believe would be consistent with the principles of open-access.

³³ We also note that the auctioned capacity need not be as great or greater than the capacity made available in the allocation process.