Pacific Gas and Electric Company

Comments of Pacific Gas & Electric Company

Congestion Revenue Rights Auction Efficiency, Track 1B – Draft Final Proposal

Submitted by	Company	Date Submitted
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Pacific Gas and Electric Company (PG&E) respectfully offers the following comments on the California Independent System Operator's (CAISO) Congestion Revenue Rights (CRR) Auction Efficiency Track 1B Draft Final Proposal.

PG&E supports CAISO's proposal to equitably allocate shortfalls among congestion revenue rights and eliminate incentives to bid for low-priced high-payout paths that profit from modeling issues that contribute to revenue inadequacy. While additional measures should be explored in the future, PG&E believes that the CAISO's proposed Track 1B changes are worth adopting in 2019 because they could make a significant impact on CRR revenue inadequacy.

In summary,

1. PG&E supports the CAISO's approach for allocating Day-Ahead Market congestion revenue shortfalls arising on individual constraints to the CRRs that use capacity on the constraint in the binding direction.
2. PG&E supports the CAISO's approach to netting hourly surpluses and deficiencies of constraints.
3. PG&E supports allocating net surplus on constraints to metered demand based on the CAISO's principle that CAISO payments should not exceed the full target payment of the CRR.

1. <u>PG&E supports the CAISO's approach for allocating Day-Ahead Market congestion revenue shortfalls arising on individual constraints to the CRRs that use capacity on the constraint in the binding direction.</u>

The transmission models used in the CRR allocation and auction processes may differ from the transmission model used in a given hour of the Day-Ahead Market. These differences can lead to a set of CRRs that satisfy the Simultaneous Feasibility Test (SFT) in a CRR allocation or auction but may not satisfy the SFT for the transmission model for the Day-Ahead Market. As a result, CRRs can use more capacity than is available on some binding constraints in the Day-Ahead Market. Consequently, the congestion rent collected based on the LMPs from the Day-Ahead Market may not be sufficient to cover the target payments to the CRRs. The "target payment" to each CRR is the difference in congestion components of the LMPs in the Day-Ahead Energy Market at the CRR source and sink nodes times the MW quantity of the CRR.

In the Addendum to Draft Final Proposal for Track 1B, the CAISO presents an approach for allocating any revenue insufficiency on a binding constraint in the Day-Ahead Market to the CRRs that use capacity on the binding constraint in the congested direction in the Day-Ahead Market. PG&E supports the proposed approach.

In the following, we focus on the method that CAISO proposes for treating revenue inadequacy in a given hour of the Day-Ahead Market since that is the fundamental source of the revenue inadequacy. We comment on the Daily Settlement or Monthly Re-Settlement in Section 2 below.

PG&E believes that the method that CAISO proposes for allocating revenue insufficiency among CRRs in the Final Draft Proposal Addendum behaves appropriately for the following reasons:

a. The resulting payment to each CRR in a given hour will be less than or equal to the target payment for that CRR in the hour of the Day-Ahead Market.
b. The approach adjusts CRR MW quantities that will be settled on over-subscribed constraints similarly to the way that the SFT adjusts CRRs to enforce transmission limits

We expand on these points in the appendix.

2. PG&E supports the CAISO's approach to netting hourly surpluses and deficiencies of constraints.

In the Draft Final Proposal, the CAISO proposes to allow surpluses on a given constraint in one hour to offset deficits on the same constraint in another hour over the course of the month. It will offset these hourly surpluses and deficiencies by settling each CRR daily and then re-settling the same CRR monthly. By netting surpluses and deficits on the same constraints, CRR holders are fairly allocated their share of the monthly CRR revenue inadequacy, but the impact of deviations between the CRR model and DA market is lessened.

3. PG&E supports allocating net surplus on constraints to metered demand based on the CAISO's principle that CAISO payments should not exceed the full target payment of the CRR.

The CAISO proposes to only distribute surpluses to CRRs if the surplus is collected on a constraint when the CRR accrues a deficit monthly. Any remaining surpluses from monthly net surplus constraints will be distributed to measured demand. This approach ensures the CAISO payments do not exceed the full target payment value of the CRR. Further, as the CAISO stated during the May 18th stakeholder call, the unintended incentive for market participants to target constraints that are monthly net deficient is increased if surpluses from monthly net surplus constraints are used across constraints to reduce the shortfall from the net deficient constraints. PG&E shares this concern.

Since the CAISO is analyzing the hourly surplus and deficit on a constraint by constraint basis, it is unlikely for the CAISO to have a way to adjust constraints' payouts and deficits without creating the possibility that the CAISO payments could exceed the full target payment of the CRR. The only way that this could be done is to prioritize revenue deficient CRRs to determine which net deficient CRRs should receive the surplus from the monthly net surplus constraints.

Netting monthly net deficient constraints against monthly net surplus constraints would also encourage market participants to continue to participate in rent seeking. Rather than the current practice of market participants targeting CRRs that are most likely not to bind in the CRR model but bind in the DA market, market participants would have the incentive to attempt to target constraints that have a monthly net surplus. If the CAISO feels the need to consider alternative approaches to allocating net surplus on constraints to metered demand, PG&E asks the CAISO to provide data showing that the monthly net surplus constraints are not consistent. If similar monthly net surplus constraints are appearing consistently, PG&E is concerned that constraint targeting would be very effective.

Appendix

a. The resulting payment to each CRR in a given hour will be less than or equal to the target payment for that CRR in the hour of the Day-Ahead Market.

When the Day-Ahead Market does not collect sufficient congestion revenue in a given hour of the Day-Ahead Market to fully fund the CRRs' target payments, CAISO should reduce payments to the CRRs that contribute to the revenue inadequacy. PG&E believes that it would be inappropriate to adjust the payments to CRRs in a way that could increase payments to some CRRs above their target payments. That is, when the CRRs are revenue inadequate, the adjustment process should allocate available congestion rents in such a way that payments to the CRRs in a given hour will be less than or equal to the target payments for the CRRs.

The approach in the Draft Final Proposal did not achieve this goal. CAISO modified its approach in the Addendum to meet this goal.

In both approaches, CAISO would determine hourly revenue insufficiency per constraint and adjust payments to CRRs in ratio to each CRR's utilization of capacity on the constraint in the hour that the deficit occurred.

In the Draft Final Proposal and the Draft Final Proposal Addendum, CAISO defines the constraint flow difference[1]. This is the difference between the flow on the constraint in the Day-Ahead Market and the capacity used by the CRRs on the transmission system model used in the Day-Ahead Market[2]:

$$CFD_{k,m,t} = \sum_{n=0}^{N} SF_{n,k,m,t} \cdot IFMMW_{n,k,m,t} - \sum_{q=0}^{Q} CRRMW_q \cdot \left(SF^{src}_{q,k,m,t} - SF^{snk}_{q,k,m,t}\right)$$

Suppose that in an hour of the Day-Ahead Market the CRRs use more capacity on a binding constraint than is available in the Day-Ahead Market. A CRR can utilize capacity on a constraint in the direction of congestion on the constraint or opposite the direction of congestion[3]. If a CRR utilizes capacity on a binding constraint in the direction of congestion, the approach in the Draft Final Proposal would decrease the payment by the CAISO to the CRR. If a CRR utilizes capacity on a binding constraint opposite to the direction of congestion, the approach in the Draft Final Proposal would decrease the payment by the CRR to CAISO. By decreasing the payment by the CRR to the CAISO, the CAISO is increasing the value of the counterflow CRR when there is revenue inadequacy.

In the Draft Final Proposal, CAISO proposed adjusting the payments to the CRRs if the constraint (k, m) is over-allocated in the CRR processes. For CRR q', CAISO defined the proportion by which it would adjust the CRR's capacity on (k, m) that it would settle:

[1] We will use the notation that is used in the Appendix. For example, all shift factors are the shift factors from the transmission system model used in the Day-Ahead Market.
[2] We will ignore the possibility of a CRR Clawback as discussed in the Addendum to simplify the discussion.
[3] We are only interested in constraints that are congested in the hour of the Day-Ahead Market. A constraint that is not congested has a zero shadow price and so cannot contribute to revenue insufficiency for a CRR.

$$\alpha_{q',k,m,t} = \frac{CRRMW_{q'} \cdot \left(SF^{src}_{q',k,m,t} - SF^{snk}_{q',k,m,t}\right)}{\sum_{q=0}^{Q} CRRMW_q \cdot \left(SF^{src}_{q,k,m,t} - SF^{snk}_{q,k,m,t}\right)}$$

The MW of capacity that CAISO would settle for each CRR q' on constraint (k,m) would be adjusted pro-rata whether the CRR utilizes capacity on the constraint in the binding direction or opposite to the binding direction:

$$CRRMW_{q'} \cdot \left(SF^{src}_{q',k,m,t} - SF^{snk}_{q',k,m,t}\right) + \alpha_{q',k,m,t} \cdot \left(\sum_{n=0}^{N} SF_{n,k,m,t} \cdot IFMMW_{n,k,m,t} - \sum_{q=0}^{Q} CRRMW_q \cdot \left(SF^{src}_{q,k,m,t} - SF^{snk}_{q,k,m,t}\right)\right)$$

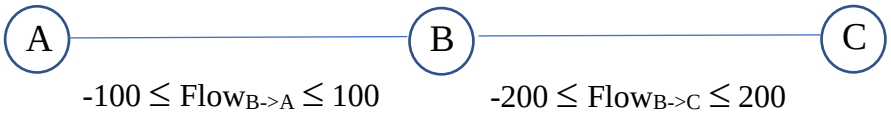
Since the charge to a CRR that utilized capacity on the constraint opposite to congestion in the Day-Ahead Market would be reduced, the approach has the potential to increase payments to CRRs over the target payment when there is revenue inadequacy. This is inappropriate.

We will demonstrate this with a simple example. Consider a simple system with three nodes, A, B and C and two lines.

- Line B->A with the positive direction of flow defined as flow from node B to node A
- Line B->C with the positive direction of flow defined as flow from node B to node C.

The transmission model used in the CRR process enforces the following flow limits:

- a minimum flow limit on B->A of -100 MW and a maximum flow limit of 100 MW
- a minimum flow limit on B->C of -200 MW and a maximum flow limit of 200 MW



Two CRRs are defined:

- CRR_{BtoC}, 300 MW
  - Uses 300 MW on Line B->C and 0 MW on line B->A
- CRR_{CtoA}, 100 MW
  - Uses -100 MW on line B->C and 100 MW on Line B->A.

Together, the CRRs utilize 100 MW on Line B->A and 200 MW on Line B->C. They pass the Simultaneous Feasibility Test (SFT) for the specified transmission model and so should be revenue adequate if the transmission model used in the DA Market were the same as that in the CRR SFT.

Consider a single hour in the DA Market. Suppose that the transmission model used in the DA Market changes.

The transmission model used in the DA Market enforces the following flow limits:

- a minimum flow limit on B->A of -100 MW and a maximum flow limit of 100 MW
- a minimum flow limit on B->C of -110 MW and a maximum flow limit of 110 MW

Suppose that the LMPs in the DA Market for the hour are $40/MWh at node A, $10/MWh at node B and $20/MWh at node C. In the DA Market, CAISO would collect $1,100 of congestion rents on line B->C and $3,000 of congestion rents on line B->A.

The target payments to the CRRs for the hour are:

- CRR_{BtoC} $3,000 ($3,000 for capacity on line B->C and $0 for capacity on line B->A)
- CRR_{CtoA} $2,000 (-$1,000 for capacity on line B->C and $3,000 for capacity on line B->A).

The CAISO collects congestion rents that are $900 less than the target CRR payments. This arises on line B->C since the CRRs use a net of 90 MW more capacity on line B->C than is available in the DA Market.

Using the approach in the Final Draft Proposal,

- CRR_{BtoC} would be paid for 165 MW of capacity on Line B->C and 0 MW of capacity on Line B->A. It would be paid $1,650.
- CRR_{CtoA} would be paid for -55 MW of capacity on Line B->C (i.e. charged for 55 MW of capacity from C to B on Line B->C) and 100 MW of capacity on Line B->A. It would be paid $2,450.

The ISO pays the CRRs the congestion revenue collected in the hour. However, the outcome is anomalous. The actual payment to CRR_{CtoA} is $2,450 which exceeds its target payment of $2,000. The payment to CRR_{CtoA} increases when the congestion rents are insufficient to fully fund the CRRs. Increasing the payments to CRRs that use capacity on congested lines opposite to the congested direction is undesirable and can lead to strategic behavior by participants in an attempt to take advantage of this characteristic.

CAISO corrected this problem in the Addendum to the Final Draft Proposal. The payments to CRRs for congested lines would only be adjusted for the CRRs that utilize capacity on the congested line in the congested direction. If the CRR utilizes capacity on the congested line opposite to the congested direction, the CRR does not contribute to revenue insufficiency on the line and so its payment would not be adjusted. The formulas in the Appendix were modified to accomplish this[4].

CAISO changed the calculation of $\alpha_{q',k,m,t}$. As a result, only the payments to the CRRs that utilize capacity on an over-allocated constraint in the direction that the constraint binds are reduced pro-rata. The proportion by which the approach adjusts the CRR's capacity on (k, m) that CAISO will settle is:

[4] We will assume that each line is congested in the positive direction defined for the line. Modifying the equations to treat congestion in the negative direction is straightforward.

$$\alpha_{q\prime,k,m,t} = \begin{cases} 0 \; if \; CRRMW_{q\prime} \cdot \left(SF^{src}_{q\prime,k,m,t} - SF^{snk}_{q\prime,k,m,t}\right) < 0 \\ \dfrac{CRRMW_{q\prime} \cdot \left(SF^{src}_{q\prime,k,m,t} - SF^{snk}_{q\prime,k,m,t}\right)}{\sum_{q=0}^{Q} max\left\{0, CRRMW_q \cdot \left(SF^{src}_{q,k,m,t} - SF^{snk}_{q,k,m,t}\right)\right\}} \end{cases} otherwise^{5}$$

The MW of capacity that CAISO will settle on constraint (k,m) for each CRR q' is adjusted pro-rata only when the CRR utilizes capacity on the constraint in the binding direction:

$$CRRMW_{q\prime} \cdot \left(SF^{src}_{q\prime,k,m,t} - SF^{snk}_{q\prime,k,m,t}\right) + \alpha_{q\prime,k,m,t} \cdot \left(\sum_{n=0}^{N} SF_{n,k,m,t} \cdot IFMMW_{n,k,m,t} - \sum_{q=0}^{Q} CRRMW_q \cdot \left(SF^{src}_{q,k,m,t} - SF^{snk}_{q,k,m,t}\right)\right)$$

We return to the example to show the effect. Using the revised approach,

- CRR_{BtoC} would be paid for 210 MW of capacity on Line B->C and 0 MW of capacity on Line B->A. It would be paid $2,100.
- CRR_{CtoA} would be paid for -100 MW of capacity on Line B->C and 100 MW of capacity on Line B->A. It would be paid $2,000.

The ISO only pays the CRRs the congestion rents that it collects. Also, the payment to each CRR is now less than or equal to its target payment. A CRR no longer benefits from revenue inadequacy.

b. The approach adjusts CRR MW quantities that will be settled on over-subscribed constraints similarly to the way that the SFT adjusts CRRs to enforce transmission limits

Using bids for CRRs, the CRR auction produces a set of CRRs that maximize as-bid value in a fashion that respects the transmission limits in the SFT. Based on a set of CRR nominations, the CRR allocation process produces a set of CRRs that minimizes the sum of weighted squared differences between the allocated CRRs and nominated CRRs while respecting transmission limits. These optimization processes adjust the CRRs to provide quantities of CRRs below the bid or nominated CRRs that utilize transmission on a binding constraint in the direction that the constraint binds. If bid or nominated CRRs compete for capacity on a constraint in the binding direction, they may be reduced. CRRs that provide counterflow on the constraint are not necessarily reduced in the auction or allocation[6].

The approach proposed by CAISO for adjusting the MW of CRR that will be settled respects transmission limits in the Day-Ahead Market. While this is not exactly the same as a SFT, the approach should treat transmission limits in a way that is roughly consistent with the way that the SFTs in the auction or allocation treat transmission limits. That is, the MW of CRRs that will be settled that use capacity on an over-subscribed constraint in the Day-Ahead Market should be reduced

[5] Again, we ignore the possibility of clawback to simplify the point we make.
[6] They may be reduced if the CRRs interact with other CRRs on other binding constraints or based on economics.

while the MW of CRRs that provide counterflows on the over-subscribed constraints should not be reduced.

We return to the example problem above. Suppose that the transmission model used in the CRR nomination process is the same as that used in the DA Market. That is, the CRR process enforces the following flow limits:

- a minimum flow limit on B->A of -100 MW and a maximum flow limit of 100 MW
- a minimum flow limit on B->C of -110 MW and a maximum flow limit of 110 MW

Assume that the participants submit nominations that are consistent with the provided CRRs in the earlier example:

- CRR^{nom}_{BtoC}, 300 MW
    - Uses 300 MW on Line B->C and 0 MW on line B->A
- CRR^{nom}_{CtoA}, 100 MW
    - Uses -100 MW on line B->C and 100 MW on Line B->A.

The allocated CRRs that satisfy the SFT would be:

- CRR_{BtoC}, 210 MW
    - Uses 210 MW on Line B->C and 0 MW on line B->A
- CRR_{CtoA}, 100 MW
    - Uses -100 MW on line B->C and 100 MW on Line B->A.

The nomination process reduces the CRRs that utilize capacity on B->C in the binding direction while providing the full amount of nominated CRRs that utilize capacity on B->C opposite to the binding direction.

Suppose that we return to the first example where the transmission model in the CRR process does not match the transmission model in the Day-Ahead Market. The approach in the Final Draft Proposal Addendum adjusts the settled MW of CRRs on binding constraints in roughly analogous fashion to that of the SFT in the allocation and auction process.

- CRR_{BtoC}, 300 MW allocated
    - Settles 210 MW on Line B->C and 0 MW on line B->A
- CRR_{CtoA}, 100 MW allocated
    - Settles -100 MW on line B->C and 100 MW on Line B->A.

The approach in the Final Draft Proposal treats binding constraints very differently in that the CRR MW that are settled on a binding constraint are adjusted whether the CRR uses capacity in the binding direction or opposite to the binding direction.

- CRR_{BtoC}, 300 MW allocated
    - Settles 165 MW on Line B->C and 0 MW on line B->A
- CRR_{CtoA}, 100 MW allocated
    - Settles -55 MW on line B->C and 100 MW on Line B->A.

The approach in the Final Draft Proposal Addendum treats adjustment to CRRs in a fashion that is more consistent with the way that the SFT in the auction or allocation treats adjustments to nominated or bid CRRs.

PG&E would also like to express its views on a related issue. Suppose that the CRRs defined going into the Day-Ahead Market over-utilize transmission capacity that is available on a constraint in the Day-Ahead Market. The payment to CRRs that utilize capacity on the constraint in the congested direction will be reduced while the payments by CRRs that utilize capacity on the constraint opposite to the congested direction will not be adjusted. PG&E believes that this is appropriate for the reasons outlined above.

Suppose that a participant has a CRR from A to B (CRR_{AtoB}) that utilizes capacity on a constraint in the direction opposite to congestion on the constraint. In settling the CRRs, the CRR holder would pay the Day-Ahead Market shadow price for capacity on the constraint to the ISO. Also suppose that the participant bought a CRR from B to A (CRR_{BtoA}) of the same size as its CRR_{AtoB} in a later auction. This CRR would use capacity on the constraint in the congested direction and so CAISO would pay the CRR holder the shadow price of capacity on the constraint. If the CRRs were revenue sufficient, the payment to CRR_{BtoA} would cancel the payment by CRR_{AtoB}. That is, the two CRRs cancel out when settled. If the constraint were revenue deficient, then the payment to CRR_{BtoA} would be reduced while the payment from CRR_{AtoB} would not be reduced. The net payment would not be zero so the CRRs do not cancel when settled. Some may contend that both the payments to the CRRs that utilize capacity in the direction of congestion on a constraint and payments from the CRRs that utilize capacity on the constraint opposite to the direction of congestion should be reduced to allow the CRRs to cancel.

The auction and its SFT allow a participant to submit a bid to buy a CRR that would cancel a CRR that it holds. However, there is no guarantee that the bid CRR will satisfy the SFT so the participant may not receive a CRR that would cancel the CRR that it holds. This is consistent with the way that the adjustment to the payment mechanism in the Draft Final Proposal Addendum works. If the CRRs satisfy the transmission constraint on a line in the Day-Ahead Market, the net payment to the participant will be zero. If the CRRs do not satisfy the transmission constraint in the Day-Ahead Market, the net payments may no longer cancel. This is similar to the way that the SFT could adjust one of a pair of CRRs without adjusting the other.

Buying a CRR from B to A to cancel a CRR from A to B may well not be needed. As part of the Track 1A proposal, the ISO will allow parties to submit an offer to sell a CRR that they hold rather than bidding to buy a CRR in the opposite direction to cancel out the first CRR. Completely removing a CRR rather than holding two CRRs in opposite directions to cancel should address the issue.