Opinion on
Initial Implementation of
the Energy Imbalance Market and Related Market Design Changes

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Executive Summary

The Market Surveillance Committee (MSC) of the California Independent System Operator (ISO) has been asked to provide an opinion on the California ISO's proposal for initial implementation of an Energy Imbalance Market (EIM) with the PacifiCorp balancing authority areas (BAAs).[1] The EIM design would allow implementation of a coordinated real-time dispatch encompassing both the California ISO BAA and the PacifiCorp BAAs. This coordinated market has the potential to benefit California ISO market participants as well as power consumers and generators within the PacifiCorp balancing authority areas. Realizing these benefits will require effective and efficient market and dispatch designs, as well as a cost-effective implementation.

The EIM design described in the Draft Final Proposal is also intended to provide a general blueprint for the market and operating design that would be applied to other BAAs that choose to participate in the EIM. However, it is recognized that there are some elements of the design in the draft final proposal that only represent a starting point, and that the ISO intended that these design elements could evolve over time with the accumulation of operating experience and expansion of the EIM.

While the implementation of the EIM is a complex and challenging effort, it is difficult to overstate the potential benefits of success. Wholesale electricity markets in the western U.S. have for decades been challenged by multiple jurisdictions, complicated and antiquated transmission rights, and other barriers to integration, such as the relatively small size of many balancing authority areas from the standpoint of load and generation. Although we provide extensive discussion of *potential* problems that could arise, we also want to emphasize that the CAISO has taken important steps to prepare the system to deal with these problems if they arise, and that there will be important benefits from a successful EIM implementation. If successful, the EIM can represent the first step toward much more efficient use of the western grid, allowing

[1] California ISO, Energy Imbalance Market, Draft Final Proposal, September 23, 2013, www.caiso.com/Documents/EnergyImbalanceMarket-DraftFinalProposal092313.pdf .

customers throughout the west to benefit from the vast potential of a diverse resource mix. We therefore strongly support the goals of this initiative, and recommend that the Board of Governors approve the proposed EIM design.

Expanding the geographic scope of the real-time dispatch has the potential to improve market efficiency and lower costs to consumers, in part because the real-time dispatch will be better able to take advantage of the spatial diversity of variable renewable production. This is particularly important in the WECC, with the planned rapid expansion of solar and wind resources in the next decade. Expanding the balancing market increases the pool of energy resources that can be dispatched to balance the inherent variability and uncertainty of renewable resources output. The larger the geographic region that can be successfully integrated, the greater these benefits are likely to be. Indeed, in principle, the benefits of market enlargement from the standpoint of accommodating variations in renewable output may rise sharply with the geographic scope of the integrated region. This is because correlations of both renewable output and load are likely to be lower between geographically distant areas.

However, it is important to remember that this market design is not being drawn upon a blank slate. The establishment of a geographically expanded balancing market involves many steps, and is made more complicated by the need to accommodate and respect existing rights and practices on the western grid. It will not immediately resolve all of the integration problems and pricing inconsistencies created at the "seams" between market regions. Further, there are some risks associated with the implementation of the EIM changes that will need to be carefully monitored and analyzed by the California ISO as this design moves toward implementation, and addressed as necessary.

For example, some efficiency benefits can be lost because, according to the current proposal, the CAISO and PacifiCorps BAAs will develop forward schedules separately using distinct procedures that may be inconsistent in important ways from the procedures to be used in their combined imbalance market. If there are significant interactions in congestion impacts between the BAAs in real-time, it will be important that constraints that are likely to be significant in the balancing market be visible and considered in day-ahead scheduling, to the extent possible. If such constraints are not considered in the day-ahead market or base schedules, but are accounted for in the integrated real-time balancing market, then discrepancies between day-ahead market/base schedules and real-time dispatch may result in congestion revenue shortfalls and uplift costs, as well as potential cost shifts between transmission customers and energy consumers or producers.[2] In the body of this opinion, we describe in detail the ways in which these may occur.

[2]Note that these interactions can occur today without an EIM since flow effects of external transactions are not considerd in the California day-ahead market and flow effects of the ISO schedules are not limited by external constraints. Therefore the EIM provides an opportunity to improve the modeled flows and their effects.

Further, the current California ISO approach to local market power mitigation assumes that markets are fully competitive at the balancing area level. That approach also relies upon being able to mitigate bids to a level that reasonably represents the marginal costs of output from a particular resource. As the EIM market region expands to include more traditional vertically-integrated systems as well as hydro systems with more complex opportunity costs, the appropriate marginal cost assumptions to apply to other regions will need to be considered on a case-by-case basis.

Fortunately, the task being undertaken by the CAISO is not unprecedented. Several other regional ISOs and RTOs, such as the Southwest Power Pool and the Mid-continent ISO, have implemented similar designs and grappled with similar issues. The experiences of those ISOs as they expanded their footprints indicate that the CAISO and its EIM partners should be able to manage these challenges.

In the body of this opinion we provide a detailed discussion of a subset of four issues:

1. rules for managing schedules,
2. rules for accounting for Greenhouse Gas emissions,
3. options for phasing in the implementation of EIM, and
4. market power mitigation.

We briefly summarize the basic conclusions from these discussions below.

1. **Schedule Management Rules.** First, if there are significant congestion interactions between the California ISO and PacifiCorp transmission systems, then there is potential for significant shortfalls in real-time congestion rents arising from the independent determination of market-based day-ahead schedules on the California ISO transmission grid and the base schedules on the EIM BAA grids. This can occur if market participants are able to structure day-ahead schedules (either physical or virtual market-based on the CAISO side, or base schedules on the PacifiCorp side) that exceed the actual historical use of the transmission system in the neighboring BAAs. There is also a related potential for a shift of costs and benefits between the transmission customers that pay the embedded costs of the grid and other market participants that is not associated with congestion rent shortfalls (i.e., there can be cost shifts even if there are no congestion rent shortfalls). If there appears to be a potential for unacceptably high congestion rent shortfalls or cost shifts due to the interactions from schedules at particular locations, this potential should be addressed prior to the go-live date. While we discuss several options for mitigating this problem in the opinion, we do not recommend a specific approach to resolve these situations because the best way to resolve these kinds of issues in the short-run will depend on the individual circumstances. We recommend that the California ISO have the functionality in its systems that will enable it to address these issues promptly, if it becomes apparent in testing that there exist these kinds of significant congestion interactions between the California ISO and PacifiCorp transmission systems at some locations for particular constraints.

The California ISO proposes to address these possible impacts in part by allocating specific congestion rent shortfalls to virtual transactions that contribute to them. In addition, as discussed by the Department of Market Monitoring,[3] the California ISO will have the ability in the CAISO day-ahead market to impose flow limits on specific transmission constraints on the PacifiCorp transmission system. The ISO will be able to take measures to activate this functionality, if it identifies constraints that could be impacted by inflated schedules in the California ISO day-ahead market. These steps can prevent day-ahead market schedules on the California ISO system from being used to shift costs onto transmission customers of the PacifiCorp BAAs. Conversely, when clearing the day-ahead market, the California ISO will also have the ability to use the historical impact that transactions on the PacifiCorp BAAs have had on the California ISO system, rather than market participants' base schedules, if the ISO identifies constraints on the ISO system that are being impacted by inflated or displaced base schedules. In this manner, the ISO can prevent the shifting of costs to ISO transmission customers by PacifiCorp BAA base schedules. Further, the market system functionality that the ISO could activate will also have provisions to allocate congestion costs to the PacifiCorp BAAs in the event that their flows exceed their entitlement over California ISO constraints.

We believe that, particularly if the EIM expands, the California ISO will eventually need to develop a workable general framework that will account for these interactions in establishing forward schedules. This is not a new problem; the MISO, PJM and New York ISO are all using various methods to account for similar interactions and avoid both congestion rent shortfalls and unintended cost shifts.

2. **Greenhouse Gas Emissions Accounting Rules.** Second, we believe that the system that the CAISO proposes for accounting for Greenhouse Gas Emissions is appropriate and consistent with the spirit of the rules adopted by the California Air Resources Board. Some stakeholders have expressed concern that the new rules would enable EIM participants to specify a separate GHG cost component without bounds. However, we conclude that, in effect, this capability already exists under the present market rules in which the offer price of imports to CAISO can reflect whatever emission cost the out-of-state supplier chooses to include.

3. **Phase-In Options.** Third, we note that the ability to limit the capacity of intertie transactions can be a potentially useful tool for diagnosing the source of any pricing or uplift issues that may arise. We, therefore, support having such a functionality in the California ISO system. Hence, we believe that testing will reveal much about the potential for uplifts or software issues and enable the California ISO to assess whether limiting the EIM transfer capability to a low value (such as zero) for an initial period would be potentially helpful in verifying that the real-time dispatch is operating as

[3] CAISO Department of Market Monitoring, "Comments on Energy Imbalance Market Draft Final Proposal," October, 25, 2013, www.caiso.com/Documents/DMMComments_EnergyImbalanceMarket-DraftFinalProposal.pdf, p. 6.

intended. The expectation is that if such a step were taken, the limitation would be imposed for no more than a period of days, not months or longer.

4. **Market Power Mitigation.** Last, we note that taken by itself, expansion of the EIM would very likely enhance competition by expanding the contestability of regional markets. However, some questions remain about the implementation of balancing and transmission pricing within the non-CAISO EIM BAAs. We describe some conditions in which local market power could be an issue in these regions. We support the CAISO's plans to include the market system functionality that will allow for mitigation to be potentially triggered by congestion on interties between EIM areas, as well as on internal constraints.

To conclude, we believe that implementation of the EIM between the California ISO and PacifiCorp will yield large cost savings, while facilitating the integration of renewable power sources. We anticipate that realization of these benefits would motivate other control areas to join the EIM, and furthermore encourage consideration of expansion and integration of day ahead as well as imbalance markets.

However, to fully realize these benefits, attention needs to be paid to the important but manageable details of market power mitigation and schedule management alignment. Testing is needed ahead of time to determine whether market power and schedule management issues might indeed be significant and what measures would then be appropriate to expeditiously implement.

1. Introduction

The Market Surveillance Committee (MSC) of the California Independent System Operator (ISO) has been asked to provide an opinion on the ISO's proposal for initial implementation of an Energy Imbalance Market (EIM) with the PacifiCorp balancing authority areas (BAAs).[4] The EIM design would allow implementation of a coordinated real-time dispatch encompassing both the California ISO BAA and the PacifiCorp BAAs. This coordinated market has the potential to benefit California ISO market participants as well as power consumers and generators within the PacifiCorp balancing authority areas. Realizing these benefits will require effective and efficient market and dispatch designs, as well as cost-effective implementation.

The EIM design described in the Draft Final Proposal is also intended to provide a general blueprint for the market and operating design that would be applied to other BAAs that choose to participate in the EIM. However, it is recognized that there are some elements of the design in the draft final proposal that only represent a starting point, and it is intended that these design elements could evolve over time with the accumulation of operating experience and expansion of the EIM.

[4] California ISO, "Energy Imbalance Market," Draft Final Proposal, *op. cit.*, Footnote 1.

Implementation of the EIM involves a number of market, operational and governance design elements. Some of these have aspects of concern to particular market participants. We discuss four of these elements, including the following:

1) The rules that the California ISO proposes to apply to:
    a. schedules in the ISO day-ahead market that materially impact transmission constraints in the EIM BAA transmission system and
    b. base schedules of the EIM BAA that materially impact transmission constraints in the ISO transmission system;
2) The rules the California ISO proposes to use to account for California Greenhouse Gas (GHG) emission costs in the EIM real-time dispatch;
3) The transition path for implementing the EIM; and
4) The potential exercise of market power in the supply of imbalance energy within EIM BAAs, and the mitigation of that market power.

These issues have been discussed in MSC meetings in Folsom on July 2 and September 6, 2013. In addition, MSC members have participated in stakeholder calls discussing the EIM design and implementation on April 11, June 6, July 9, and August 20, 2013.

While the implementation of the EIM is a complex and challenging effort, it is difficult to overstate the potential benefits of success. Wholesale electricity markets in the western U.S. have for decades been challenged by multiple jurisdictions, complicated and antiquated transmission rights, and other barriers to integration, such as the relatively small size of many balancing authority areas from the standpoint of load and generation. If successful, the EIM can represent the first step toward much more efficient use of the western grid, allowing customers throughout the west to benefit from the vast potential of a diverse resource mix. We therefore strongly support the goals of this initiative, and recommend that the Governing Board of the California ISO approve the proposed EIM design.

There are some risks associated with the implementation of the EIM changes that will need to be analyzed by the California ISO as this design moves toward implementation, as well as monitored following implementation.

First, there is a potential for significant congestion rent shortfalls in real time arising from the independent determination of market-based day-ahead schedules on the California ISO transmission grid and the base schedules on the EIM BAA grids. However, it is also possible that the congestion interactions between schedules on the California ISO and EIM BAA grids would be so small and/or the potential to create forward schedules that would contribute to congestion rent shortfalls so limited that the resulting real-time congestion shortfalls will be insignificant. The potential magnitudes of these shortfalls can be evaluated during testing prior to EIM go-live. This would be done by using the full network model to assess whether there are locations at which injections or withdrawals produce significant interactions between the CAISO and PacifiCorp BAA transmission grids. The testing will also assess the ability of market participants to submit inflated physical or virtual schedules at those locations in the California ISO day-ahead market or to submit inflated base schedules at those locations in the PacifiCorp BAAs that can adversely exploit such interactions.

If there appears to be a potential for unacceptably high congestion rent shortfalls due to schedules at particular locations, this potential should be addressed prior to go-live. We do not recommend a particular way to resolve these situations because the best way to resolve a particular situation in the short-run will likely depend on the individual circumstances of these interactions, which we cannot foresee. As discussed above, the California ISO will have a number of features built into the EIM software which could be used to address these issues if they are identified during testing or arise during EIM operation. We understand that the California ISO will incorporate functionality for one potential solution in its market systems that it could potentially activate if it identifies the potential for unacceptably high congestion rent shortfalls. This will include the ability to impose flow limits in the CAISO day-ahead market on specific transmission constraints in both the PacifiCorp and CAISO transmission systems. This functionality will enforce a flow limit for CAISO flows over EIM BAA constraints. This functionality will also include flow limit for EIM BAA flows over ISO constraints. Since the day-ahead market will model EIM BAA base schedules but will not adjust them, we understand this functionality will also include provisions to allocate congestion costs to EIM BAAs for flows on CAISO constraints that exceeds the entitlements.

Second, there is a related potential for cost and benefit shifts between the transmission customers that pay the embedded costs of the grid and other market participants that are not reflected in congestion rent shortfalls. As with the potential for congestion rent shortfalls, it is possible that the congestion interactions would be so small and the potential to create forward schedules that would contribute to these cost shifts so limited that the resulting real-time cost shifts will be insignificant. As above, if there appears to be a potential for unacceptably high cost shifts due to schedules at particular locations, this potential should also be addressed prior to go-live.

It may be that testing will confirm that there is little potential for either congestion rent shortfalls or other sources of cost shifts as a result of interactions between schedules on the California ISO and PacifiCorp BAA grids. As additional BAAs join the EIM, this may not always be the case and the California ISO will eventually need to develop a workable general framework to account for these interactions in establishing forward schedules. This is not a new problem. The MISO, PJM and New York ISO are all using various methods to account for similar interactions.[5] We do not recommend at this time that the California ISO develop and apply such a general framework for the implementation of the EIM with PacifiCorp because it is not clear that there will be material interactions. If the interactions are indeed small, then the California ISO and PacifiCorp have other implementation issues that should receive higher priority.

While the implementation of the EIM will pose some operational challenges for the California ISO and adjacent control areas, experience at other ISOs and RTOs that have implemented similar designs indicates that the California ISO should be able to manage these challenges.

[5] Further, these interactions can occur today without an EIM since the ISO's day-ahead market do not consider the flow effects of external transactions, while flow effects of the ISO schedules are not limited by external constraints. Thus the EIM provides an opportunity to improve the modeled flows and their effects.

This experience includes the Southwest Power Pool, with its real-time imbalance market since 2007, and the Mid-continent ISO, with its initial implementation of a multi-BAA real-time dispatch during 2005-2009.

The remainder of this opinion is organized as follows. Section 2 reviews four particular features of the most recent CAISO proposal, and offers some observations on those features. Our recommendations are summarized in Section 3.

2. The CAISO Proposal

Four aspects of the California ISO's draft final proposal of September 23, 2013 are summarized below, along with issues raised by each. Much of our discussion is rather detailed in order to make clear the ways in which problems can occur, and also to point out how the ways in which the ISO's proposal and possible subsequent adaptations which might become necessary are likely to be effective in dealing with them.

The first aspect is a set of rules concerning the settlement of forward schedules: those of California ISO market participants that impact EIM constraints, and, reciprocally, those of EIM participants that impact California ISO constraints. We focus on several issues that may arise if the forward schedules on the California ISO and PacifiCorp BAA transmission systems create material flows and settlement entitlements on each other's transmission systems.

The second aspect we summarize is the set of rules that implement the California Greenhouse Gas emission cost pricing system within the EIM real-time economic dispatch.

The third aspect addressed is the general topic of the transition from the current California ISO single BAA operational design to a real-time market that encompasses both the California ISO and the PacifiCorp BAAs, and ultimately to a real-time market that encompasses additional BAAs that are either interconnected directly with the California ISO, or interconnected with PacifiCorp.

The fourth and final aspect concerns the potential for the exercise of market power in the supply of imbalance energy within the PacifiCorp BAAs. Three issues are raised in that discussion of market power. The first concerns the allocation of congestion costs under PacifiCorp's OATT and the potential for these charges to be inflated through the exercise of locational market power on constraints within the PacifiCorp BAAs. The other two issues arise from the potential exercise of locational market power either on constraints within or connecting into the PacifiCorp BAAs. The second issue concerns the pricing of energy for energy imbalance and generator imbalance services under the PacifiCorp OATT, while the third issue concerns the potential for inflation of the prices used to settle economic redispatch of resources that support base schedules.

Although we provide extensive discussion of *potential* problems that could arise in the following sections, we also want to emphasize that the CAISO has taken important steps to prepare the

system to deal with these problems if they arise. Hence, to some extent, our elaboration on potential problems provides justification for the preventive measures included in the design.

A. Settlement of Forward Schedules

Summary of The Proposal. An important element of the EIM design is the settlement of forward schedules against real-time injections and withdrawals. Real-time injections and withdrawals on the California ISO transmission grid would be settled against day-ahead market schedules, similar to what is in place today and proposed for implementation under FERC Order 764.[6] Meanwhile, real-time injections and withdrawals on the EIM BAA grid (which initially would only include the PacifiCorp BAAs) would be settled against so-called "base" schedules.[7] Settlement against base schedules rather than day-ahead schedules in the EIM BAA is necessary because there will be no day-ahead market for the EIM area. This element of the proposed EIM design is very similar to the design that the Southwest Power Pool (SPP) has used since 2007 to settle its real-time imbalance market.

As we describe below, there is a well known incentive issue inherent to this design that could lead stakeholders to submit misleading or strategically designed forward schedules. Without testing, it is not possible at this time to determine how significant this problem might be. Fortunately, the CAISO has committed to both extensive testing of this and other issues, and to including software functionality, described below, that should be able to limit the monetary transfers caused by these incentives.

This design, in which forward schedules provide the basis for financial settlement of real-time deviations rather than being treated as physical entitlements, is necessary in order to avoid the "use it or lose it" incentives created by physical entitlements and to provide efficient incentives for participation in real-time dispatch. This is particularly important for the EIM proposal because broad participation in the real-time dispatch would maximize the regional economic benefits from EIM implementation and would also contribute to the California ISO's ability to efficiently and reliably accommodate high levels of intermittent resource output in the coming years.

The SPP design upon which this element of the EIM is based has one well-known limitation. This limitation is that market participants have an incentive to structure their base schedules to maximize the economic value of those schedules, rather than strictly match these schedules to their anticipated real-time use of the transmission system. In particular, by submitting base schedules that create greater flows on binding transmission constraints than would their actual real-time use of the transmission system, a market participant can earn extra revenues. This is accomplished by selling back in real-time, at real-time prices, the unused transmission capacity that was reserved by the excess base schedules. Conversely, by not submitting forward base schedules covering the output of generation resources that would provide counterflow over

[6] www.caiso.com/informed/Pages/StakeholderProcesses/FERCOrderNo764MarketChanges.aspx .

[7] Base schedules will be hourly balanced schedules for generation and forecast load (including losses) submitted to the California ISO by the EIM entity (the balancing authority), see "Energy Imbalance Market," Draft Final Proposal, *op. cit.*, Section 2.1, p. 11; Section 3.2, p. 18; and Section 3.3.2, pp. 31-34.

constraints likely to bind in real-time, a market participant would be paid real-time prices for those counterflows when they are settled as real-time deviations to its base schedules.[8] While this kind of scheduling behavior does not directly lead to any economic inefficiency, it can potentially result in significant unintended cost shifts which could deprive some market participants of the economic benefits of participating in the expanded real-time dispatch.

The SPP limits, but does not eliminate, this kind of scheduling behavior and cost shifting by imposing charges for base schedules that materially overstate or understate real-time load. These penalties only apply outside a deadband range and do not address schedules that accurately reflect real-time load but do not accurately reflect the resources that will be used to meet that load in real-time. Thus, it is still possible to cleverly define base schedules for resource outputs that provide the same total megawatt output as the real-time dispatch, but that are geographically distributed in order to inflate real-time payments for relieving congestion.

Like the SPP market, the EIM design will also have charges for base schedules that materially overstate or understate real-time load in their base schedules, with deadbands for schedules within 5% of real-time load and higher charges for schedules differing from real-time load by more than 10%.[9] But as in the SPP, there is no provision for penalizing differences between generation sources that are used for base schedules versus those used in real-time. Although, as noted, such a strategy could be used to systematically increase payments for reducing congestion in real-time, no penalties are proposed because they would also undermine the incentive to participate in the real-time dispatch.[10]

The SPP real-time settlement design also limits the impact of this strategic scheduling behavior on congestion rent shortfalls and cost shifting by using a mechanism for prorating forward schedules that are infeasible, whether because of a lack of counterflow, because of overstated load, or because of real-time transmission outages. [11] The current EIM design does not require the California ISO to apply any proration to infeasible base schedules. However, the California ISO will take account of the flows associated with day-ahead base schedules within the EIM, as well as its modeling of other WECC loop flows, in running its day-ahead market. This should limit the extent to which EIM base schedules give rise to congestion rent shortfalls on the California ISO transmission system. The EIM design allocates congestion rent shortfalls due to infeasible EIM base schedules on constraints within the EIM BAAs to the customers in those BAAs. Therefore, the issues relative to the settlement of infeasible base schedules on constraints

[8] These incentives exist because there is neither a cost to creating congestion, nor a benefit from relieving it, through the submission of base schedules. In the California ISO day-ahead market, by contrast, those who would congest scarce transmission capacity in this manner would have to pay for it in the Integrated Forward Market (IFM). Such a strategy is possible, for instance using virtual bids, but its profitability depends on the difference between forward and real-time prices. In contrast, in the SPP, no day-ahead prices are paid, so this strategy is much less risky, but it has to be implemented through transmission schedules associated with physical generation and load and for which transmission charges have been paid.

[9] "Energy Imbalance Market," Draft Final Proposal, *op. cit.*, p. 39.

[10] *Ibid.*, pp. 37-40.

[11] Southwest Power Pool, EIS Market Protocols, Revision 35.0, Section 6.8.6.

within the PacifiCorp BAAs are left for PacifiCorp to resolve. PacifiCorp may be able to manage these incentives, and perhaps apply rules to limit strategic submission of base schedules, under the terms of its Open Access Transmission Tariff.

There is, however, one feature of the proposed initial CAISO design relating to base schedules that differs materially from the SPP design. This is the use of two independent processes for awarding forward schedules on the California ISO grid and the EIM BAA grid. This design will work well if day-ahead market schedules on the California ISO grid have little if any impact on binding transmission constraints within the EIM BAAs and, reciprocally, if base schedules on the EIM BAA grids have negligible effect on binding constraints in the California ISO grid. This may not be the case, however, which gives rise to the potential for real-time congestion rent shortfalls from two sources.

Sources of Potential Rent Shortfalls of Real-Time Congestion Rent. The first source of potential shortfalls is as follows. If injections and withdrawals on the California ISO grid affect EIM balancing authority transmission constraints that are likely to bind at a material shadow price in real-time, California ISO market participants will likely find it profitable to submit physical and virtual schedules in the day-ahead market that create flows on these EIM BAA transmission constraints. This behavior would potentially be profitable because the market participant would settle its deviations against these day-ahead market schedules at real-time prices that would reflect the shadow price of the binding EIM BAA constraint, obtaining a profit that equals the flow deviation on the constrained line times the shadow price (net of any other cost due to the deviation). Under the current EIM design, transmission constraints within the EIM BAA would not be enforced in the California ISO day-ahead market, and the charges for submitting such physical and virtual transactions are small. Hence, if material interactions exist between schedules on the California ISO grid and the EIM BAA transmission constraints, there could be large aggregate flows created by transactions that (a) would not flow in real-time but (b) would be designed to receive real-time congestion payments. This would give rise to significant costs shifts and congestion rent shortfalls if they were to be settled at real-time prices.[12]

The potential for large cost shifts and/or congestion rent shortfalls is a particular concern with respect to virtual transactions. Virtual bidders may, in at least some instances, be able to identify a combination of virtual demand and supply bids on the California ISO grid that create material flows on the targeted transmission constraint within the EIM BAA, while creating little if any flows on constraints within the California ISO that would be enforced in the day-ahead market.

California ISO market participants would also have an incentive to submit physical generation schedules in the day-ahead market that would not flow in real-time but would be dispatched

[12] This behavior and its economic impact can be viewed as a generalization of the "dec" game that is played in zonal energy markets (such as the former California design), where constraints that bind in real-time are not recognized in the forward market. As a result, market players can schedule transactions that congest those constraints, and then be paid to relieve them; in the classic dec game, a generator is dispatched against the (high) zonal day-ahead price, and then can buy back the power at the (low) price at its location in real-time when the constraint is enforced. This is not an exercise of market power (and hence cannot be mitigated as such), but rather an exploitation of a market inconsistency that players of any size can profit from.

down at a profit in real-time because of their impact on binding transmission constraints within the EIM BAA.[13] It is likely that the magnitude of this behavior by physical generation resources will generally be limited by the capacity of the physical generation having such impacts, and could also be limited by the impact of these schedules on constraints within the California ISO grid that would be enforced in the day-ahead market. However, it is important to understand that the existence of these interactions and potential cost shifts and congestion rent shortfalls is a possibility, whether there could be material impacts from this type of bidding strategy by physical generation resources is an empirical question.

The actual outcome will depend both on (a) the magnitude of the impacts of California ISO schedules on PacifiCorp BAA transmission constraints and (b) the extent to which California ISO market participants have the ability to structure additional day-ahead market schedules that do not flow in real-time. It may be very unlikely that such schedules can be constructed and have a high impact. There would be no cost shift under EIM operation from physical transactions on the California ISO grid that impact transmission constraints in the PacifiCorp BAAs, as those flow impacts occur today and are simply part of the loop flows on the PacifiCorp system. There is only a potential cost shift to the extent that additional physical schedules would clear in the day-ahead market that do not flow today but will earn real-time congestion payments under the EIM. Conversely, there is a potential for offsetting benefits if some of the California physical schedules that flow in the current market and create loop flows on the PacifiCorp system would be dispatched down in the EIM, providing economic benefits to both the California ISO market participant (who would settle its forward schedule at a profit) and PacifiCorp transmission customers (who would be able to reduce flows on the constraint at lower cost than relying only on redispatch within the PacifiCorp BAA).

Hence, the point of our comments is *not* that the circumstances giving rise to cost shifts and or congestion rent shortfalls are particularly likely. Rather, our conclusion is that it is possible that those circumstances will exist at some locations and if they do, market participants will have an incentive to take advantage of those circumstances. Thus, we conclude that there is a potential for substantial cost shifts or congestion rent shortfalls that arise from physical schedules that impact binding constraints on the EIM BAA transmission grid, but that there is also a likelihood of the reverse: no material cost shifts or congestion rent shortfalls.

The second of the two sources of real-time congestion rent shortfalls is the possibility that the final base schedules within the EIM BAA would create greater flows on binding California ISO transmission constraints than were accounted for when running the California ISO day-ahead market. If these flows resulting from EIM BAA schedules are larger than those modeled in clearing the California day-ahead market, then there is a potential for the combination of the final base schedules and day-ahead market schedules to yield flows in excess of the transfer limit. This will give rise to congestion rent shortfalls on the California ISO transmission system if the transmission constraint binds in real-time.

[13] As indicated in the previous footnote, this is a version of the familiar "dec" game from zonal day-ahead market designs, such as the pre-MRTU California design.

Elements of the EIM Design That Address Potential Real-Time Congestion Rent Shortfalls. Two elements of the EIM design address the potential for congestion rent shortfalls arising from the interregional congestion impacts just discussed. First, the EIM market rules would address the first potential source of congestion rent shortfalls by allocating to the California ISO all congestion rent shortfalls on the EIM transmission system that are due to the net impact of virtual demand and supply schedules in the California ISO day-ahead market on transmission constraints within the EIM BAAs. The ISO would in turn allocate these shortfalls to the virtual traders whose transactions accounted for the flows that contributed to the infeasibility. Under the proposed design, payments to virtual bidders would be reduced dollar for dollar to the extent that net payments to virtual traders contributed to a congestion rent shortfall on a given transmission constraint.[14] Hence, no congestion rent shortfalls due to virtual bids in the California market impacting transmission constraints in the EIM BAAs will be borne by transmission customers within the EIM BAAs. Any such congestion rent shortfalls will be made up by those California ISO transmission customers whose virtual bids impacted the transmission constraints within the EIM BAA.

The second element addressing the potential shortfalls is that the California ISO will model its best assessment of EIM BAA base schedules in running the day-ahead market. This will not avoid all congestion rent shortfalls because the final schedules can differ from those modeled day-ahead, but this will allow the California ISO to avoid consistent large congestion rent shortfalls. However, it will not be sufficient to avoid costs shifts if EIM BAA market participants are able to submit adjusted base schedules that overstate their actual use of the California ISO transmission systems.

In addition, the EIM market rules will allocate all remaining congestion rent shortfalls on constraints within the EIM BAA (i.e., congestion rent shortfalls not due to virtual bids in the California ISO day-ahead market) to the real-time congestion balancing account for the EIM BAA, with those costs borne by transmission customers of that BAA. Hence, California ISO transmission customers will not be exposed to congestion rent shortfalls arising from a combination of base schedules and California ISO day-ahead market physical schedules that cause infeasible flows on transmission constraints within the EIM BAA.

These two elements of the EIM design should limit the overall magnitude of congestion rent shortfalls due to infeasible forward schedules and should also limit the impact of congestion rent shortfalls on California ISO transmission customers. Unfortunately, these elements of the design cannot address the fundamental source of the congestion rent shortfalls (the failure to model constraints in the EIM BAAs in the day-ahead market together with the incentive of EIM BAA transmission customers to submit base schedules with larger impacts on binding transmission constraints in the California ISO system). Nor will the design completely eliminate congestion rent shortfalls due to a combination of infeasible day-ahead market and base schedules. In addition, while some elements of the design that avoid congestion rent shortfalls will also reduce cost shifting, there is a potential for cost shifting among transmission customers that is not associated with congestion rent shortfalls, as discussed below.

[14] "Energy Imbalance Market," Draft Final Proposal, *op. cit.*, pp. 68-72.

Limitations of the EIM Design in Addressing Congestion Rent Shortfalls. We now highlight four specific limitations of the current EIM design as it relates to cost shifts and congestion rent shortfalls due to forward schedules impacting binding constraints within the California ISO or EIM BAA. These limitations are recognized by the California ISO and are the motivation for the ISO having the ability to take additional steps to address them if they appear likely to be relevant in actual EIM operation.

First, the design does not address possible congestion rent shortfalls due to physical schedules in the California ISO day-ahead market that impact EIM BAA constraints.[15] On one hand, physical schedules associated with typical real-time use of the California ISO transmission system should not produce any material congestion rent shortfalls because this usage occurs today and PacifiCorp is able to manage its impact. However, as explained above, the potential for congestion rent shortfalls and cost shifts will instead arise to the extent that California market participants are able to design physical schedules in the California ISO day-ahead market schedules that do not reflect actual real-time use of the California ISO transmission system but are instead designed to cause material flows on transmission constraints within the EIM BAA that will bind at significant shadow prices in real-time. These costs would be assigned to the real-time congestion balancing account for the EIM BAA, and they would be borne by transmission customers of that BAA, not California ISO transmission customers. However, the EIM will not work if EIM BAA participants have to bear undue uplift costs and associated cost shifts.

It is possible that this limitation will turn out to be inconsequential in practice, because physical schedules in the California ISO day-ahead market might have little if any impact on transmission constraints in the EIM BAAs. Although it is anticipated that this will likely be the general situation, it will not necessarily always be the case. In addition, individual instances in which physical schedules in the California day-ahead market create flows on transmission constraints within the EIM BAA will not give rise to material congestion rent shortfalls or cost shifts if there is little ability to inflate day-ahead schedules above the actual typical real-time physical flows, but this also will not necessarily always be the case.

Even if this turns out to generally be true for generation resources located within the California ISO, it is possible that there will be physical schedules at selected California ISO proxy buses for interchange schedules can have substantial impacts on transmission constraints within the EIM BAA, so that day-ahead interchange schedules that do not flow in real-time could be combined with offsetting virtual bids on the California ISO system to take advantage of the proposed design.[16] However, it is also not certain that there would be such a potential. Any such

[15] The EIM design does not allocate a portion of congestion rent shortfalls to physical schedules that are dispatched down because this would convert the day-ahead schedules into, effect, "use it or lose it" schedules, and thereby reduce the incentive for suppliers to participate in the EIM real-time dispatch.

[16] The proposed rules regarding the settlement of virtual bids would not affect the offsetting virtual transactions because the offsetting transactions would not be designed to create any material flows over the EIM balancing authority constraint relative to the reference bus. Flows over the constraint within the EIM BAA would be created by the physical bids at interchange pricing points. The purpose of the offsetting virtual transaction would not be to create profitable flows over binding transmission constraints but to cause the overall transaction to have no impact on the aggregate supply demand balance.

interchange transactions can be scheduled today and it may turn out that their impact on the PacifiCorp system is limited by contract path scheduling limits.

The second limitation is as follows. If the base schedules of the EIM BAA create material flows on California ISO transmission constraints that are binding in real-time, the intent is to account for those flows in the California ISO day-ahead market. This would avoid real-time congestion rent shortfalls that would be borne by California ISO transmission customers. However, to the extent that some base schedules are structured to create flows on the California ISO transmission constraints that exceed the actual real-time usage, the EIM congestion settlement design will entail California ISO transmission customers paying EIM BAA transmission customers for the real-time use of the California ISO transmission system. This will not cause congestion rent shortfalls but will yield a cost shift, reducing the benefits to California ISO transmission customers from participation in the EIM.

As with the first limitation, it is possible that the inter-BAA congestion impacts would be so slight or the opportunities to structure base schedules that have this effect so limited that the potential cost shifting impact will be *de minimis*.[17] These are empirical questions that we have not analyzed.

Turning to the third limitation, if a material proportion of the real-time flows on a binding transmission constraint within the EIM BAA was due to the EIM real-time dispatch itself, and hence would not be reflected in EIM base schedules, there might be no infeasibility of day-ahead schedules and base schedules and no congestion rent shortfalls. However, there could be cost shifts from EIM BAA rate payers to bidders in the California ISO day-ahead market. In particular, it could be profitable to submit virtual and physical bids in the California ISO day-ahead market that would create flows on EIM BAA transmission constraints in real-time. If there were no congestion rent shortfalls on the real-time constraints, virtual bidders would receive full payment.[18] The EIM settlement system would then entail EIM BAA transmission customers paying California ISO transmission customers for the real-time use of the EIM BAA transmission system and would shift congestion rents from EIM BAA ratepayers to virtual and physical schedules in the California ISO. As noted above, while these costs would be assigned to the real-time congestion balancing account for the EIM BAA with those costs borne by transmission customers of that BAA, and not borne by California ISO transmission customers, these kinds of cost shifts will reduce the benefits from EIM participation and undermine the long-run success of the EIM.

A fourth limitation of a design that does not account for impacts on EIM BAA constraints in the California ISO day-ahead market that is unrelated to cost shifts or congestion rent shortfalls is

[17] It is possible that the cost of purchasing transmission and the rules used to maintain feasibility of transmission schedules on transmission constraints within the EIM BAA will effectively preclude material impacts from schedules designed to benefit from their impact on California ISO transmission constraints

[18] It could also be the case that virtual transactions could be constructed that are so large that they give rise to congestion rent shortfalls, despite physical schedules that are below the limit. In this case, the congestion rent shortfalls would be borne by virtual bidders but there would still be a cost shift.

that generators within the California ISO whose output provides counterflow over EIM BAA constraints would have an incentive to withhold their output from the day-ahead market because their output would be systematically undervalued in the day-ahead market relative to real-time. This is, of course, analogous to the problem in zonal energy pricing systems where generation in load pockets can be discouraged from bidding day-ahead because it would prefer to obtain the higher "inc" price in real-time.

As we explained above, none of these four limitations will be a significant issue unless there are locations at which injections and withdrawals on the California ISO transmission system materially impact binding constraints on the PacifiCorp system or, symmetrically, at which injections/withdrawals on the PacifiCorp system significantly affect binding constraints in the California system. And even if such interactions exist, the potential for material cost shifts and/or congestion rent shortfalls depends on the ability of market participants to inflate their forward schedules at those locations. While we do not at present know whether these conditions will be satisfied at any locations on the California ISO or PacifiCorp grids, the California ISO will be able to empirically assess these possibilities in testing once the full network model has been developed and implemented. Hence, the California ISO should know long before EIM go-live whether there is a potential for material cost shifts or congestion rent shortfalls associated with the PacifiCorp EIM and, if so, take steps to address the particular problems identified at the specific locations where they could exist.

A need to address these kind of inter-BAA congestion impacts may not arise with the initial EIM implementation as it is possible that the interregional congestion impacts will be so small between the California ISO and the PacifiCorp BAAs that the proposed design will operate with little or no congestion rent shortfalls, cost shifts or impact on generator bidding incentives arising from these types of interactions. But this may not be the case. It is possible that as the network model is developed and tested for the EIM real-time dispatch, it will become apparent that certain schedules will have material impacts on binding transmission constraints in the other region. It may be that between the constraints imposed by the proposed cost allocation rules for virtual bids that contribute to congestion rent shortfalls on EIM BAA constraints and resource specific limits on physical schedules, there may be little opportunity to take advantage of these situations, but that also may not be the case. If market participants identify such a "money pump" and have the means to take advantage of it, one should expect a rapid increase in transactions designed to exploit it as was the case with the "dec game" in California and in Texas.

We do not recommend a particular means for resolving any such situations because the best way to resolve a particular situation in the short-run will likely depend on the individual circumstances of these interactions, which we cannot foresee. The implementation of the EIM with PacifiCorp is hopefully only the first step in the development of a broader EIM in the west coordinated by the California ISO. While the interactions between transactions and constraints on the PacifiCorp and California ISO transmission systems may be small, this will likely not always be the case as the EIM expands over time to include additional BAAs.

Possible General Solutions to the Problems of Network Interactions Leading to Congestion Rent Shortfalls and/or Cost Shifts. Fortunately these problems have conceptually easy and

economically rational solutions, although implementation may require nontrivial software modifications. The current design is acceptable as a starting point, but the California ISO will need to eventually extend the EIM design to address the issues of external constraints and seams problems in the manner that they have, for several years, been addressed by eastern ISOs such as the Mid-continent ISO and PJM, and more recently between PJM and the New York ISO. This is to either (a) impose limits in the day-ahead market on the allowable flows on external transmission constraints[19,20] or (b) use estimates of shadow prices to "cost out" flows on the external constraint in the day-ahead market so as to align day-ahead market and real-time prices and flows. [21] Such designs can be used to avoid the cost shifts associated with payments for reducing flows from forward schedules on binding transmission constraints in real-time, and would ensure that day-ahead nodal prices and schedules within California account for the impact that intra-California day-ahead schedules have on congested transmission lines within the EIM BAA.

A design in which transmission constraints within the EIM BAA are taken into account in the California ISO day-ahead market would address several other limitations of the proposed design, contributing to (a) improving market efficiency if the congestion interactions are material and (b) achieving consistency between the day-ahead and real-time schedules and prices within California.[22]

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[19] For a discussion of the determination of these forward flow limits between PJM and MISO, see Joint Operating Agreement Between the Midwest Independent Transmission System Operator, Inc. and PJM Interconnection, L.L.C,, December 11, 2008, Attachment 3, Interregional Coordination Process, Version 2.0, Section 4, Day-Ahead Market Coordination. For a discussion of the determination of M2M entitlements between PJM and the New York ISO, see New York ISO Dec. 30, 2011 filing in Docket ER08-1281 and ER12 -718-000, NYISO & PJM Market to Market Coordination Schedule, Section 6.

[20] There is a diversity of opinion among the MSC members as to whether such flow limits on EIM constraints should be based on allocated physical capacity on these constraints or whether such limits should also reflect expected counterflow procured from EIM resources in the real-time market. On one hand, flow limits based only on allocated physical capacity may be too conservative and prevent scheduling day-ahead transactions in the CAISO BAA that can be made feasible in real time through procurement of inexpensive counterflow provided by EIM resources. On the other hand, scheduling such transactions based on the assumed existence of inexpensive counterflow necessarily implies real-time congestion rent shortfalls if the constraint binds in real-time and the California ISO will have no assurance that the marginal counterflow will be inexpensive.

[21] This approach would also require a set of entitlements to govern payments between the California ISO and the EIM BAA in order to avoid cost shifts.

[22] In should be noted that imposing an estimated shadow price on flows over constraint lines outside California is different from what has become known as "constraint relaxation" in which the market software imposes high penalty values on flows in excess of physical constraints. In the former case, the shadow price can be interpreted as an estimate of the cost of providing counterflow and maintaining feasibility, while in the latter case, the penalty is designed to cap the cost of counterflow and hence relax the constraint to limit the use of counterflow produced by remote resources with very small shift factors on the constraint. Furthermore, it is a mathematical fact that if all flows created by transactions inside California on transmission lines outside of California are correctly priced in the California IFM using the true shadow prices (that would result from optimization of the integrated system) and added to the California total dispatch cost (i.e., the IFM objective function), then the optimization of the California

The California ISO has the ability, in theory, to eliminate the potential for excessive congestion rent shortfalls or wealth transfers due to the impact of its day-ahead market schedules on EIM BAA constraints by either enforcing a flow constraint or an estimated shadow price on flows over these constraints in its day-ahead market, with the flow constraints or shadow prices set to reflect the typical real-time impact of California ISO schedules on the EIM BAA constraint that would not require real-time redispatch to accommodate. Imposing such "external" flow constraints in the day-ahead market clearing process would cause these flow constraints to bind in the day-ahead market (thus reflecting the real-time transmission constraints) if virtual bids or excess physical schedules submitted in the California day-ahead market create substantial flows on congested transmission lines in the EIM BAA. If instead an estimated shadow price is used to penalize flows in the objective function, it would incent market participants in the California ISO system, and the day-ahead market software itself, to consider the real-time cost impacts of day-ahead schedules.

The EIM design could similarly avoid the congestion rent shortfalls or cost shifts arising from EIM BAA base schedules designed to impact binding transmission constraints on the California ISO grid by enforcing a flow constraint on California ISO transmission lines in accepting base schedules.

Virtual Bidding Issues. Some stakeholders have expressed concern with the potential impacts of the design for assigning congestion rent shortfalls to virtual bids in the California ISO day-ahead market. The proposed allocation is broad and could deter market participants from submitting any virtual bids at locations that significantly impact constraints in the EIM BAAs.[23] However, there is no way to modify or narrow the scope of the assignment without creating the opportunity for bidding strategies tailored to take account of the modified design. While these provisions will not be necessary if it turns out that schedules on the California ISO grid do not have material impacts on binding transmission constraints on the EIM BAA transmission system, these provisions will also have no impact on virtual bidders in that circumstance.

Some stakeholders have suggested that virtual bids that create counterflow on transmission constraints in the EIM BAA transmission grid also not be charged for the real-time deviation, the

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dispatch would yield the same California schedules as the integrated optimization (under certain mathematical assumptions concerning convexity). Consequently, it is reasonable to optimize the day-ahead California schedules by augmenting the California dispatch cost function with a term representing the cost of external flows priced at the real-time shadow price estimates on the respective lines. If this shadow price approach is adopted, it would require additional rules regarding the allocation of the congestion rents in the IFM to avoid cost shifting.

[23] The cost assignment to virtuals is not profit neutral. There can be situations in which a constraint binds on the California ISO transmission system in the day-ahead market, then a more limiting constraint on the EIM balancing authority system binds in real-time. In this kind of circumstance the design for assigning real-time congestion rent shortfalls to virtual bids can result in the virtual bid paying a congestion charge in the day-ahead market but not having any congestion reflected in its real-time revenues. This cannot be avoided by modifying the design. Modifications that avoid this outcome simply open the door to other strategies for exploiting the failure to enforce the EIM BAA constraints in the day-ahead market that could result in large congestion rent shortfalls.

reverse of not being paid for the real-time deviation for virtual bids that create flows on the transmission constraints. While there are circumstances in which such a policy would have the intended effects, there are other circumstances in which it would open the door to bidding strategies that could create large congestion rent shortfalls.

For example, with this rule virtual bidders could identify a location in the California ISO system that has two effects:

- virtual supply day-head at that location provides counterflow to a California ISO transmission constraint that binds day-ahead, raising the price paid for virtual supply at that location, but
- that same virtual supply impacts a constraint in the EIM BAA that is more restrictive than the constraint that binds on the California ISO transmission system, but binds instead in real-time.

With such a rule for not charging for real-time deviations, the virtual bid would be paid for relieving congestion in the day-ahead market and then not charged for failing to provide it in real-time when a different constraint binds. While these are special situations, virtual bidders will be able to identify locations at which these circumstances exist and take advantage of them with their bids.

Hence, there are no tweaks to the California ISO design that can narrow its impacts on virtual bids without opening the way for bidding strategies designed to exploit the failure to enforce EIM BAA constraints in some manner in the California ISO day-ahead market. The only real alternative is to address the core problem and take account of the constraints in some manner in the California ISO day-ahead market. That will be necessary in the long-run in any case as the EIM is expanded to BAAs other than PacifiCorp.

B. Greenhouse Gas Pricing

Another important element of the California ISO EIM design is the way it accounts for the AB32 California Air Resources Board (CARB) greenhouse gas emissions pricing program in EIM real-time dispatch. This element of the EIM design is unique to the California ISO because no other ISO faces similar issues. The EIM design accounts for GHG emission costs for power dispatched to serve California ISO load directly in the objective function of the real-time economic dispatch and directly in real-time prices. While this design is distinctive, it is carefully structured and provides efficient real-time price signals while honoring the intent of the CARB GHG emissions pricing program within California and not exporting the California pricing program to EIM BAAs outside California, except to the extent that generation in those BAAs is dispatched to support exports to meet California load.[24]

[24] In addition to being reviewed by California ISO staff and the Market Surveillance Committee, the EIM GHG pricing design was reviewed by William Hogan, "CAISO Energy Imbalance Market Straw Proposal: Comments" (www.whogan.com) who concluded "The basic proposal is internally consistent and would not upset either incentives at the margin or treatment of related FTRs" (*ibid.*, p.3).

The dual pricing design for greenhouse gas allowances will set efficient and consistent prices for California and the EIM BAAs, in which generation within California and within EIM BAAs will be dispatched consistently with their bids and the prices at their location. In other words, at any given point in time, the shadow price on the GHG regulation reflects the (bid – in) emissions costs of the generation resource assigned to meet additional California consumption, as long as as-bid costs are reflective of true emissions costs, both inside and outside of California.

Moreover, by reflecting GHG costs in market prices, rather than having them manifested in uplift costs, the design sends an efficient price signal for the supply of low emission generation and avoids the potential for market participants to develop bidding strategies that exploit non-market clearing prices to receive large uplift payments. A design in which GHG costs are not reflected in market prices but instead shifted into uplift would not provide an efficient price signal in California, would not minimize the cost of meeting California load, and would likely open the door for inefficient bidding strategies that would yield inflated uplift costs for California power consumers.

There is more than one approach that could be used to determine which units (and associated emissions cost) dispatched to meet overall EIM load should be deemed delivered to California. The approach proposed for the EIM dispatch approximates the outcome if units were self-selecting to serve California load or load somewhere else in the EIM, and therefore is a practical and realistic means for determining the GHG obligations. It is important to understand that an alternative that may at first glance seem equally reasonable – allocating imports pro-rata amongst all generation that is incremented upwards in the EIM– would not in fact be workable. This is because some of the generation that would be dispatched in the EIM market to serve outside load may in fact have emissions costs well in excess of the California GHG component. If there were no incremental need outside of CAISO, such generation would not be dispatched. But when incremental needs exist both inside and outside of CAISO, the dispatch will also be "mixed" in the sense of GHG cost prioritization. The allocation of these costs needs to reflect this reality.

An important improvement in the Draft Final Proposal, relative to the initial California ISO design for GHG dispatch, is that it allows market participants to submit bid-based GHG emission cost adders that would govern the dispatch of their resources to meet California load.[25] Sellers external to the EIM implicitly include a bid-based GHG emission cost adder in their offers for imports into California in the day-ahead market and HASP today, and these bundled offers can set the California ISO day-ahead market and HASP prices. A design in which resources in the EIM BAA are able to submit bid-based GHG emission cost adders in their dispatch offers enables them to be dispatched consistent with bundled offers, while allowing the GHG emission cost adder to only be reflected in the price of power exported to California.

Some stakeholders have expressed a concern that resources in the EIM BAA might submit excessive GHG emission cost adders, inflating prices in California. The unusual circumstance of differing environmental regulations creates the need for plants to offer two separate prices – one reflecting their incremental cost if they are dispatched to serve California load (and hence incur GHG emission costs) and reflecting their incremental cost if they are dispatched to serve load

[25] "Energy Imbalance Market," Draft Final Proposal, *op. cit.*, pp. 84, 87, and 96.

elsewhere in the EIM. This design does in effect allow offers to vary depending upon the location of the buyer whose load they are deemed to be dispatched to meet. We have a few observations to add to this, however.

First, this ability to offer separate prices depending on whether a resource is deemed dispatched to meet California load or load elsewhere in the WECC is conceptually rooted in the fact that the *costs* of serving load in California will in fact be different, in general. The current proposal would not limit the differences in offers to a pre-determined administrative estimate of the difference in costs, however. Thus, the potential impact of this ability under the GHG regulations for suppliers to offer supply at different prices depends upon the competitiveness of supply offers into California. If the import market into CAISO were fully competitive, the *technical* ability to price-discriminate beyond the cost differences would be made irrelevant by competition. Thus, any potential impacts of the GHG emission cost regulations on the ability to price discriminate between California and other markets depends upon the competitiveness of the import market.

Second, even if the ability to price-discriminate between California and other destinations is present under the GHG regulations, the impacts do not necessarily reduce efficiency. To the extent that assets outside of California would only be willing to provide imports to California if they were able to command a premium price, the price difference will result in more imports than would otherwise be the case.

A third key point is the ability to offer separate prices for power sold into California is not an element of the EIM design but of the GHG regulations and is already the case. Currently all resources outside of California are already able to set the price at which they are willing to offer imports into California at any level they want in the day-ahead and hour-ahead time frames. In RTD, there are virtually no offers from resources external to California because of the current lack of integration of the markets.

Therefore, we conclude that the California ISO design increases the supply of resources available to California relative to the current system and will result in a lower, not higher marginal GHG emission costs. The fundamental point is that any supplier that does not want to sell power into the CAISO under the EIM design, or wants to offer supply only at an extreme price, can already do so today simply by not offering to sell power into the CAISO except at a high price.

C. Transition Paths

The third aspect of the EIM design that we address concerns the best way to implement the EIM.

The California ISO proposes to stage the implementation of the EIM in two ways. First, the CAISO proposes to stagger its initial implementation of the EIM to come roughly six months after 15 minute scheduling and settlements are implemented on the California ISO system (FERC Order 764 compliance). This provides the California ISO time to address any issues that arise with the initial implementation of 15 minute scheduling and pricing.

Second, the initial EIM implementation will be limited to the PacifiCorp BAAs with what we understand will be only roughly 100 megawatts of transfer capability available between the California ISO and the PacifiCorp BAAs. This will enable the California ISO to identify and correct implementation issues that are not identified in testing, and for operators to gain experience with the EIM design on a system in which relatively little generation is being dispatched between the California ISO and the EIM BAAs.

The California ISO phase-in design avoids spending resources on throwaway software or implementation of interim designs that will require unproductive diversion of CAISO resources to build and fix problems in the interim designs.

There is a potential for the California ISO to add some additional transition steps to its current design if outcomes during testing suggest that such staging would be desirable. For example, if as a result of software testing there are uncertainties at the time EIM goes live regarding the functioning of the interregional congestion pricing embedded in the EIM pricing software, a further transition step could be added. This step would initially operate the EIM market for a short period with 0 MW transfer capability between the California ISO and the PacifiCorp BAA. This would enable the California ISO to confirm that the interregional congestion pricing is operating as intended before beginning to dispatch generation between the BAAs in real-time.

Similarly, if there are uncertainties at the time of EIM go-live regarding issues relating to the operation of the interregional dispatch that are identified during testing, an additional transition step could be provided by starting with an initial transfer capability that is even less than 100 megawatts and if no problems are observed, gradually increasing the transfer capability up to 100 megawatts over a day or so.

A potential advantage of such a staging is that running the market with zero transfer capability could make it easier to diagnose some kinds of software issue affecting congestion pricing if there are no changes in interchange. It is also possible that limiting the amount of interchange could limit the financial impact of a software issue while it is being diagnosed and corrected. However, even if we restrict the net flow between the systems to zero there can still be significant network interactions and cross impacts on congestion that can lead to the problems discussed earlier. Furthermore, these staging approaches could also cut the other way, making it harder to diagnose the existence of a particular software issue because the scheduling limit is always binding. Hence whether either of these transition stages would be desirable depends on the kind of software issues observed during development and testing, and whether their identification would be aided or hindered by either of these steps.

If there are reasons for concern with software issues identified during testing whose identification would benefit from these kind of additional transition steps, these approaches could be utilized without the cost and implementation risk of developing other software.

However, there is no need to decide upon implementing such additional transition steps until and unless issues are identified during testing that make such a course of action worthwhile. In any case, any such additional transition steps should have a duration of days, not weeks or months, unless issues are identified. Running the EIM market in such an extended transition period

would entail incurring the costs of EIM operation while foregoing most of the benefits, which will raise consumer costs. Therefore, this should not be done unless there is a need for it based on software issues observed during development or testing.

If software issues emerge during development and testing over the next year whose diagnosis could be aided by such transition steps, these options can be considered as the implementation date approaches.

Finally, the ISO intends to assess the potential for excessive congestion rent shortfalls or cost shifts during testing prior to go-live, and will incorporate functionality for one potential solution in its market systems that it could potentially activate.

D. Market Power Mitigation

Introduction. Under the EIM framework, load serving entities located within the PacifiCorp BAAs and the CAISO, as well as other EIM BAAs in the future, will have more options for purchasing power than they do today. As a general rule, that will mean that there will be more, not less competition, meaning that there will be less, not more, potential for the profitable exercise of market power.[26]

However, in evaluating the potential for the exercise of market power, we also need to take into account other changes accompanying EIM implementation that may create the potential for the exercise of market power in ways that are not relevant today. In particular, in the case of PacifiCorp, it is planned that implementation of the EIM will coincide with changes in the Open Access Transmission Tariff (OATT) under which transmission and balancing services are provided by PacifiCorp. Generally speaking, by transitioning to a real-time balancing framework based on spot markets, the cost of providing balancing services will improve by being reflected in the prices determined in the EIM real-time spot market. In general this should improve efficiency, but there are circumstances in which these changes could in theory create opportunities for the exercise of market power that did not exist under the previous OATT terms.

We focus on three issues. The first concerns the allocation of congestion costs under Sections 33.3 and 33.4 of PacifiCorp's OATT and the potential for these charges to be inflated through the exercise of locational market power on constraints within the PacifiCorp BAAs. The second concerns the pricing of energy for energy imbalance and generator imbalance services under Schedules 4 and 9 of the PacifiCorp OATT, which would be based on EIM locational marginal pricing. There is potential for these prices to be inflated by the exercise of locational market power either on constraints within or connecting into the PacifiCorp BAAs. The third issue concerns the potential for inflation of the prices used to settle economic redispatch of resources

[26] In theory, it is possible that the linking of market areas will result in more effective exercise of market power and decreases in market efficiency (see the two market analysis in E. Sauma and S. Oren, "Proactive Planning and Valuation of Transmission Investments in Restructured Electricity Markets," *J. Regulatory Economics*, Vol. 30 (2006), pp. 261-290). However, the demand and cost conditions that lead to that result are highly unusual; under randomly selected demand and cost functions, the probability that the linking of market areas will decrease efficiency has only a very small probability in that two market model.

that support base schedules. This inflation can occur through the exercise of locational market power either on constraints within the PacifiCorp BAAs or into those BAAs.

Each of these concerns is discussed in some detail below. The EIM design will address the potential for the exercise of market power on constraints internal to the EIM BAAs by applying the California three pivotal supplier test to constraints that are binding in RTUC using the same local market power mitigation methodology that is presently applied to constraints within the California ISO.[27] There is no provision in the published Draft Final Proposal for the application of the three pivotal supplier test when the scheduling limit between the PacifiCorp BAAs or when the scheduling limit between PacifiCorp West and the California ISO are binding in RTUC or in RTD.[28] However, it is our understanding that it has been agreed that the California ISO's locational market power mitigation will also be applied when the scheduling limits between the California ISO and PacifiCorp or between the PacifiCorp BAAs are binding.[29]

Issue 1: Cost of Relieving Transmission Constraints. The first concern relates to allocation of congestion costs under the PacifiCorp OATT. Under the current OATT terms for network transmission service within the Pacific Corp BAAs, there are provisions for the transmission provider to redispatch network resources, including PacifiCorp's resources, on a least-cost basis to manage congestion. The OATT also provides for any such redispatch costs to be assigned proportionately to network customers based on hourly load at the monthly peak.[30]

It is not clear to us how these provisions will be applied under the EIM.[31] To the extent that some component of real-time redispatch costs (including congestion rent shortfalls) are based on EIM real-time prices, it will be important to make sure that those real-time prices are not unduly impacted by the exercise of market power within the PacifiCorp BAAs. For example, while EIM participants will be hedged against real-time congestion charges in meeting their load through their base schedules, they would still be exposed to excessive charges for congestion if base schedules are collectively infeasible and the redispatch costs needed to support the base schedules are inflated by potentially extreme offer prices by resources possessing locational market power.

While we need to understand more clearly what is intended, it appears that the EIM proposal will address the potential for inflated congestion costs due to the exercise of locational market power within EIM BAAs. The application of the CAISO local market power mitigation procedure will first use the three pivotal supplier test to identify situations in which there is a potential for the exercise of locational market power that could inflate these redispatch costs, followed by application of the current mitigation design to those offers.

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[27] See California ISO, "Energy Imbalance Market," Draft Final Proposal, *op. cit.*, pp. 27-28.

[28] *Ibid.*, p. 27, "Real-time LMPM procedures will be applied separately within each BAA…".

[29] Department of Market Monitoring Comments, *op. cit.*, Footnote 2.

[30] PacifiCorp Open Access Transmission Tariff, Sections 33.3 and 33.4, pp. 107-108.

[31] This subject does not appear to be covered in "PacifiCorp's Energy Imbalance Market Entity Proposal," September 13, 2013.

Issue 2: Energy and Generator Imbalance Service. PacifiCorp proposes to price Energy Imbalance Service and Generator Imbalance Service under its OATT using the EIM real-time prices.[32] In the case of load serving entities within the PacifiCorp BAAs, this imbalance energy is the difference between (a) their real-time load and (b) the sum of their generation output and scheduled interchange. In the case of generators located within the PacifiCorp BAAs, it is instead the difference between their schedule and their actual real-time output. For example, a wind generator located in PacifiCorp West might be selling power to a customer located in another balancing authority area using an hourly transaction. It would buy and sell imbalance energy from PacifiCorp to make up the difference between its schedule and its actual real-time output.

At present, the PacifiCorp OATT provides for monthly netting of deviations within 2 megawatts or 1.5% of schedule. The monthly total is settled financially using an hourly proxy price based on day-ahead bilateral prices at four trading points: COB, Four Corners, Mid-C and Palo Verde.[33] Deviations outside this band are settled at 110 or 125% of the hourly proxy for under scheduling and at 90% and 75% of the hourly proxy for over-scheduling. It is not clear whether the provisions for deviations outside the band will continue to be in effect or whether they will be replaced by the penalties under the EIM design for over- and under-scheduling. The over- and under-scheduling charges proposed by the California ISO have wider bands (5 and 10%, rather than 1.5% and 7.5%) but higher penalties (125% and 200% for under-scheduling, versus PacifiCorp's 110 and 125%, and 75% and 50% for overscheduling, versus PacifiCorp's 90% and 75%).[34]

As noted above, it is proposed that under the EIM, this index-based pricing would be replaced with market-based pricing, with imbalance energy priced in the California ISO EIM market at nodal prices (locational marginal prices, LMPs). In a competitive market, this change would enhance efficiency as it would much better relate the price of imbalance energy to its actual cost. While the current index-based method is not an reasonable approximation given the lack of real-time spot prices, it is based on day-ahead rather than real-time prices and on flat 16 hour average on-peak prices and 8 hour off-peak prices. However, because the current indices are based on multi-hour block transaction prices at locations external to the PacifiCorp transmission system, they are not subject to any possible exercise of locational market power by PacifiCorp. This will not necessarily be the case if these index prices are replaced by EIM LMP prices within the PacifiCorp BAAs.

While resources within the PacifiCorp BAAs will have to compete with resources located in adjacent regions that can provide supply to support base schedules through hourly interchange transactions (and perhaps 15 minute transactions under FERC Order 764), this will not be the case in the time frame of the 5 minute real-time dispatch.[35] Within this shorter time frame, the

[32] See *ibid.*, Section X.3, pp. 27-28.

[33] See PacifiCorp Open Access Transmission Tariff, Schedule 4, pp. 209-210.

[34] See California ISO, "Energy Imbalance Market," Draft Final Proposal, *op. cit.*, pp. 38-40.

[35] The competitiveness of external resources in the 15 minute market depends on whether price-base offers that sink in the PacifiCorp BAAs will be considered by PacifiCorp in the 15 minute timeframe,

only resources available to meet deviations will be those located within the EIM, both those within the California ISO and those within the PacifiCorp BAAs.

The energy imbalance market can generally be presumed to be competitive in these 15 and 5 minute timeframes when the scheduling limits between the California ISO and the PacifiCorp BAAs are not binding, as imbalances within the PacifiCorp balancing authority areas could be met with generation within the California ISO as well as the local balancing authority area.[36] However, this presumption would not apply when the scheduling limits are binding. When the scheduling limit between the California ISO and PacifiCorp West is binding for imports into PacifiCorp West, the only resources able to meet upward load deviations (real-time load in excess of the hourly base schedule) will be resources within the PacifiCorp BAAs. Moreover, since it is our understanding that the EIM scheduling limit from PacifiCorp West into PacifiCorp East will apparently initially be zero, the only resources able to meet upward load deviations in PacifiCorp East will be resources located within that area (including those supporting export schedules into PacifiCorp West that could be dispatched down in real-time).

PacifiCorp's Triennial market power update, filed this past summer, shows 1708 megawatts of non-affiliate generating capacity in PacifiCorp East and 237 megawatts of non-affiliate generating capacity in PacifiCorp West.[37] While this is a substantial amount of generating capacity to cover the real-time deviations of relatively small amounts of non-native load in these BAAs,[38] the availability of this generation to be dispatched up in real time is unclear. For instance, we do not know how much of this generating capacity would be baseload generation that is typically fully committed to meet hour-ahead schedules, such as low-cost coal or run-of-river hydro, and how much would be typically available to incremented upwards.[39] It is also possible that some of this generation would be wind generation that could not be dispatched to meet imbalances.

While it is unclear whether there is enough capacity available for dispatch within the PacifiCorp BAAs to constrain the exercise of market power by PacifiCorp when the scheduling limits are binding, it is also uncertain whether it is likely that these import scheduling limits would often

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which we understand they are not intending to do. If that is the situation, resources from external regions could only compete in the hourly timeframe.

[36] There are two qualifications to this generalization. First, it is possible that the scheduling limit with the California ISO would be non-binding on imports but that other transmission constraints within the California ISO would limit the set of resources that could be dispatched on the margin to meet imbalances within the PacifiCorp balancing authority areas. Second, anytime that the GHG cost spread between the California ISO and the EIM balancing authority areas is large, the cost of imbalances met from generation within the California ISO would exceed the competitive price within the EIM balancing authority areas. Thus, even though imports from the California ISO would constrain the exercise of market power PacifiCorp within the PacifiCorp balancing authority areas, the GHG costs could render this a loose constraint.

[37] See Affidavit of Rodney Frame, Docket No. ER10-3246, Attachments 6 and 7, June 28, 2013.

[38] Wholesale peak load of 593 megawatts in PacifiCorp East and 721 megawatts in PacifiCorp West.

[39] We attempted to access the working papers to PacifiCorp's Triennial filing to see what these resources are, but could not obtain access to them as they are all non-public.

bind. PacifiCorp could in theory force the scheduling limits on imports to bind by raising its offer prices for its generation with the PacifiCorp BAAs. However, it is unclear whether it could plausibly be profitable for PacifiCorp to raise its offer prices so that these imports constraints would bind in order to sell a few megawatts of balancing energy at inflated prices. The factors that would tend to make such an attempt to exercise market power unprofitable are discussed below, first for PacifiCorp West, then for PacifiCorp East.

PacifiCorp West. In the case of PacifiCorp West, raising its offer prices enough to cause the scheduling limit on imports to bind would entail:

a) Foregoing any profits from using low cost generation within PacifiCorp West to support exports into the California ISO.
b) Replacing PacifiCorp generation within PacifiCorp West with roughly 100 megawatts of imports from the California ISO (plus paying the congestion rents, depending on who gets them, see item (d) below). This would be particularly expensive when the California ISO price spikes in real-time and PacifiCorp would buy 100 megawatts of power at that high price, with the price paid by PacifiCorp capped only by the high bids it submitted, instead of meeting 100-200 megawatts of its load with its own generation.
c) At times purchasing power to meet PacifiCorp imbalances from load serving entities within PacifiCorp West at the inflated price.
d) Generation of large real-time congestion rents on the scheduling limit between the CAISO and PacifiCorp, resulting from the high bidding strategy and congestion on imports into PacifiCorp. A crucial question is: who would get this money? If these congestion rents on the scheduling limit are distributed to EIM load on a load-ratio-share basis, PacifiCorp would be paying this premium to make the interface bind and most of the money would be flowing to CAISO transmission customers.[40] This cost would likely hugely swamp any revenues on a few megawatts of imbalance energy sold to others. It is hard to see how this could be profitable even with only 100 megawatts of scheduling capacity unless most or all of the congestion rents on the BAA scheduling limits flowed to PacifiCorp. In our opinion, the more transfer capability there is, the more hopelessly unprofitable such an attempt to exercise market power would be. However, at this point it has not been determined how real-time congestion rents on scheduling limit constraints between BAAs are intended to be allocated.

Would there be enough imbalance energy sales within the PacifiCorp BAAs for the increased profits on these sales to offset these other costs and foregone profits? One way to reduce the cost of this strategy for exercising market power would be to try to guess the CAISO price and set the PacifiCorp base schedules so that the 100 megawatt of power purchased would likely be cheaper than the PacifiCorp generation backed down. Another way to reduce the losses from this

[40] It does not appear that the Draft Final Proposal addresses the allocation of congestion rent shortfalls or surpluses on the scheduling limits between balancing authority areas, versus constraints within them. The discussion of the BAA real-time congestion balancing account consistently refers to "constraints in each BAA," see California ISO, "Energy Imbalance Market," Draft Final Proposal, *op. cit.*, Section 3.7.8.2, pp. 68-70.

strategy would be trying to anticipate when the CAISO price would likely be higher than PacifiCorp's costs and switch the high offer strategy off. It is not clear that either would be easy.

An evaluation of the potential for the exercise of market power in the supply of energy or generator imbalance services in PacifiCorp West is made somewhat more complex by the impact of GHG compliance costs, which would act as a tariff on exports from the California ISO to PacifiCorp West, even when the scheduling constraint is not binding. The potential existence of this "tariff" would not by itself enable large uncompetitive increases in offer prices for energy, because the increase in offer prices would be capped by the GHG emission cost margin. However, the existence of this emission cost margin could enable PacifiCorp to realize small mark-ups over incremental cost of these sales, without losing potential profits on export sales to California, and without losing sales to imports from California.

This possibility is illustrated by the following example. Suppose that the cost of GHG compliance is $20 per MWh on the margin, so that the California ISO price would exceed the competitive PacifiCorp price by $20. PacifiCorp could in theory exercise market power in the imbalance markets within the BAAs by lowering its GHG emission cost bid to a very low value and raising its incremental energy bids of resources within the PacifiCorp BAAs by an offsetting amount. In essence, this strategy would raise the level of prices within the PacifiCorp BAAs to just under the level of prices in the California ISO market, without forgoing exports into the California ISO or attracting imports from the California ISO.

This design for the exercise of market power would not be easy to actually implement because PacifiCorp would need to guess the real-time market clearing price in the CAISO, including the GHG cost premium, and offer incremental energy at just under this price. In addition, the potential for the exercise of market power would be capped by the GHG premium. Hence this strategy would not permit PacifiCorp to charge, say, a $500/MWh premium over the competitive price, but PacifiCorp could potentially gain around $5-10 per MWh in extra margin on energy and generator imbalance services.

This strategy would avoid giving up profits on exports, because the cost of power delivered into California would be unchanged (the GHG cost bid would be artificially low and the energy offer price artificially high) and would also avoid losing profits on imports from the California ISO. Hence, this strategy has the potential to be profitable in circumstances in which strategies that would raise energy prices throughout the PacifiCorp BAAs by more than the GHG emission cost margin would be unprofitable. This bidding strategy would also be somewhat less obvious, as the market monitor would just observe a smaller GHG emission cost margin between PacifiCorp and the California ISO than would otherwise be the case. Incremental offers would vary from interval to interval in a manner related to California ISO prices rather than their costs, but this might not be easy to distinguish from offer prices varying with the opportunity cost of sales outside the California ISO, which might also tend to follow expected California ISO prices net of GHG emission costs.

However, this strategy for exercising market power would still be vulnerable to small amounts of generation overscheduling by load serving entities within the PacifiCorp BAAs so they could sell

their imbalances to PacifiCorp and to generators within the PacifiCorp BAAs, leaving a few megawatts unscheduled so they could sell them in the EIM market in real time.

PacifiCorp East. The case of PacifiCorp East is slightly different because of the lack of EIM import capability and the generally lower cost of resources there. Therefore, raising offer prices and causing the scheduling limit on exports (which we understand would be 0 MW from PacifiCorp West into PacifiCorp East and also 0 MW from the California ISO) would entail the following:

a) Foregoing any profits from using low cost generation within PacifiCorp East to meet load within PacifiCorp West or to support exports into the California ISO,[41] and
b) At times purchasing power to meet PacifiCorp imbalances from load serving entities within PacifiCorp West at the inflated price.[42]

Moreover, if PacifiCorp attempted to exercise market power in this manner on an ongoing basis, this would incent load serving entities within PacifiCorp East to schedule imports slightly in excess of their expected load, the increase serving to either reduce their purchases from PacifiCorp at the high price and/or to increase their sales to PacifiCorp any time its load exceeded its base schedule.[43]

In addition, such an ongoing effort to exercise market power in PacifiCorp East would likely induce resource owners in that BAA to set their hour-ahead schedules to leave a small amount of spare capacity available on their resources to be dispatched into the EIM in real-time.[44] Given the apparently huge amount of third party capacity in PacifiCorp East (1708 megawatts according to the market based rate filing), it is not clear how such an ongoing effort to exercise market power could be successful in PacifiCorp East unless there is some factor limiting the ability of these resource owners to offer their power into the EIM.

[41] If power was being exported from PacifiCorp East into other regions within the EIM and all undispatched generation within PacifiCorp East was offered at very high prices, then an increase in load within PacifiCorp East would not be met by dispatching up generation within PacifiCorp East. It would instead be met by dispatching up generation elsewhere in the EIM and reducing exports from PacifiCorp East. This would cause the real-time imbalance price in the PacifiCorp West to equal the price, adjusted for losses, elsewhere in the EIM. Hence, exports into the EIM from PacifiCorp East would need to be reduced to zero in order to raise real-time imbalance prices with PacifiCorp East.

[42] PacifiCorp upward load deviations would normally be met with its own generation, so even if it paid a high real-time price, it would be paying the price to itself. However, if the load serving entities within the PacifiCorp balancing authority areas had a downward deviation at the same time, then PacifiCorp would purchase part of their imbalance from the load serving entity at the inflated price.

[43] The profitability of this strategy would be reduced if it required purchasing additional transmission service.

[44] The profitability of this strategy would also be dampened to the extent that it required the purchase of additional transmission service. The total exports would not increase, so additional transmission service would only be required if the transmission service used to support the exports could not be used to sell power into the EIM.

Issue 3: Redispatch of Base Schedules. The third concern relates to the economic redispatch of generation that supports base schedules. Under the EIM, deviations from base schedules will be settled at real-time LMPs. Hence generation would be economically redispatched between base schedules and other resources, with the settlement prices potentially reflecting the impact of transmission congestion. No load serving entity would be exposed to congestion charges for real-time imbalances if it served its load using its base schedules, as such an entity would have no real-time deviations. There would, however, be a potential for inflated bids from resources within the EIM BAAs to somewhat reduce the benefits from dispatching down high cost resources in the base schedules in real-time and replacing them with lower cost resources. However, the potential profits would be capped at the difference between the cost of the high cost resource in the base schedule and the cost of the PacifiCorp resource that could replace it.

The inflated bids could be a result of either locational market power on constraints within the BAAs or as market power within the BAAs as a result of binding scheduling limits on imports into the BAAs. This third concern is very similar to the second concern in terms of the factors potentially limiting the exercise of market power with the additional consideration that any exercise of market power could only inflate costs up to the cost of the resources included in the base schedule.

Addressing Market Power within the PacifiCorp Balancing Authority Areas. Given, on the one hand, the potential for the exercise of market power in the imbalance energy market within the PacifiCorp BAAs following implementation, and, on the other hand, the considerable uncertainty over whether such an exercise of market power could possibly be profitable, there are three general courses that could be taken:

a) Use existing California ISO software to apply market power mitigation. This could be triggered either when scheduling limits on real-time imports from EIM into one or more of the PacifiCorp BAAs bind, or only when those limits bind and those interfaces fail a three pivotal supplier test.
b) Develop customized software tailored to the PacifiCorp market structure that would mitigate offer prices of resources located within one or more PacifiCorp BAAs when the exercise of market power was potentially profitable; or
c) Require PacifiCorp to sell imbalance power at a real-time price calculated setting the shadow price of scheduling constraints in the import direction to zero.

As explained above, it is our understanding that the California ISO proposes to apply the first approach using the three pivotal supplier test at the time of EIM start-up, with the possibility of making adjustments after there is some experience with the actual operation of the EIM market.[45] If PacifiCorp would fail the three pivotal supplier test any time one of the scheduling constraints is binding, there would be no difference between the three pivotal supplier trigger and the import constraint trigger. This approach might impose offer price mitigation at some times when it is not appropriate relative to other approaches. But the software implementation costs would be much lower, as the procedures could be implemented largely with existing software capability. If mitigation were triggered, both approaches require accurate measures of hydro generation

[45] Department of Market Monitoring Comments, *op. cit.*, Footnote 2.

opportunity costs to avoid inefficiently shuffling the relative dispatch order between energy-limited hydro and non-hydro resources.

The second approach would perhaps minimize the unnecessary application of offer price mitigation but could entail devoting significant resources to developing software that might almost never be used.

The third approach would be similar to the first in terms of the trigger for its application, as it would be relevant only when the import constraints bind. It would not mitigate offer prices, however, just the charges of the balancing authority area operator. In this way it would avoid potentially inefficient shuffling of the dispatch order and reduce the need to develop accurate opportunity cost measures for hydro generation. On the other hand, it could impose cost shifts if conditions lead to frequently binding import constraints and high incremental costs within the EIM BAAs.

We support the first approach, given its implementation advantages, together with its consistency with local market power mitigation procedures already in place in the California ISO footprint.

Market Power Summary. In summary, the market power implications of the EIM are almost completely centered on the non-CAISO areas of the EIM, and are quite difficult to predict at this stage. The apparent change in the terms of PacifiCorps OATT *might* create incentives to exercise market power, and such exercise *might* be possible on a system level. However, there are several institutional and structural factors that appear to mitigate the potential profitability of any system-wide market power strategy. The potential is plausible enough that we believe it is appropriate that the EIM stand ready to impose mitigation, and that it be able to do so on interties between EIM areas as well as on constraints interior to each BAA. Our sense is that, in the absence of significant market power, such potential mitigation would rarely be triggered, and therefore be relatively innocuous. However, this should be monitored closely and if mitigaiton is viewed to be inefficient, other course such as suggested here should be considered.

3. Conclusion

This is a very important initiative. Expanding the geographic scope of real-time dispatch has the potential to improve market efficiency and lower costs to consumers, in part because the real-time dispatch will be better able to take advantage of the spatial diversity of variable renewable production. This is particularly important in the WECC, with the planned rapid expansion of solar and wind resources in the next decade. Furthermore, expanding the balancing market also increases the pool of energy resources that can be dispatched to balance the inherent variability and uncertainty of renewable resources output. The larger the geographic region that can be successfully integrated, the greater these benefits are likely to be. Indeed, in principle, the benefits of market enlargement from the standpoint of accommodating variations in renewable output may rise sharply with the geographic scope of the integrated region.

We strongly support these efforts. In this opinion, we have chosen to focus on four areas that we see as both important issues relevant to the immediate task of integration with the PacifiCorp

balancing areas as well as any further expansion that includes other balancing areas. These four areas are the rules for managing schedules, the rules for accounting for Greenhouse Gas emissions, the options for phasing in the implementation of EIM, and market power mitigation. Although we provide extensive discussion of *potential* problems that could arise, we also want to emphasize that the CAISO has taken important steps to prepare the system to deal with these problems should they arise.

With regards to the issues relating to schedules and to market power, the CAISO has committed to plans to add important functionality to the EIM software that we believe should be capable of mitigating any serious problems that may arise with the integration with PacifCorp.

We do believe that eventually, particularly if the EIM expands beyond the California ISO and PacifiCorp, the ISO will need to develop a workable general framework that will account for these interactions in establishing forward schedules. This is not a new problem, and the MISO, PJM and New York ISO are all using various methods to account for similar interactions.

We also support the CAISO's plans to include the functionality to allow for market power mitigation to potentially be triggered by congestion on interties between EIM areas, as well as internal constraints. However, the current California ISO approach to local market power mitigation assumes that markets are fully competitive at the balancing area level. That approach also relies upon being able to mitigate bids to a level that reasonably represents the marginal costs of output from a particular resource. As the EIM market region expands to include more traditional vertically integrated systems as well as hydro systems with more complex opportunity costs, the appropriate assumptions to apply to other regions will need to be considered on a case-by-case basis.

We believe that the system that the CAISO proposes for accounting for Greenhouse Gas Emissions is appropriate and consistent with the spirit of the rules adopted by the California Air Resources Board. Some stakeholders have expressed concern that participants would be able to specify a separate GHG cost component without constraint, but we note that in effect this situation already exists.

Last, we note that the ability to limit the capacity of intertie transactions can be a potentially useful tool in helping to diagnose the source of any pricing or uplift issues that may arise. We therefore support adding such functionality to the system. However, even if we restrict the net flow between the systems to zero there can still be significant network interaction and cross impact on congestion that can lead to strategic behavior and cost-shifting problems. Hence, we believe that testing will reveal much about the potential for uplifts, and that limiting the transfer to an extreme, such as zero, capacity would be potentially helpful, but for no more than a period of days, not months or longer.