Opinion on
Extended Day-Ahead Market (EDAM)

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I. Introduction

The Market Surveillance Committee has been asked to comment on the EDAM initiative.[2] This initiative would establish a voluntary day-ahead electric energy market which would optimize commitment and dispatch of resources and transfer of energy across multiple balancing area authorities. The proposed market would coordinate and build on the experience with the real-time Western Energy Imbalance Market (WEIM),[3] which has yielded significant cost savings and supporting state policy goals.

In preparation for this Opinion, the MSC held public meetings on Oct. 21 and Dec. 19, 2022 to discuss the three major components of the proposal, which address transmission, resource sufficiency evaluation (RSE), and greenhouse gas (GHG) accounting. In addition, the MSC has held numerous meetings since 2020 on the related Day-Ahead Market Enhancements (DAME) initiative.

This opinion is structured as follows. In Section II, we summarize our general conclusions about the importance of the EDAM initiative to market efficiency, and our suggestions for each of the three major components. Then in Sections III, IV, and V, respectively, we discuss the three major components of the EDAM proposal: application of RSE; GHG accounting; and inter-BAA transmission charging and management.

II. General Conclusions

We agree with the stance of many stakeholders that there are significant potential benefits to an expansion of the current energy-imbalance market into day-ahead trading. The vast majority of power is trading well in advance of the real-time WEIM. There is abundant empirical evidence that RTO-style day-ahead markets, such as that coordinated by the CAISO, can improve the

[1] The opinions in this document reflect the personal views of the members of the committee and do not necessarily represent or reflect the views of any institutions with which they are affiliated.

[2] *Extended Day-Ahead Market, Final Proposal*, CAISO, December 7, 2022, www.caiso.com/Initiative-Documents/FinalProposal-ExtendedDay-AheadMarket.pdf.

[3] *www.westerneim.com.*

efficiency of power-system operations and lower the cost of serving customers. These benefits stem from both the ability of RTOs to optimize and deploy resources across relatively large footprints and the removal of various trading frictions that increase transaction costs in more traditional markets.[4] The success of the EDAM initiative would therefore be a significant step forward for the western power market.

It is worth noting that the EDAM design attempts to reconcile, rather than replace, the two prominent electricity trading paradigms: traditional trading through Open Access Transmission Tariffs (OATT) and RTO-based market dispatch. While the latter system is theoretically more efficient, a result supported by empirical studies, transitions from traditional trading systems can create significant concerns over losses in benefits to some parties. As a result, it might be easier to secure agreement on market reforms if the transition is to a system that is less of a departure from the OATT and WEIM structures that are familiar to most market parties in the West. As such, while the proposal would extend many elements of the RTO market model to day-ahead markets outside of the CAISO, it also imposes some elements of the OATT model on current participants in the CAISO.

We also note that there are many important details of both the EDAM, as well as the related Day Ahead Market Enhancements (DAME) initiative, that remain either ambiguous or unresolved at this time.[5] The ultimate success of this initiative will very much depend upon those details being resolved in a satisfactory manner. In this opinion we highlight several issues that are either ambiguous or of concern and potentially in need of revision, or at least monitoring. The unresolved questions constitute the "known unknowns" at this time. These issues include detailing how exactly supply shortfalls in both the EDAM market and WEIM market will be distributed amongst participants,[6] as well as important financial considerations such as the appropriate penalty values for reserve shortfalls, the GHG formulation that will be used,[7] some elements of the design for compensation for foregone short-term firm and non-firm revenues, the details of the export constraint in EDAM, and several elements of the DAME design which will be part of the EDAM rules that are currently unresolved.

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[4] The "pancaking" of transmission charges across multiple systems in traditional power markets, even for interfaces experiencing no congestion, is an example of these frictions. The experience in other regions forming ISOs (such as MISO) has been shown that contract path transmission scheduling designs typically materially understate the available transmission.

[5] Very recently the DAME initiative has been deferred, so our comments relating to the interaction of DAME and EDAM should be considered in the context of the fact that DAME details could change.

[6] These ambiguities concerning allocation of shortfalls include both 1) the treatment of situations in which multiple balancing areas are unable to cover their EDAM schedules and the aggregate resources available within EDAM and WEIM are insufficient to cover the shortfalls, and 2) instances in which a balancing area is unable to cover the exports included in its EDAM schedules as a result of transmission outages or deratings which curtail its imports from other balancing areas, rendering its EDAM export schedules infeasible.

[7] As discussed below (Section 4), the final proposal describes several options for a GHG export constraint, at least one of which we believe would almost certainly have significant unintended impacts.

The ambiguities in the current proposal, as well as the ambitious scale and scope of the combined initiatives, together imply that there are almost certainly "unknown unknowns" as well. These will become apparent only as the initiative proceeds further toward implementation. A common theme in this opinion is the need for detailed simulation to assess the impacts of different model specifications and parameters, as well as to evaluate how the pieces fit together. We agree that this is an appropriate time to take the first formal steps to establishing the EDAM. This will focus attention on the critical details of market design, and build momentum that will enable stakeholders and policy makers to complete the hard work that needs to be done to successfully implement the vision of a West-wide day-ahead market.

The DAME and EDAM designs contain a number of design elements that have not been tested in other ISOs but are important elements of the proposed design. It is likely that the proposed design will benefit from adjustments based on experience from EDAM operations. The likelihood that EDAM will begin operation with a small set of balancing areas that will expand over time will help the CAISO and other EDAM participants improve the design with accumulating experience. It is important that the CAISO build flexibility into the software so that parameters can be adjusted without undue delay.

III. Comments on the EDAM Resource Sufficiency Evaluation (RSE)

3.1 Summary

- The EDAM RSE, like the WEIM RSE, is conceptually a useful tool for increasing confidence that participating in these markets will not create spillovers of scarcity between participating BAAs. As noted in the prior section, however, there are a number of elements of the design which we believe need further development and specification.
- The EDAM RSE will not test for internal congestion, and will allow some types of bilateral financial contracts, as well as demand reduction programs, to count as physical resources. These are examples of design choices that make the EDAM somewhat less strict than it would otherwise be and should be closely monitored for their impact.
- BAAs that pass the EDAM RSE will enjoy the benefit of a pooled WEIM RSE. Concerns about the incentives created by a pool WEIM RSE for EDAM participants could be mitigated by retaining the current WEIM RSE policy. This policy does not pool RSE evaluations across BAAs, but instead bases the WEIM RSE on EDAM import and export schedules for EDAM participants.
- Financial penalties for failing the RSE appear inconsistent with recent changes to the proposed Imbalance Reserve product, and should be re-evaluated to reconcile the EDAM and DAME initiatives. These penalties will also be based upon the higher of multiple bilateral indices that could be unrepresentative of local market conditions.

3.2 Background

The concept of a resource sufficiency test was first developed for the implementation of the Energy Imbalance Market (EIM). In our earlier opinion discussing the WEIM RSE, we noted how the RSE is motivated by a desire to mitigate the risk of scarcity conditions spilling over from one

participating BAA to another.[8] Within ISOs, this function is served by resource adequacy (e.g., capacity) mechanisms.

> *"Since there is no shared long-term resource adequacy policy, or even a common vision for one, across WEIM participants, the RSE is effectively intended to serve as an alternative mechanism to avoid undue leaning on the pool by any WEIM participant. In principle the RSE allows individual BAAs to pursue their own RA approach, while also isolating the most severe short-term consequences of an inadequate RA approach of an individual BAA from its neighboring BAAs, especially during times of regional stress affecting several BAAs."*[9]

Scarcity in one BAA can always threaten reliability in its neighbors, but NERC rules require that BAAs to do everything possible to confine internal reliability issues within their territory. Relative to traditional practice, participation in WEIM, and now EDAM, creates a higher level of "pooled risks" between participants, although nowhere near the level of risk-sharing experienced within ISOs. In many cases, risk-pooling is beneficial as negative shocks are less likely to simultaneously impact large areas. This concept is implemented in EDAM and WEIM as a "diversity benefit" that reduces reserve requirements of individual BAAs. The RSE is motivated by the fact that this benefit depends upon participants being resource sufficient. As we noted in our earlier opinion, *"(c)hronic, predictable shortfalls in capacity would instead create an EIM-wide diversity 'penalty' for consumers in resource adequate BAAs rather than a benefit, in the sense that they would need to commit additional capacity to compensate for the lack of unloaded capacity across the EIM."*[10]

The RSE in the EDAM proposal shares many of these same motivations, although it is important to note that the nature of the risk sharing is different in a day-ahead time frame than it is in the real-time WEIM. The main reliability implications of EDAM participation stem from the agreement of participants to treat transfers cleared in the (day-ahead) EDAM with the same priority as their own internal load. Currently, in the CAISO BAA, only high priority exports scheduled in the day ahead are given the same priority as internal load.

Participants in EDAM will also share the pricing implications of scarcity as well. The Final Proposal states that "If the market cannot cure all resource insufficiencies, the power balance constraint will be relaxed optimally" across the EDAM footprint. While this could be interpreted as meaning that energy shortfalls would be pooled in EDAM and that scarcity pricing would not be confined to only BAAs responsible for shortages, CAISO staff have informed us that the EDAM would not force a region to export itself into physical scarcity, which we interpret as meaning load shedding. However, we have not seen an explicit representation of the market constraints that would accomplish this, and this important detail will need to be fleshed out before implementation. The CAISO has also not explained how rules regarding export curtailments and load

[8] J. Bushnell, S. Harvey, and B.F. Hobbs, *Opinion on WEIM Resource Sufficiency Evaluation Enhancements, Phase 2*, Market Surveillance Committee of the CAISO, Nov. 29, 2022, www.caiso.com/Documents/MSCDraftOpinioonResourceSufficiencyEvaluationEnhancementsPhase2.pdf

[9] Ibid., p. 3.

[10] Ibid., p. 10.

shedding would be applied when there are multiple balancing areas that are short. The CAISO needs to develop this rules and processes and discuss them with stakeholders before EDAM is implemented. The CAISO will not have time to figure this when tight supply days occur.

Assuming the implementation does indeed contain protections that would limit EDAM exports to amounts that would prevent physical scarcity in the exporting region, the pooled risks will be limited to:

- Pricing;
- Limits on the ability to curtail exports in real-time if a region experiences a reliability shock after the day-ahead market clears; and
- The potential for capacity not to be available in other EDAM BAAs to support the diversity benefit if a balancing area has short-term conditions that exceed its individual allocation of uncertainty.

The benefit side of the EDAM participation ledger features the ability to pool uncertainty risk across multiple regions. The conceptual benefit stems from the fact that many generation and load shocks will be loosely or even negatively correlated across larger geographic areas. This will be manifested in the market mechanism by a reduction in the amount of Imbalance Reserves required to be scheduled in a given EDAM area, implemented through formulas that will specify the IRU requirements in the IFM. We currently have not been able to review either the specific methodology for determining the IRU requirement or the diversity benefit adjustment to that requirement. We are therefore unable to assess how faithfully this formula reflects the conceptual benefits of pooled uncertainty. However, this formula will create a clear self-fulfilling market benefit for BAAs who pass the RSE in the sense that the EDAM will mechanically reduce, by the amount of the estimated diversity benefit, the amount of IRU required for LSEs in those BAAs.[11] However, this is only a benefit if other EDAM BAAs procure sufficient capacity, including imbalance reserves, to support the diversity benefit.

The RSE can therefore be seen as a tool for limiting the shared risks of pooling day ahead market outcomes, while helping to realize the diversity benefits of pooling. Given this background we will now discuss some key elements of the EDAM RSE as currently proposed.

3.3 Key Elements of the EDAM RSE

3.3.1. Passing the EDAM RSE can decrease a BAA's WEIM RSE requirement

Currently, the RSE evaluation in the (real-time) WEIM is conducted on a BAA-by-BAA basis. Each BAA is expected to demonstrate sufficient resources to meet its load and flexibility needs for the next hour. Participants in the EDAM will have their requirements pooled in the WEIM, and their WEIM RSE will be evaluated in aggregate, *provided they pass the EDAM RSE*. If a BAA fails the EDAM RSE, its WEIM RSE *may* be evaluated on its own, rather than pooled with others, if the EDAM market is unable to resolve the capacity shortfall in the failing BAA.

[11] Of course, LSEs in non-CAISO areas that are not participating in EDAM will not be required to purchase any IRU, but would also not gain any benefits from that product either.

Note that this failure penalty is better characterized as a forgone benefit, rather than a penalty, given that an EDAM failure would mean that its WEIM RSE would, at worst, be set just as it is today. Similarly, BAAs that participate in WEIM but not EDAM will be also have their RSE evaluated individually in WEIM.

The appeal of this policy is that it recognizes and rewards the diversity benefits of pooling amongst sufficiently resourced BAAs. The general concept is that the pooled EDAM BAAs should not be held individually liable in the WEIM RSE for shocks that arise after the day-ahead time-frame provided they have procured sufficient resources to cover their energy and reserve needs in EDAM. We understand, however, that pooled BAAs will be individually responsible for balancing shocks in real-time if there is insufficient balancing capacity available within the WEIM.

The attractiveness of this policy will depend how accurately the EDAM RSE reflects the true resource positions of participants. As such, there is a trade-off in the rigor with which the EDAM RSE is measured and enforced, and the degree of pooling in the WEIM RSE. There is also a potential for this design to reduce the incentive of individual balancing areas to incur costs to make additional capacity available in response to unfavorable developments following the clearing of the RSE and EDAM, but prior to real-time. These reduced incentives, coupled with the lack of adequate real-time shortage pricing, could reduce the supply of capacity that is available to support the diversity benefit in real-time. If it turns out that certain elements of the EDAM RSE, such as the treatment of financial contracts and lack of intra-BAA congestion modeling, contribute to misleading results, one reasonable recourse would be to revert to the current implementation of the WEIM RSE where BAAs are not pooled and are instead evaluated individually but treating EDAM import and export schedules as base schedules.

3.3.2. The EDAM RSE will not model internal congestion

The EDAM RSE is designed as a somewhat abstracted check of BAA-level resource capability, rather than a fully executed model of resource dispatch. As such, while intertie constraints between BAAs will be considered by the RSE when measuring the contribution of imports to the supply of a given BAA, the RSE will not model transmission constraints internal to a BAA. This could result in over-counting the capacity of some resources trapped in "generator pockets," but this decision also simplifies the calculation of the RSE and allows for multiple advisory runs before a determinative, final RSE run.

As with many other aspects of the RSE, we are not in a position to assess the quantitative impact this policy may have on the accuracy of the RSE. We note that larger BAAs often experience significant internal congestion, and that this is anticipated in some cases by zonal reserve requirements (and is also reflected in WEIM flexiramp deliverability issues that the ISO is in the process of addressing). We recommend ongoing evaluation of any mismatch between capacity identified for RSE compliance and the capacity actually utilized in the IFM, in order to better assess the value of the RSE.

3.3.3. The EDAM RSE will allow some financial contracts to be treated as resources

The proposed RSE will allow "*delivered firm energy contracts, commonly but not exclusively executed through WSPP Schedule C arrangement*."[12] This element was desired by several stakeholders, and the FP notes the "historical reliability" of such contracts. Liquidated damages clauses in firm energy contracts would provide a strong incentive to the seller to ensure delivery of the promised energy, and it appears that excluding these contracts would be disruptive to the planning and trading practices of several potential EDAM participants. That said, we note several potential concerns.

a. No requirements on contract terms. The final proposal does not specify any specific required elements to contracts that would be claimed by a BAA, leaving that flexibility up to the BAA itself. Thus, while current WSPP Schedule C arrangements with substantial performance penalties to ensure that the supply is available to meet balancing area may be highly reliable, less strictly defined contracts may also be deployed when the consequences of non-performance do not fall on the balancing area contracting for that supply. The EDAM provisions that would cause balancing areas EDAM RSE to be reassessed if these resources are not tagged, are therefore very important in maintaining reliability.

b. Location may be undefined. The proposal encourages BAAs to identify the specific location of the contract's source, but our understanding is that many contracts do not rely upon a single resource. If a network injection point is not specified, then a delivery point at an intertie to the receiving BAA would be required. These locations will be modeled in the IFM. This is less of a concern for the RSE run, which would not model internal congestion, but these contract offers that are cleared in the IFM will, in effect, be virtual supply bids that will settle at the FMM prices if no resource is ultimately identified to support the supply offer.

c. Resources could be double counted. During the WEIM RSE stakeholder initiative, an analogous issue was discussed pertaining to the treatment of exports in the CAISO HASP market. From those discussions, it was clear that at least some firm energy contracts ultimately utilize the CAISO market to source the energy for delivery. This raises the possibility that a contract could be used to pass the RSE, and then be fulfilled with a purchase from a generator that was also used to pass the RSE. The CAISO is aware of this risk and will rely upon the e-tag process to police it. This strikes us a reasonable, minimal, check, but we are not able to assess if further review will be required. The final proposal expresses a commitment to continue to monitor this issue.

[12] Final Proposal, p. 66. The final proposal does not strictly define which contracts will and will not count for such consideration.

3.3.4. Failure of the RSE will result in financial penalties linked to the highest bilateral price index in the WECC

In addition to the potential ramifications of failure for the WEIM RSE test, the other consequence of EDAM RSE failure is a financial surcharge that will be assessed to failing BAAs. The MW magnitude of the failure will be measured as the single hour with the largest deficiency. The $/MW magnitude (price) of the surcharge will be based upon a translation of a bilateral index of a 16-hour block peak energy contract.[13]

This surcharge approach features several elements we supported in our opinions on the implementation of the WEIM RSE.[14] Namely it is financial in nature, and its severity will automatically scale with market conditions in the WECC. In our opinions on the WEIM RSE, we noted that failures have often happened in times and places where energy prices are quite low. Under such conditions, the burden a failing BAA is imposing on its neighbors is modest. That said, there are several aspects of the proposed penalty structure that concern us.

a. **Mismatch between surcharge and market conditions.** By basing the surcharge upon a 16 hour block at the higher of two index points means the policy could still produce a considerable mismatch between the surcharge and local market conditions. Parts of the west can be significantly constrained during stressed periods, while others still retain ample resources. For example, prices could be quite low in the Pacific Northwest and very high at Palo Verde. A failing BAA located in the northwest would face a surcharge much higher than more local market prices may justify. The credit-back provisions for non-failure hours will limit the consequences of this mismatch, but this misalignment could still be very large in the hours of RSE failure.

   Similar concerns could apply to the conditions in a given failing hour, the surcharge for which could be inflated by its cost being bundled with 15 other hours. The policy seems to assume that failures are likely to happen during "high priced" hours and that the 16 hour block would, if anything, be lower than the price in a single, relatively stressed hour. However, many WEIM RSE failures have arisen during low-priced or non-peak hours. The EDAM RSE results may be less volatile than the WEIM RSE, but at this point we do not have any evidence on how it may perform.

b. **The surcharge is based upon energy prices, while the RSE measures capacity.** The MW requirement for RSE capacity is based upon both the expected load and the required Upward Imbalance Reserve (IRU). The reliability implications of relaxing IRU are

[13] Even though the failure may arise in only one or two hours, the surcharge will mimic a bilateral swap between the 16 hour index and 16 hours of energy in the failing BAA in the sense that the failing LSE will be charged a multiple of the 16-hour price and be credited for (e.g. "sell back" the energy in the hours in which it did pass the RSE). However, when the LMP in the failing BAA is higher than the index price, the "profit" from the hypothetical swap would be capped at zero and not be allowed to reduce the penalty amount from other hours. To the extent the local load-weighted LMP is significantly lower than this block price, the credit will be small.

[14] Bushnell et al., 2022, op. cit.

significantly different from an outright energy insufficiency. Our understanding is that the design for the Day Ahead Market Enhancements will include a demand curve for IRU that will allow for a relaxation of the IRU requirement at prices significantly below the maximum energy price set by the power-balance constraint. We strongly support this change to the IRU requirement.

However, the RSE surcharge would be applied more rigidly. While there will be a small "safe harbor" Tier 1 quantity that would result in no penalties for small failures, beyond this quantity, penalties rise to multiples of the prevailing energy index price. This strikes us as inconsistent with an appropriate IRU demand curve. For example, the Option 1 IRU demand curve proposed by the CAISO in a January stakeholder meeting would set the surcharge price at $500 for relaxation up to 50% of the IRU requirement. By contrast, failing to show capacity sufficient to meet this same requirement of 50% of IRU would result in a surcharge set at two times the 16-hour block energy price. This could easily rise well above $500/MW. We note that this issue is tied to the resolution of DAME design elements that are not yet finalized.

In this fashion, the overall cost to BAAs of the new IRU product, whose design and implementation remains incomplete and untested, could be significantly elevated by its contribution to the RSE requirement.

Given this logic, we suggest that the EDAM design should consider allowing the IRU price to form the basis, or at a least cap, for the price of the RSE failure penalties for failures of magnitudes in the range of IRU shortfalls. For example, the per MW charge for RSE failure could be capped by the resulting weighted average IRU price in the hour of the failure. Even then, we note that this would amount to a magnification of the cost of an IRU shortfall to EDAM BAAs, although it would not impact the IFM energy price itself. A second tier of penalties linked to the energy price indices could be applied for RSE failures that reach the magnitude of energy shortfalls, or very large IRU shortfalls.

c. **Bilateral indices may be illiquid and potentially impacted by anomalous transactions.** The final proposal acknowledged stakeholder concerns that bilateral indices are subject to less formal monitoring, can have poor liquidity, and therefore be more vulnerable to being unduly impacted by individual trades at a particular point in time with prices reflecting transaction-specific factors that drive the index price upward or downward and possibly also by transactions seeking to impact the index. A lack of liquidity can also mean that an index might not accurately representing underlying market conditions. Linking an EDAM surcharge payment to such an index can increase the incentives to execute such trades. We are not in a position to evaluate the liquidity of these specific indices under a range of market conditions, but also note that these concerns are conceptually valid, even if currently hypothetical.

3.3.5. Firm transmission rights will be required to claim credit toward the EDAM RSE for a resource-specific import

This is a reasonable requirement that serves to provide some assurance that capacity relied upon to satisfy the RSE can be delivered to the LSE relying on that capacity. The requirement also serves to ensure that transmission providers whose transmission facilities are used to deliver capacity to satisfy the RSE receive payments to cover the embedded costs of their transmission assets.

The main concern that has been discussed with respect to this element of the EDAM design is the potential limited access to firm transmission on interfaces on which firm transmission is not available from the transmission provider (which is obligated to make firm transmission available at a regulated rate under its OATT). If most or all firm transmission on a particular EDAM interface is held by transmission customers, the transmission customers have no obligation to make unused firm transmission available for sale to others. Today, unused firm transmission is released as non-firm so neither the transmission customer nor the transmission provider has the ability to withhold unused transmission from the market in real-time.

3.3.6. . The potential for market power in transmission will depend upon the amount of firm transmission available for purchase from Transmission Service Providers, as well as the concentration of ownership of firm transmission rights.

We understand that that most potential EDAM transfer interfaces have material amounts of firm transmission available for sale at the OATT tariff rate. The EDAM design will operate as intended on these interfaces. However, we understand there are a small number of interfaces on which there is little or no firm transmission available for sale from the transmission provider. On these interfaces, firm transmission service would need to be purchased from other transmission customers that have purchased long-term firm service. These transmission customers have no obligation to offer that transmission for sale at the OATT tariff rate. If only one or a handful of such customers who own scarce firm service, there is potential for such customers to exercise market power by raising prices of that service by reducing the amount of service available on the market. We have not been able to assess how significant the potential for such market power could be. However, as noted above, this requirement to purchase firm transmission would not apply to non-resource specific contracts use to meet the RSE requirement of the CAISO or other balancing areas, which should diminish the concerns.

This could be a potentially significant change for some LSEs who currently utilize non-firm hourly rights to schedule RA resources or other contracted resources to meet their load serving obligations. We understand from the CAISO that most of the RA imports that currently utilize non-firm transmission are non-resource-specific contracts. This may also be the case for most LSEs outside the CAISO that rely in part on non-firm transmission to meet their load. These contracts would continue to be allowed to use non-firm transmission to deliver their supply to the sink balancing area to meet the EDAM RSE. The advantageous treatment of such contracts under the RSE may bias future RA procurement toward these types of contracts.

There is also a concern that the Bucket 2 Pathway 2 design could in some circumstances create incentives for transmission customers to choose Pathway 2 rather than offering excess firm transmission for sale to LSEs needing the transmission to meet RSE requirements. We have also not been able to assess now material those incentives might be. The new firm-transmission right requirement will apply only to the RSE evaluation, and not to the actual purchase of energy from RSE resources. Therefore, this requirement ought not constrain actual supply in the day-ahead market or real-time, but could increase costs of RSE compliance. Considering this, we note that, even if there was substantial concentration of transmission rights, the willingness to pay for these rights will be constrained by both the costs of alternative means of RSE compliance as well as the penalties imposed for failing the RSE.

A related concern is that the current EDAM design allows firm transmission that is not needed to cover bucket 1 transfers to be made available for scheduling in EDAM under bucket 2 pathway 2. It is our understanding that firm transmission scheduled using pathway 2 would not be available for release for purchase as non-firm following the EDAM. This design apparently could have the effect that WSPP energy contracts could be scheduled in the EDAM, but that scheduling would use up capacity on the impacted interfaces so that so non-firm transmission might be available for purchase. A relatively small amount of transmission will be impacted by these rules given the likely initial participation in EDAM, which would provide the CAISO and EDAM stakeholders the opportunity to observe how these provisions operate in practice and make needed adjustments.

In addition, the CAISO has indicated that it expects that the amount of firm transmission rights on interfaces with little or no firm transmission rights available for sale from transmission providers will initially be relatively small. Moreover, the CAISO has proposed that only firm transmission rights purchased from transmission providers participating in EDAM will be eligible to choose Pathway 2, even if the rights sink on an EDAM interface. Under these circumstances, we do not see a need to delay EDAM development in order to more fully investigate these concerns. However, the concerns will need to be assessed as they could become relevant if particular balancing areas join EDAM.

At this point, all we can say is that there is potential for market power in transmission rights creating costs of compliance with the RSE that are not consistent with market conditions. Because this issue relates to the financial compensation for transmission rather than the physical withholding of transmission itself, this is an issue that should be monitored and the policy reconsidered if serious problems are detected. As explained above, there is also a potential for the treatment of bucket 2 transmission to make non-firm transmission unavailable for scheduling WSPP-type contracts post-EDAM.

3.3.7. The RSE optimization objective does not exactly align with the penalty regime

Resources will be dispatch in the RSE run with an objective to "minimize the requirement shortfall across the entire 24-hour optimization horizon." By contrast, penalties for non-compliance will be based upon the single largest hourly shortfall in capacity. In other words, the optimization will not minimize penalties and a strategy of procurement to minimize penalties may not match the objectives of the optimization.

3.3.8. The allocation of the cost of penalties within a BAA will be left to each BAA

Each BAA will have discretion to determine how the costs of penalties (as well as the revenue from penalties paid by other BAAs) will be distributed. We agree that this is an appropriate policy for EDAM, but also note that for BAAs, like the CAISO, with multiple LSEs it is quite possible that a BAA level RSE shortfall could arise even if a given LSE is more than sufficiently resourced. Ideally, the incentives for RSE compliance could be extended to the LSE level in multi-BAA LSEs.

IV. Comments on EDAM Greenhouse Gas (GHG) Accounting and Reporting

4.1 Summary

- **Incorporating GHG costs into dispatch and pricing just for some areas of EDAM and not others requires a process for deeming which power is deemed delivered into a GHG-regulated area.** Typically, a market-based dispatch is only concerned with aggregate supply and demand balances, subject to physical network constraints. There is no matching of specific sources for delivery to specific load sinks as part of the market run. Any such matching typically occurs in financial forward contracts and other bilateral arrangements. However, the EDAM, like the WEIM, will need to minimize two different measures of costs (one with and one without GHG costs) for deemed to flow into different parts of its footprint.

- **The proposal would expand the WEIM approach of constraining the supply that can be deemed imports into GHG-regulation areas.** Those constraints will limit, but not eliminate, the possibility that low-GHG energy included in a baseline reference schedule would be deemed to be delivered to a GHG regulated area in the IFM. By contrast, import purchases in the CAISO IFM today do not feature any analogous constraints.

- **The baseline against which this import constraint will be applied will shift from the self-reported base schedules in WEIM, to a hypothetical reference pass in EDAM.** The base schedules submitted to WEIM today feature no limitations on what supply can be excluded from the base schedules outside of GHG areas, or included in base schedules within GHG regulated areas, and hence be deemed delivered to a GHG-area. The replacement of self-reported WEIM base schedules with an EDAM reference pass that limits deliveries into GHG-areas could potentially, and simultaneously, reduce the potential for "resource shuffling" in the broadest sense of the term, but increase the amount of "secondary dispatch" in the sense that the latter is a form of resource shuffling that arises only within the WEIM/EDAM markets. In other words, imports into CAISO of some low-GHG energy in today's IFM could be considered a form of resource shuffling,[15] but

[15] We use the term resource shuffling more broadly here to encompass any transactions that result in a swapping of a high-GHG to a low-GHG source between regulated and unregulated LSEs. As discussed

which are not presently treated as secondary dispatch could be considered secondary dispatch under the EDAM framework. We are not able to quantify the amount of such imports, in part because the CAISO has not shown the extent to which low cost/low emission resources are excluded from non-CAISO base schedules.[16] LSEs in GHG regions will be still able to secure low emission energy from non-GHG areas to meet their load, and comply with any GHG regulation obligations, through forward contracts; the Final Proposal exempts resource adequacy supplies imported by GHG areas from the reference pass, making them available to those areas in the IFM market run.

- **The forward contract requirements for importing low-GHG energy are overly restrictive.** The Final Proposal would limit this exemption from the reference pass to energy from resources with Resource Adequacy contracts. This exemption would apparently exclude energy from non-RA clean-energy sources that are under medium-term, or even long-term energy contracts to GHG area LSEs. The categories of contract status eligible for exemption from the reference pass should be expanded to include such contracts before EDAM implementation.[17]

- **We support efforts that continue to explore revisions and alternatives to the proposed GHG treatment.**

4.2 Background

Currently two states with WEIM participants—California and Washington State--have adopted cap-and-trade programs for CO2 emissions, and others may adopt similar or other forms of carbon pricing. A goal of the GHG accounting in the EDAM is to reflect GHG compliance costs in the market optimization and to support reporting under these state GHG emission programs. This includes the California Air Resources Board's (ARB's) goal of accounting for emissions associated with imports into California as well as the programs of other states with GHG programs and balancing areas that participate in the EDAM.

Since these GHG programs raise the cost of producing electricity for generators located within GHG capped regions, the regulations in these states feature language requiring that they also account for emissions from out-of-state electricity delivered into the regulated state. For example, entities that "deliver" power into the California electricity system are required to report the emissions associated with that imported power and acquire emissions allowances to offset those emissions. These policies in turn create a risk of the "shuffling" of sources of imports, where high

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above, transactions in today's IFM are generally not considered resource shuffling under the guidelines developed by the California Air Resources Board.

[16] Moreover, the analysis included in the December 19, 2022 presentation to the MSC shows that around half of deemed GHG imports are from supply included in base schedules, rather than excluded. See S. Spewak, California ISO, "Extended day-ahead market greenhouse gas (GHG) discussion," Market Surveillance Committee Meeting December 19, 2022, p. 13.

[17] It is our understanding that the ISO staff memo to the Boards for the Feb. 2, 2023 meeting of the Boards will propose a change consistent with this recommendation.

carbon supply sources are replaced with lower-carbon resources as the deemed source of the import, and the output of the high carbon supply source is used to meet the load of an LSE not subject to CO2 regulation, directly or indirectly replacing the lower-carbon resource that had been redirected to the regulated LSE.

Awareness of, and concern over, resource shuffling long predates the implementation of the WEIM and now EDAM.[18] The California ARB initially proposed requiring the individual responsible for reporting GHG emissions for each compliance entity to sign an attestation, under penalty of perjury, that they "have not engaged in any scheme or artifice to claim GHG reductions that are not real." This approach, together with its lack of detail defining resource shuffling, was extremely controversial. On Aug. 8, 2012, Federal Energy Regulatory Commissioner Phillip Moeller issued an open letter to California Governor Jerry Brown expressing concern over the "uncertainty and great concern among entities selling into California" caused by "failing to define resource shuffling, but nevertheless prohibiting it." The ARB subsequently developed a list of "safe harbor" business practices that would not be considered resource shuffling. Because the ARB has been primarily concerned with major long-term shifts in energy procurement, the safe-harbor provisions include "short-term dispatch in the California Independent System Operator (CAISO) markets."[19]

The term "secondary dispatch" arose with the advent of the WEIM market. The WEIM, like the proposed EDAM, models the GHG cost of "delivering" power into a GHG area (at the time just California). Because the market software optimizes for GHG costs, it will prefer outcomes where, all else being equal, lower carbon resources are dispatched into regions with GHG costs, while higher-carbon sources are deemed delivered to non-GHG regulated areas. During early periods of the WEIM, a phenomenon was detected whereby resource output levels would be dispatched above their base schedule levels in such a way that low-carbon power that was included in base schedules to serve load in a non-GHG area, could be deemed the source of GHG imports to California, accompanied by "backfilling," or replacing, that power with increased output from a higher GHG source. This was a very visible example of resource shuffling, at least relative to the output implied by the WEIM base schedules. We will define "secondary dispatch" as the redirecting towards a GHG area of the output of a resource which was originally designated in a base schedule for consumption outside of a GHG-area.

Some stakeholders have argued that the WEIM market leads to an understatement of GHG emissions induced by California imports. Similar issues could arise with the recently implemented Washington GHG program. This outcome can occur because under the current WEIM GHG design, GHG-import status can be assigned to a resource up to the amount of its unloaded WEIM generation (the difference between total real-time generation and the base schedules), even if the resource is not dispatched above its base schedule. . As noted above, the WEIM optimization

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[18] J. Bushnell, "The design of California's cap-and-trade and its impact on electricity markets." *Climate Policy*, 8, 2008, 277-292; Y. Chen, A.L. Liu, & B.F. Hobbs, "Economic and emissions implications of load-based, source-based, and first-seller emissions trading programs under California AB32," *Operations Research*, 59, 2011, 696-712.

[19] California Air Resources Board. *FAQ on Resource Shuffling,* https://ww2.arb.ca.gov/sites/default/files/cap-and-trade/guidance/resource_shuffling_faq.pdf

would tend to assign low-emissions WEIM generation to GHG areas in order to minimize GHG costs in its objective function. The California ARB tracks WEIM secondary dispatch, based upon a simple procedure of multiplying total California WEIM imports by a default rate of 0.432 tons/MWh and subtracting resource-specific emissions from imports identified in the market. The California ARB then reduces freely allocated allowances to California electric distribution utilities by this amount to offset the estimated additional emissions associated with secondary dispatch.

Importantly, any transactions that happen before the WEIM time-frame that are reflected in WEIM base schedules will not be considered to be resource shuffling. In the WEIM context, therefore, our view of secondary dispatch reflects a measure of resource shuffling of real-time imbalance energy, given base schedules that were formed in a context with no formal restrictions on resource shuffling. With the expansion of the WEIM market into a day-ahead time frame, the question becomes how to treat EDAM's day-ahead transactions that, together with forward bilateral schedules, will form the basis of real-time reference schedules for EDAM participants.

As we describe below, the proposed EDAM approach applies a multi-pass method that imposes much more formal restrictions on the scheduling of day-ahead GHG transactions than WEIM imposes. Therefore "secondary dispatch" in the EDAM context is conceptually different from the way the term has been applied to date in the WEIM. One consequence of this approach, as we discuss below, is to give LSEs in non-GHG regions preferential access to low cost/low-carbon resources that would be dispatched in the GHG reference pass, if those resources have not been procured in advance to serve an LSE in a GHG regulated area and therefore exempted from the GHG reference run described below. In practice, we understand that most low cost low emission resources are tagged as not being available for dispatch into California so only small amounts of such supply has been deemed delivered to the CAISO under the current WEIM GHG design. Unless there is some reason to expect this behavior would change in the future, little such supply could potentially be deemed delivered to California in any case, and the GHG reference pass would differ insignificantly from base schedules in its treatment of low cost low carbon resources.[20]

4.3 Elements of the GHG Proposal

4.3.1 *Baselines will be established by a reference pass*

As described above, the WEIM formulation uses BAA-level self-reported base schedules as the baseline against which secondary dispatch would be measured. The EDAM proposal would replace the WEIM base schedule concept with the results of the "reference run" phase of a multi-pass solution. It is our understanding of the reference pass that it mimics a market run except that zero net EDAM imports (aside from the exemption noted below) are allowed into each GHG regulated area. The principle is to establish the level of resource output "but for" exports into

[20] See California ISO, Department of Market Monitoring, Annual Report on Market Issues & Performance, 2021, July 2022, Figure 3.27 p. 162; Annual Report on Market Issues & Performance, 2020 August 2021, Figure 3.21, p. 141.

GHG regions. As described in the next section, resources dispatched to serve non-GHG load in the reference run will be constrained from delivering energy into GHG regions in the subsequent market-run. In this way, low-price, low-carbon resources not under contract to LSEs in GHG regions will likely not be deemed the source of imports to GHG areas, even if the resource operator designated them as available for import to California, and although a daily purchase of clean energy may not constitute resource shuffling. For example, increased imports of uncontracted low-carbon energy to meet an unexpected increase in demand would not constitute resource shuffling but would be constrained under this design because those resources would be allocated to non-GHG areas in the reference run.[21] However, as noted above, we understand that most of the zero cost low GHG resources owned by LSEs serving load outside California are designated not available to be deemed the source of CAISO GHG imports so this design does not have much practical effect for very low cost low GHG supply.

The shift from self-nominated base schedules to GHG-constrained IFM dispatch is a significant change in how resource shuffling has been addressed. On the one hand, if the EDAM was to instead implement a market dispatch without any consideration of GHG costs, the resulting dispatch could transparently designate low-carbon resources for delivery into GHG regulated areas. On the other hand, many of those very same considerations have likely been internalized into the bilateral market and have influenced offers into today's CAISO market. Consider, for example, that imports of low-carbon energy into California purchased out of today's IFM would be part of a CAISO EIM base schedule and therefore not contain any "secondary dispatch" as it is defined today in the WEIM context.[22] When considering other aspects of GHG treatment in the EDAM proposal, it is important to keep this fact in mind when considering elements of the proposal that could create unpredictable impacts on market outcomes while yielding only hypothetical benefits in reduced emissions.

4.3.2 *Mitigation of secondary dispatch*

The EDAM proposal would implement constraints designed to limit the "secondary dispatch," relative to a reference schedule. As discussed above secondary dispatch in the EDAM will be limited by establishing a reference run that excludes imports to GHG regions. The constraints on changes to this reference schedule will be similar to those applied in WEIM, but the reference schedule will be defined differently in EDAM than in WEIM. However, some stakeholders have expressed concern that the ISO's constraints for limiting secondary dispatch might not be fully effective in doing so.

[21] The proposal also contains provisions that allow delivery into GHG regions from resources under contract to serve LSEs in those regions, although we believe the classes of contracts considered should be expanded. We discuss these provisions in Section 4.3.3.

[22] The practical effect of the change may be small to the extent that low-GHG resources are procured under contracts and will be excluded from the proposed reference run.

As discussed by the ISO during the stakeholder process,[23] it is mathematically possible to define an IFM model that would secure GHG-energy for imports to GHG zones through a scheduling process that constrains such energy to come only from increases in production from individual resources, where those increases are measured relative to their output in the GHG-reference pass. However, the CAISO has argued that the binary variables required by such a formulation would add significant complexity, and it is not included in the EDAM proposal.[24] Similar considerations led to the rejection of an analogous approach in the WEIM.[25]

We agree with the ISO that increasing the complexity of the IFM solution creates trade-offs with other objectives and needs to be carefully balanced with the potential gains. In addition, the potential for this binary variable-based modeling approach to result in prices that are not consistent with the dispatch is undesirable and could have significant unexpected consequences for market efficiency if it were a material issue. We are not able to assess the likely empirical impact of this alternative approach but it clearly has solution time and price formation impacts, for both GHG-regulated and non-regulated areas, relative to the CAISO's proposed EDAM design.

Instead, the ISO proposes a requirement that the deemed GHG-imports from any resource be no more than:

> *"the positive difference between the upper economic limit on the energy bid and the GHG reference obtained from the GHG reference pass."*[26]

This constraint is directly analogous to the one applied today in WEIM, with the important difference that the role of the base schedule in WEIM is replaced with the GHG reference pass. While this substitution limits the ability of the market to redirect energy relative to the reference pass, it does not eliminate it.[27]

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[23] A. Gilbert, Extended Day-Ahead Market Greenhouse Gas Discussion, CAISO Market Surveillance Committee Meeting, p. 13, www.caiso.com/Documents/ExtendedDay-AheadMarketGreenHouseGas-Presentation-Oct21_2022.pdf.

[24] In particular, such an IFM model formulation would necessitate the uses of additional binary variables (one per resource per hour) to enforce that constraint while still allowing for the possibility that congestion, changes in commitment, or other factors would mean that the optimal IFM output for a resource could be less than the GHG-reference pass output. The introduction of such variables would increase computational times, and would also increase the likelihood that LMPs and/or GHG-energy would not support the optimal schedule, resulting in a need for bid cost recovery or other out-of-market actions to ensure that resources are incentivized to follow market schedules.

[25] *EIM Greenhouse Gas Enhancements, 3rd Draft Final Proposal*. California ISO. April 25, 2018. http://www.caiso.com/informed/Pages/StakeholderProcesses/CompletedClosedStakeholderInitiatives/RegionalIntegrationEIMGreenhouseGasCompliance.aspx

[26] Final Proposal, p. 99.

[27] For example, a combined cycle unit of 400 MW capacity might produce 300 MW in the GHG-reference pass in a given hour. This would then mean that the above quoted constraint would limit GHG-energy in the IFM from that resource to being no more than 400-300 = 100 MW. Even if it turns out that the output from that generator is also 300 MW in the IFM (the same as the GHG-reference pass), in the

To the extent that the two-pass approach has any impact on deemed imports relative to the current base schedule design, this could induce inefficient strategic bidding. Various stakeholders pointed out in a discussion of a similar design back in 2018-2019 that if WEIM entities are in fact excluding cost low-emission supply from their base schedules they could reduce the likelihood of this supply of clearing in the GHG reference pass by offering it at higher prices in the EDAM. Similarly, in theory, strategic offer behavior could also frustrate the goal of the new EDAM constraint to reduce secondary dispatch. In particular, it is possible for resource owners to construct offers to increase the amount of low-emissions GHG-reference generation that could be assigned GHG-energy status, by increasing the number of partially loaded generators in the reference pass, and as a result have both GHG-reference generation as well as headroom between their capacity and reference pass output. For instance, hydro power owners might bid half of the capacity of every hydro resource at a very low price and the other half at a higher price that they predict would not clear the GHG-reference pass, but would clear the IFM or the WEIM. The CAISO has noted that this offer price strategy might cause the supply not to clear in the IFM, but the supply could still be offered at a lower price in the WEIM and both clear in the energy market and be eligible to support GHG imports. The likelihood of the supply being offered at price that does not clear in the GHG reference pass but does clear in the market pass will increase as the GHG component of market prices in the GHG regions rises over time. This strategic behavior could conceivably be detected by the market monitor. That behavior could potentially also be deterred if individual generating units were separately dispatched rather than aggregate plants, which would likely shrink the MW quantity of partially loaded capacity in the GHG reference pass, although that would complicate the scheduling software.[28] It is hard to assess these factors because we do not know the detailed facts of the current secondary dispatch, nor the likely numbers and capacities of partially-dispatched generators in the EDAM reference pass.

In summary, although the CAISO's proposed formulation would not eliminate secondary dispatch, relative to the reference run, in the EDAM, its prevalence as a fraction of the volume of energy transacted in EDAM could be appreciably smaller than in the WEIM because of constraints that force any secondary dispatch to be sourced from resources that are partially but not fully dispatched in the GHG-reference pass to provide GHG-reference energy that can also be designated as GHG-imports. We encourage CARB and DMM to carefully monitor offer behavior and to estimate the amount of secondary dispatch in order to identify opportunities to limit that behavior without raising barriers to achieving the efficiency benefits of a regional day-ahead market.

ISO's formulation, it could still provide 100 MW of GHG-energy. This presents the possibility of some secondary dispatch, because the 100 MW of imported energy to the GHG zone must have been made possible by increasing the output of some other (possibly higher emitting) generator in the IFM run relative to the GHG-reference pass.

[28] As an extreme example, Grand Coulee has 33 generating units averaging just over 200 MW apiece, totaling 8600 MW for the entire plant.

4.3.3 *Treatment of GHG-zone LSE assets and contracts in non-GHG zones*

As discussed above, the proposed resource-specific solution, with its GHG reference pass, effectively gives non-GHG zones "first-crack" at buying energy from low price (and low-carbon) resources unless those resources have been procured by GHG zones through an RA or other contract that is excluded from the reference pass and thereby eligible to supply load in GHG regions. The intent of the design is to prevent or discourage output of a resource from being claimed as delivering into a GHG area if it is already deployed in the reference pass to serve some other BAA in a non-GHG area. If there is low-emissions power that LSEs in California (and Washington State) have contracted for but EDAM procedures do not exclude from the GHG-reference pass, then those LSEs are placed at a disadvantage, because the IFM will likely sell that power at the lower WEIM price to non-GHG areas, thereby forcing those LSEs to buy power to meet their GHG region load at a higher price that includes GHG emission costs. The current proposal only mentions RA contracted resources contracts as eligible to be excluded from the reference pass, and thus eligible in the IFM to be deemed the source of imports to GHG region.[29] We urge the proposal be revised to allow explicitly for a much larger range of arrangements for supply contracted by California and Washington LSEs to be identified and excluded from the reference pass and thereby qualify as importable into a GHG area in the market pass.

The California Air Resources Board (CARB) GHG policy clearly intends for renewable energy projects procured by California entities to be claimed as sources of imported power, but this proposal as written would apparently deny that opportunity. One possible solution would be to allow for any resource being identified by GHG region LSEs as under contract as part of an RSE evaluation to also qualify for import status by being excluded from the GHG reference pass. This would reconcile the conditions for claiming a resource for RSE purposes as a legitimate import source. [30] Also, we note that many newly developed renewable energy projects may yield little or no RA capacity but still generate considerable zero-carbon energy. The entire bid-range of those resources, if contracted to GHG-area LSEs, should be excluded from the GHG-reference pass.

Even with such arrangements, the current system would still effectively not allow uncontracted low-priced low-emission power being made newly available to the market from being deemed

[29] FP, p. 99 states that the GHG reference pass will not schedule RA resources in EDAM BAAs outside the ISO BAA by ignoring the energy bids of these resources. Consequently, these RA resources will have a zero GHG counterfactual schedule, which means they can be fully attributed to the CA GHG regulation area in the IFM…".

[30] Another secondary issue that needs to be addressed when there are multiple GHG areas is that the current objective function design will deem the lowest emission resources delivered to the GHG region with the highest emission penalty rate. Stakeholders should understand that this element of the design could result in the state with the higher emission penalty having a lower GHG cost adder. A key issue for the CAISO implementation is that resources excluded from the GHG reference pass because they are under contract to GHG region LSEs be deemed delivered to the particular GHG region in which the LSE is located in the market pass. This can generally be implemented by the resource owner allowing the resource to be deemed an import only into the GHG region the resource is under contract to. This should not result in complexities if the low emission output is offered as price taking supply but could lead to anomalous outcomes for supply offered at prices above the non-GHG region clearing price.

imported to a GHG region. Newly available excess hydro supply, for example, that might be bid into EDAM, would likely be dispatched into non-GHG areas in the reference pass -- because imports into GHG areas would not be allowed in that pass. The prospect of discouraging resource shuffling/secondary dispatch as a result of an EDAM solution may be viewed as justifying the loss of this opportunity, but it should be clear that limits on the deeming of GHG imports may or may not be effective in deterring shuffling but could create economic inefficiencies.

4.3.4 *BAA-level GHG-energy export constraints*

A controversial element of the proposed GHG design is an export constraint that is intended to further reduce secondary dispatch. As originally formulated in the Draft Final Proposal, the constraint would have capped BAA deemed-GHG exports in the market pass at the level of exports in the GHG reference pass.[31] For BAAs with a net import position in the reference pass, no deemed-GHG exports would have been permitted in the market pass. Moreover, BAA-level exports in the market pass would have been capped at the level of exports in the GHG reference pass. The fundamental premise behind such a constraint is that any increase, relative to the reference run, in transfers from a net importing region, or increase in exports from an exporting region, that is deemed imported into a GHG-region must constitute secondary dispatch. We do not agree with this premise. Further, we believe it is highly speculative whether this constraint would have had any material positive impact on the level of secondary dispatch. Rather, it is extremely likely that the design would have at times imposed anomalously high import costs on GHG regions, costs that would be entirely decoupled from emissions costs.[32]

The FP has reformulated the GHG energy-export constraint so that so that rather than being based on net exports in the GHG reference pass, the constraint would be applied to the *increase* in exports relative to the GHG reference pass.[33] This cap could be based on what the proposal calls a "static" approach, constraining GHG-energy from a given BAA by the difference between the exports in the mitigation pass in which other elements of the GHG design would be applied, and the exports in the GHG reference pass. Alternatively, the CAISO might use another post-mitigation pass iteration to set this cap.[34] While this design as we understand it has the potential for the constraint to cause inefficiently high emission cost resources to be dispatched in the market pass in some situations, it avoids the potential for extreme high import costs that are unrelated to emission costs associated with the original proposal. It also could have some impact on

[31] Draft Final Proposal p. 96.

[32] In fact, we have simulated simple cases where such a constraint is actually counterproductive, causing both market-wide fuel costs *and* emissions to worsen.

[33] The language in the FP is somewhat ambiguous: "*the aggregate GHG attribution to resources in a BAA in the non-GHG area is limited by the net export constraint; it would not exceed either the BAA's export capability or optimal net export transfer in a given interval (with the exception of RA capacity), relative to the net export transfer in the GHG reference pass*" (p. 99). It is our understanding that "optimal net export transfer in a given interval" refers to the optimal level in the IFM scheduling process (as explained in the next sentences either the level calculated in the market power mitigation pass or an early iteration of the IFM market model, both calculated without imposing the export constraint), and not the GHG-reference pass optimal level.

[34] Ibid., p. 102

reducing secondary dispatch, although without detailed simulations, it is not possible to project how large this impact is.

Some of potentially inefficient outcomes from the proposal's static approach based on a prior run could probably be avoided with the more dynamic approach to setting the optimal GHG imports that was mentioned in the final proposal.[35] However, these more dynamic approaches have the potential to introduce at least some of the issues associated with the alternative design discussed earlier in which individual resource attributions are limited to their increased dispatch relative to the GHG reference pass, including both solution complexity and inconsistent pricing outcomes. Whatever approach is ultimately adopted, the CAISO should describe its approach in more detail than is provided in the Final Proposal and allow review by stakeholders before moving forward with this design. Simulations to assess the frequency with which the export constraint would be binding, and its effect on cost, emissions, and secondary dispatch would also be usefully informative.

We strongly oppose implementation of the original export cap outlined in the draft final proposal. The design outlined in the Final Proposal appears to be an improvement that reduces the risks of significant anomalous pricing outcomes and its implementation could, in theory, allow the CAISO to identify issues and make incremental improvements in the formulation of the constraint. However, we disagree with the fundamental premise that appears to underlie the motivation for the original (Draft Final Proposal) formulation of such a constraint: that any increase in transfers from a net-importing region (or increase in exports relative to the level of exports in the GHG reference pass) constitutes secondary dispatch. The environmental benefits of such a constraint are hypothetical at best, while the potential for anomalous pricing, or even reliability outcomes, remain. We recommend that the Boards require that the CAISO come back to the Boards for approval before implementing any version of the export constraint that differs from the modified version in the Final Proposal, if testing of the implementation reveals issues with the approach contained in the Final Proposal.

4.3.5. *Suspension of the export constraint when a GHG-zone fails the RSE*

Because of concerns that the BAA export constraint imposed in the IFM model could make it raise the cost of imports to GHG-areas and even endanger reliability in those areas, the CAISO proposes to lift the export constraints when a balancing authority within a GHG regulation area fails the RSE. This might make more imports available. Some stakeholders have expressed concern over the emissions impacts of suspending the export constraints.

It is possible to implement a set of constraints and variables in the IFM could be defined that would allow GHG-energy to be exported from a BAA in excess of the amount that would be allowed under an export constraint. A variable could be created that equals this incremental export for a given BAA in a given hour, and assigned a cost in the objective function equal to the CARB unspecified emissions rate (0.432 tons/MWh times the prices of allowances). This would give the system flexibility to import additional power under stressed conditions, if justified

[35] Ibid.

economically, with less or no compromise of the environmental integrity of the GHG accounting system.

The potential need for such a rule allowing suspension of the export constraint was largely driven by the potential for extreme anomalous outcomes with the version of the export constraint proposed prior to the Final Proposal. If the CAISO implements the form of the export constraint that is described in the final proposal (as we currently understand it), the need for such a relaxation would be greatly reduced if not eliminated. Because the design of the export constraint is fluid, and it has not been developed, let alone tested, it would be prudent to retain the potential for such a suspension of the export constraint during tight system conditions, but with the expectation that this provision could be dropped after the design and implementation of the export constraint is completed and tested, or perhaps after it has been in operation for a period of time.

If it is challenging to implement such a system on Day 1 of the EDAM, it could be deferred and implemented later if RSE failures occur often enough that the emissions involved are judged to be significant.

4.3.6. *Accommodation of different GHG regulatory systems*

Under the CAISO's proposal, some stakeholders have expressed concern that the use of a counterfactual (the GHG-reference run) together with the IFM to identify GHG-energy to be imported into different GHG-areas (California and Washington) could result in clean electricity being deemed as delivered to different markets than intended by resource owners, even if the energy has been contracted to the intended sink. Based on our understanding of the constraints to be implemented in the GHG-reference and IFM models, it appears that if the change we propose in Section 4.3.2 is implemented, then resources can constrain their output to be deemed delivered to the market of their choice by appropriate specification of

- contracted energy to be exempted from the GHG-reference pass; and
- amounts of energy eligible for GHG-energy designation to each GHG-area.

For instance, a renewable source of size 200 MW might wish to direct 60 MW to California, 70 MW to Washington State, and the rest to the highest bidder in a given hour. This could be accomplished by having the resource designate 130 MW as excluded from the GHG-reference run, 60 MW as GHG-energy offers to California (but not to Washington State) in the IFM, and 70 MW as GHG-energy offers to Washington State (but not to California), with the last two categories allowed to have different GHG costs consistent with GHG prices in each of the GHG-areas.

4.3.7. *Consideration of alternative paradigms for GHG accounting*

We support the CAISO's commitment to the consideration during the first year of EDAM's operation of alternative GHG accounting schemes that might be simpler to implement than the source-by-source proposal, especially as this accounting becomes more complex as additional states create their own GHG regulatory systems. In an Opinion that we provided at the time of

AB32's original implementation,[36] we considered the merits of a load-based accounting system (similar to LADWP's proposal) as well as a source-based system that would require all sources in a zone to surrender allowances at the same rate, approximating the marginal emissions associated with increases in net load in the zone. At that time, we endorsed a source-based system as less likely to burden power markets with unneeded complexity that would market harm efficiency.

However, the hybrid "first deliverer" approach that was eventually adopted was not considered at the time. The issues associated with load bearing the compliance obligations associated with imports are different than those associated with assigning emissions responsibility for local generation.[37] Further, given the advent of clean energy programs in Washington and Oregon based on different principles than embodied in the AB32 program, the existence of WEIM, and the proposed implementation of EDAM, this is an appropriate time to consider of what GHG accounting system for imported power would be effective in furthering regulatory goals while promoting efficient electricity trade. Due consideration would need to be given to the possible challenges involved in revising state rules to implement those changes, which we understand would be avoided, at least initially, by implementing the CAISO's source-by-source proposal.

V. Comments on EDAM Transmission Treatment

The EDAM transmission design has three significant elements that we discuss in this opinion. The first is the requirement for the purchase of firm transmission to support the delivery of resources in the EDAM RSE evaluation, which we have already discussed in Section 3.3 above in the context of the RSE. The second transmission element, which we discuss next in Section 5.1, includes the provisions to compensate transmission providers for reductions in short-term firm and non-firm transmission revenues. The third consists of transmission requirements for EDAM Participation, which we review in Section 5.2.

5.1 Compensation for Reductions in Firm and Non-Firm Short-Run Transmission Revenues

We do not assess the merits of the general design nor the specific payment provisions for the compensation provisions, as the EDAM participants are better positioned to assess those equity and policy considerations. Our review has focused on whether there are any elements of the design that have the potential to lead to material unexpected outcomes in terms of the overall level of payments. In general, we conclude this is not the case. The design developed by the CAISO and potential EDAM participants contains checks on large unexpected transfers resulting from these provisions. However, there are a few elements of the design that have some open elements, which we describe later in this section.

[36] F.A. Wolak, J. Bushnell, J. and B.F. Hobbs, Opinion on load-based and source-based trading of Carbon Dioxide in California. Market Surveillance Committee of the California ISO, Folsom, CA, 2007.

[37] B.F. Hobbs, J. Bushnell, J. and F.A. Wolak, Upstream vs. downstream CO_2 trading: A comparison for the electricity context. *Energy Policy*, 38, 2010, 3632-3643.

The proposed design for compensating transmission providers transmission has four components.[38] These are make-whole payments for:

- foregone short-term firm and non-firm revenues on existing facilities.
- foregone short-term firm and non-firm revenues on new transmission investment;
- foregone non-firm short-term revenues on expiring pre-OATT contracts; and
- compensation for EDAM "wheeling" flows.

We discuss the potential for unexpected levels of payments for each component in turn below. First, we do not see the potential for material unexpected outcomes under the first component as the proposed design caps eligibility for payments based on both the historical level of short-term firm and non-firm revenues and also by the share of these historical revenues on EDAM interfaces.

We also generally do not anticipate significant unexpected outcomes under the second component as the proposed payments are capped by the historical fraction of short-term firm and non-firm revenues. We also understand from the CAISO that this ratio is less than 10% for likely near-term EDAM participants. One element of this design that needs to be evaluated over time is that there may be the potential for unintended cost impacts if balancing areas with very different types of transmission structure were to join the CAISO with much higher ratios of short-term firm and non-firm revenues. In this situation, the proposed design might shift the bulk of new transmission investments onto other EDAM participants.

In general, we also do not see the potential for material unexpected outcomes under the third component relating to expiring pre-OATT contracts, as the potential payments are capped by the overall historical proportion of short-term firm and non-firm revenues on transmission assets. However, one element of this design which we have not been able to assess is the extent to which historical non-firm revenues may include non-firm revenues on transmission capacity covered by pre-OATT contracts that was not utilized in real-time. If this is the case, the proposed design may create a potential for double recovery of any decline in non-firm revenues associated with transmission assets covered by such pre-OATT contracts. Perhaps transmission providers with such pre-OATT transmission contracts are able to separately track the non-firm revenues associated with unused capacity associated with pre-OATT transmission constraints and it is intended that these revenues would not be included in the short-term firm and non-firm revenues used to calculate forgone revenues in the first category, but this is not explained in the Final Proposal.

Fourth, we generally do not see a significant possibility of material unexpected outcomes under the fourth component relating to wheeling payments. However, there are some elements of the design that are not well defined at present and these ambiguities need to be resolved. In particular, 1) we understand from the CAISO that the calculation of wheel-through volumes will be net of any flows associated with scheduled firm transmission associated with resources shown in the RSE and cleared in the day-ahead market. This should be clarified and a method developed to

[38] The EDAM proposal defines three elements, one of which we divide into two, yielding the four listed below.

implement it. The impacted transmission provider should not be paid once for firm transmission service and then charge the rest of the EDAM a second time for non-firm transmission on the same flows. Also, 2) we observe that as the EDAM expands, the BAA-to-BAA firm transmission associated with the RSE and day-ahead market will result in loop flows over the transmission systems of other balancing areas. This design will entail calculation of these loop flows through BAAs that are off the contract path of the firm transmission rights and the assignment of firm-transmission revenues to compensate transmission providers for these loop flows, recognizing that contract path flows through a balancing area may in part flow through other balancing areas. There are going to be some complexities in implementing this design and treatment of loop flows which the CAISO has not yet specified. Since some elements of this design have apparently not been fully worked out, we cannot express any opinion on how those elements may impact transmission customers across the EDAM.

Finally, we note that our view of these provisions is that all of these payments will be reflected in the determination of transmission rates and will not result in any overall increase in the transmission cost of service recovered by EDAM transmission providers. Instead, these payments are intended to avoid undue reductions in the transmission revenues for particular transmission providers that would unduly impact power consumers in the provider's balancing area.

5.2 EDAM Participation Requirements

The ISO model and the traditional OATT model feature different approaches to the recovery of embedded transmission capital costs. The CAISO recovers the bulk of its transmission costs from a transmission access charge (TAC) paid by load, as well as exports from the CAISO system. In areas dominated by a vertically integrated utility, transmission costs are recovered through a combination of utility rates and revenue raised by the marketing of firm and non-firm transmission rights through an OATT process.

Traditionally a newly developed resource that was unaffiliated with the transmission owner in an OATT area would typically procure firm transmission rights, or risk being unable to market its output if or when non-firm transmission was not available. However, because the EDAM will consider all available transmission and would accept bids from participating resources, a new policy must be adopted for the participation of resources located in OATT areas. The concern amongst many potential EDAM participants was that, if there were no additional participation requirements, resources would be able to market their power without contributing to the recovery of the embedded transmission costs by bidding into EDAM without purchasing firm transmission service.

The EDAM proposal would adopt a hybrid approach in which participation in each BAA would continue in fashion analogous to current practice. Outside the CAISO BAA, in order to participate in EDAM, resources would either have to procure firm transmission rights from the transmission service provider (TSP) or pay a fee to the TSP equivalent to the price of the shortest-duration non-firm transmission product on offer in that area. In some areas non-firm transmission is available hourly, but in other areas, our understanding is that non-firm transmission service is available only as a daily product. The purchase of daily transmission service could be prohibitive for some high-cost resources that would only be dispatched in order to meet short-duration

peaks or for intermittent resources that would only be dispatched to their peak output for very few hours a day.

We have been told that these provisions simply continue current practice in which resources purchase firm transmission service or its equivalent. We do not have independent knowledge of these arrangements in WECC BAAs from our past experience and have not been able to verify the situation through discussions with individual stakeholders.

There is a general efficiency concern about the recovery of transmission costs through hourly marginal charges. If a resource does not procure firm transmission rights, it is reasonable to expect that this policy would result in resource bids that incorporate the transmission cost into the supply offers. This can result in a distortion of the dispatch order. While such bids would reflect the resource's marginal cost of participation, the underlying societal costs are sunk. Efficiency can therefore be harmed when the recovery of sunk costs is included in the marginal supply (or consumption) costs of resources.[39] If all supply paid an equivalent $/MWh fee, the supply offers would be shifted upward symmetrically, but in the EDAM context some lower-cost resources may not be dispatched simply because they are subject to a higher $/MWh transmission charge than other resources. We have been informed by CAISO that under present practice, all resources pay for the required firm transmission service as part of their interconnection agreement, so these efficiency concerns do not arise; however, we do not have independent knowledge of whether that is the case.

It is unlikely that such considerations would play a significant role in the early stages of EDAM, as the vast majority of resources will have some form of firm-transmission service. However, over the longer term, a system in which transmission costs are recovered – from either supply or load – through non-marginal charges, such as a periodic fixed connection charge, might be more efficient than the current system.

[39] Traditionally, load has been considered much less elastic than supply. This fact underpins the logic behind applying a TAC to load only, because, under the well-known principles of Ramsey pricing, it is more efficient to recover fixed costs from less elastic customers.