Comments of Powerex Corp. on
Regional Integration California Greenhouse Gas Compliance Technical Workshop

Submitted by	Company	Date Submitted
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Powerex appreciates the opportunity to submit comments on CAISO's October 13, 2016 technical workshop on Regional Integration California Greenhouse Gas Compliance ("Technical Workshop").

At the Technical Workshop, CAISO staff explained the existing approach used in the EIM to select the out-of-state generating resources—and associated greenhouse gas ("GHG") emissions—that are reported as serving load in California through the Energy Imbalance Market ("EIM"). CAISO staff provided examples of scenarios in which the existing EIM approach may produce results that are counterintuitive, or do not accurately identifying the out-of-state resources that are incrementally dispatched to meet California load. Powerex appreciates the efforts by CAISO staff to explain both the logic and the concerns regarding the current GHG approach used in the EIM. This discussion underscores the need to not only work toward a longer-term solution for use in a potential future regional organized market but to identify improvements that can be implemented in the EIM as soon as possible in order to address the distortions to dispatch decisions, market outcomes, and GHG reporting that continue to occur in that market.

CAISO staff presented and discussed three potential options for improving how GHG emissions are incorporated into the market optimization and process.[1] Powerex's comments regarding each option are discussed more fully in these comments, and are summarized below:

- Powerex believes "Option 2" offers the greatest promise for accurately determining which out-of-state resources are being used to serve California load. Given CAISO staff's view that Option 2 may not be computationally feasible at the present time, Powerex believes that work should continue to develop this approach in the future, but other options need to be considered for prompt implementation in the EIM.
- Powerex supports refining "Option 3" and implementing it as soon as possible in the EIM as an interim approach until a more comprehensive solution becomes computationally feasible. While Option 3 does not offer a comprehensive solution to accounting for out-of-state GHG emissions directly in the optimization, it appears to offer significant improvements over the current EIM optimization and can be implemented promptly.

[1] CAISO presentation at October 13, 2016 Technical Workshop at 15 ("CAISO Presentation"), a*vailable at* http://www.caiso.com/Documents/UpdatedAgenda-Presentation-RegionalIntegrationCaliforniaGreenhouseGasCompliance-TechnicalWorkshop.pdf

- Powerex concurs with CAISO's conclusion at the Technical Workshop that "Option 1" should not be pursued further.

I. The Existing Market Optimization Leads to Inefficient Outcomes and Must be Improved as Soon as Possible

This stakeholder process is one of a number of processes focused on issues that need to be addressed as part of the potential regional expansion of the CAISO BAA and associated market platforms. But examination of how GHG compliance will be extended to a regional market cannot be separated from the need to re-evaluate how GHG compliance currently occurs in the context of the EIM. As has been noted by CAISO, the performance of the EIM design regarding GHG compliance for out-of-state resources serving load in the CAISO BAA has raised concerns, including from the California Air Resources Board ("CARB").

In prior comments in this stakeholder process and in CARB's regulatory process, Powerex has identified and explained its understanding of some of the circumstances in which the current EIM algorithm may not accurately recognize the out-of-state resources that are used to serve load in the CAISO BAA.[2] In essence, the current EIM algorithm will "deem" imports serving load in California to be sourced from the output of the EIM participating resources with the lowest GHG adder, even if the resource's output was fully committed under its resource base schedules.[3] The general result has been that the GHG emissions reported for EIM "deemed deliveries" do not accurately reflect the additional emissions that occur specifically as a result of serving California load in the EIM.[4]

The inability of the existing market optimization to accurately consider GHG emissions associated with serving California load in the EIM can lead to several unintended adverse consequences. These adverse consequences fall into three broad categories:

1. The GHG emissions assigned by the EIM algorithm understate the actual GHG emissions associated with additional out-of-state dispatch to serve California load in the EIM. As a result, ***too few GHG emissions allowances are retired*** under California's cap-and-trade program.

[2] *See, e.g.,* Comments of Powerex Corp. on the Proposed Amendments to the Cap-and-Trade Regulation (September 9, 2016), *available at* https://www.arb.ca.gov/lists/com-attach/4-capandtrade16-WzhQOQRoWGYGZQRq.pdf

[3] For resources committed in base schedules to serving load outside of California, the EIM algorithm can result in a deemed delivery inconsistent with those prior commitments. For resources committed in base schedules to serve load inside of California, the EIM algorithm can result in deemed deliveries that may double count low- or zero-GHG imports into California.

[4] Powerex emphasizes that the issues discussed at the Technical Workshop are distinct and separate from the broader question of the environmental benefits of the EIM. The EIM has facilitated significant quantities of last-minute intra-hour exports from California, without which it may have been necessary to curtail the output of California renewable resources. These exports—which might not have occurred without the EIM—reduce GHG emissions from out-of-state resources, and hence provide significant environmental benefits in the region. Recent CAISO analysis indicates that the out-of-state GHG reductions achieved through the EIM when the CAISO BAA is a net exporter of energy in the EIM have significantly exceeded any increase in out-of-state GHG emissions during times that the CAISO BAA is a net importer of energy in the EIM. Just as the *overall* environmental benefits of the EIM do not eliminate the need to address the serious issues that have been identified with the current GHG compliance design in the EIM, these issues do not imply a lack of overall environmental benefits in the EIM. To the contrary, addressing the issues that have been identified will further increase the environmental benefits of the EIM.

2. When the EIM algorithm does not include the GHG costs of out-of-state resources that are dispatched to meet California load, it makes out-of-state resources appear more economic than in-state resources, whose GHG costs are always included. ***This can result in "leakage"*** because it may shift GHG emissions from in-state resources to out-of-state resources, even when the out-of-state resources are not lower cost (when GHG costs are included).
3. When the EIM algorithm does not accurately include the GHG costs of out-of-state resources that are dispatched to meet California load, it cannot accurately consider GHG emissions in the selection of which out-of-state resource to dispatch. In these cases, ***the EIM cannot preferentially dispatch low- or zero-emitting out-of-state resources appropriately*** over higher-emitting out-of-state resources, since GHG costs are not accurately considered.

Each of these adverse outcomes could impede California's environmental policy objectives and distorts market outcomes. For instance:

- Retiring too few GHG emissions allowances for EIM transactions permits excess GHG emissions from other transactions or in other regulated sectors;
- By not accurately distinguishing between high- and low-emitting out-of-state resources, the EIM does not provide the appropriate price signals to encourage participation by and use of cleaner resources; and
- When the EIM algorithm improperly ignores the GHG costs of out-of-state resources dispatched to serve California load, it can result in an inefficient displacement of lower-cost, lower-emitting in-state resources.

Powerex appreciates that there now appears to be broad recognition that the EIM design for GHG compliance needs to be improved. However, the numerous unintended adverse consequences of the existing EIM design will continue to occur until such improvements are implemented. It is therefore critically important for this stakeholder process to produce a strategy that addresses the shortcomings of the EIM design as soon as possible, in addition to addressing how GHG compliance will be achieved in a future regional organized market. Powerex emphasizes, however, that developing and refining a solution for a regional market can occur over the next several months or even years, but a solution for the EIM is needed urgently. For these reasons, Powerex urges CAISO and stakeholders to prioritize developing measures that can be implemented promptly in the EIM.

II. Powerex Supports Developing Option 3 as a Near-Term Interim Solution in the EIM

Discussion during the Technical Workshop indicated strong conceptual support for Option 2 (discussed more fully below) as the approach best able to accurately identify the out-of-state resources serving California load. The principal concern expressed by CAISO staff regarding Option 2 is that it may not be possible to implement it in the near term, since it involves introducing an additional optimization process prior to each market run. Powerex thus understands that Option 2 does not appear to be a feasible approach to improving GHG compliance in the EIM in the near term.

CAISO staff also presented Option 3, which would involve a more limited change to the EIM optimization and hence could be implemented promptly. As Powerex understands it, Option 3 would retain the existing algorithm for assigning deemed deliveries to California among out-of-state EIM participating resources. However, it would also add a hurdle rate that applies to all imports serving load in California, regardless of which specific resource is deemed delivered to California load. In other words, the EIM algorithm would select an out-of-state resource to serve load in California only when such a resource were economic given its energy bid, its resource-specific GHG adder, *plus* the hurdle rate applied to EIM transfers serving load in California. As described at the Technical Workshop, out-of-state resources selected to serve California load in the EIM would continue to be compensated based on the GHG shadow price, and would continue to report and comply with CARB regulations based on their resource-specific GHG emission rate. The surplus revenues collected by CAISO as a result of applying the hurdle rate to EIM transfers serving load in California would be used to procure and retire additional GHG allowances.

The introduction of a hurdle rate in Option 3 can correct for the *systematic* understatement of GHG emissions associated with out-of-state resources that serve load in California. This approach has the potential to address two of the three types of adverse outcomes currently occurring in the EIM:

1. Option 3 can ensure that the total quantity of GHG emissions assigned in the EIM more closely matches the additional GHG emissions from out-of-state resources dispatched to serve California load.

2. Option 3 can reduce GHG "leakage" by modifying the EIM algorithm to recognize both the resource-specific GHG costs *and* the hurdle rate correction in order to avoid persistently understating GHG costs when the algorithm determines whether to meet California load from out-of-state resources as opposed to in-state resources.

Option 3 does not, however, address the third adverse outcome discussed previously, related to how the EIM algorithm selects between multiple out-of-state resources with different GHG costs. Under Option 3, there will continue to be scenarios in which the EIM incorrectly ignores the GHG costs of the out-of-state resources being dispatched to serve load in California, in which case zero- or low-emitting resources will not necessarily be preferentially dispatched over higher-emitting resources. Under Option 3, this will remain an important area where the market optimization will continue to be suboptimal. Option 2, the only solution identified so far that addresses this issue, requires changes to the optimization, which CAISO staff believe may not be computationally feasible at this time. Consequently, Powerex supports prioritizing the prompt implementation of Option 3 in order to benefit from the significant improvements it offers, rather than indefinitely delaying taking action in order to pursue a more comprehensive solution.

One of the key aspects of Option 3 that will need to be finalized prior to implementation is the calculation of the hurdle rate. As discussed above, properly implemented, the hurdle rate can potentially achieve two objectives: retiring the appropriate quantity of GHG emissions allowances; and encouraging efficient dispatch as between out-of-state GHG-emitting resources

as opposed to in-state resources. However, each objective is likely to imply a different value for the hurdle rate.

The hurdle rate that achieves assigning the correct total quantity of GHG responsibility will need to reflect the difference between (1) the average resource-specific GHG emission rate of resources "deemed delivered" by the EIM algorithm; and (2) the average out-of-state GHG emissions associated with serving California load. The latter likely would be based on an after-the-fact counterfactual analysis similar to one the CAISO recently conducted.[5] For example, if the counterfactual analysis indicated that serving California load from out-of-state resources resulted in average GHG emissions of 0.5 Metric Tons/MWh, but the EIM algorithm assigned an average of 0.3 Metric Tons/MWh of GHG responsibility, then the hurdle rate could be based on the need to recognize, on average, an additional 0.2 Metric Tons/MWh of GHG emissions beyond what is assigned by the EIM algorithm. This would imply a hurdle rate of $2.5/MWh, assuming a GHG allowance price of $12.5 per Metric Ton.

While this approach would assign the correct average GHG emissions, it may result in the wrong marginal dispatch decision in the EIM. Any time that the EIM algorithm deems imports serving California load to be from non-emitting resources, for example, the hurdle rate will be the *only* GHG cost associated with displacing in-state GHG emissions with out-of-state emissions. But this hurdle rate is likely to be well below the GHG emission costs of the marginal out-of-state resources being dispatched.

In order to encourage the efficient substitution of out-of-state resources instead of in-state resources, the hurdle rate should reflect the difference between (1) the marginal resource-specific GHG cost; and (2) the ***marginal*** GHG emission rate of the out-of-state resources dispatched to serve California load. The first value is simply the average of the marginal GHG shadow prices over time, which are already calculated in the EIM optimization. The second value can be determined by starting with the same counterfactual analysis referenced earlier, modified to determine the GHG emission rate of the marginal resource dispatched to serve California load, rather than the average GHG emission rate of all such resources. Powerex notes that it may be challenging to accurately identify the marginal resource dispatched to serve California load; it may therefore be appropriate to use the emission rate for unspecified source energy as an estimate for the emission rate of the marginal out-of-state resource.

For example, if the marginal GHG cost under the counterfactual analysis was $7.5/MWh (*i.e.,* approximately 0.6 T/MWh), and the average GHG shadow price was $2.5/MWh, then the hurdle rate to encourage efficient displacement between out-of-state and in-state resources would be $5/MWh. Performing the calculation in this manner will ensure that, on average, the full $7.5/MWh of marginal GHG costs are recognized in the optimization when evaluating whether it is more efficient to serve California load from in-state resources as opposed to out-of-state resources.

[5] *See, e.g.,* CAISO presentation "Energy Imbalance Market GHG Counter-Factual Comparison (Preliminary Results: January-June 2016)" *Available at* http://www.caiso.com/Documents/EIMGreenhouseGasCounter-FactualComparison-PreliminaryResults_Jan-Jun_2016_.pdf

A hurdle rate designed to result in the appropriate marginal GHG costs will generally be higher than a hurdle rate designed to reflect the *average* GHG costs. This implies that use of the higher hurdle rate—which is necessary to encourage efficient marginal dispatch decisions—will tend to assign GHG responsibility in excess of the total GHG emissions associated with serving California load in the EIM. Therefore, a method may be required to distribute the excess rents generated by application of the hurdle rate in excess of the cost of the GHG emissions allowances that actually need to be purchased and retired.

One possible approach to distributing excess rents would be to credit the excess rents to the individual out-of-state resources that were "deemed delivered" to California. The rationale for this approach would be that, under Option 3, out-of-state EIM participating resources will continue to be compensated for accepting GHG reporting responsibility only through the GHG shadow price. As discussed previously, however, the need for a hurdle rate arises precisely because, under the current EIM optimization, the GHG shadow price does not accurately reflect the full marginal cost of out-of-state GHG emissions. Receiving a portion of the excess rents collected through application of the hurdle rate partially mitigates the depressed compensation received as a result of the current EIM algorithm systematically understating the GHG shadow price.

Another alternative for distribution of excess rents might be to simply require that resources that are deemed delivered to California in the EIM be required to retire GHG allowances based not only on the resource's specific GHG emission rate, but also based on the hurdle rate. CAISO would provide the rent collected through the hurdle rate to the entities deemed delivered, to offset the cost of the additional carbon allowances required. This approach will result in CARB collecting more carbon allowances than average emissions in the EIM associated with deliveries to California, but it is worth considering as an acceptable simplification.

III. Powerex Supports Continuing to Refine Option 2 for Future Implementation When Feasible

Option 2 appears to offer a robust and comprehensive framework for distinguishing between out-of-state resources that would be economic to serve load outside of California and the additional out-of-state dispatch (and GHG emissions) that occurs in order to serve load inside of California. Powerex believes this is an appropriate conceptual framework for accurately identifying the additional out-of-state GHG emissions associated with imports serving load in California. Applying such a framework to the CAISO's market optimization could address all three of the adverse outcomes experienced under the existing optimization in the EIM.

During the Technical Workshop, the key concern expressed by CAISO staff regarding Option 2 was the technical complexity of implementing this solution. Option 2 requires adding an additional optimization run to the market software in order to identify the economic dispatch to serve load outside of California. This new optimization run would need to be solved prior to each market run; it is currently unknown how much additional time would be required for this process, and whether it could be completed within the existing market lead times.

Powerex respects CAISO staff's assessment that it is likely not feasible to implement Option 2 in the near term. For this reason, Powerex supports prompt implementation of Option 3 as an interim measure to improve the performance of the EIM. In parallel with implementing Option 3, however, Powerex believes that work should continue toward developing the type of comprehensive and robust framework represented by Option 2. This additional work could include stress testing of how the optimization is formulated, to ensure this approach consistently leads to the correct outcomes. Developing estimates of computing time necessary to perform the additional optimization would also be helpful. If Option 2 would require more computing time than is available under current market timelines, additional work could evaluate how much (if any) accuracy would be lost by initializing the pre-market optimization farther in advance, or with less than full temporal granularity (*e.g.,* performing the pre-market optimization once per hour rather than once every 15 minutes or every 5 minutes). An exploration of the tradeoffs between simplifications and reductions to efficiency will allow CAISO and stakeholders to make more fully informed decisions regarding the best approach to GHG compliance in a regional organized market.

IV. Powerex agrees that Option 1 should not be pursued

CAISO staff concluded that Option 1 should be ruled out from further consideration. Powerex agrees. This stakeholder process is directed at developing an improved approach for incorporating information on GHG emissions in the CAISO optimization. Option 1 would make no changes at all to the market optimization. Consequently, under Option 1, the EIM (and a future regional market) would experience the same adverse outcomes being experienced in the EIM today, including understating the GHG emissions allowances that need to be retired, causing "leakage" of GHG emissions from in-state resources to out-of-state resources, and not providing efficient price signals to encourage participation by and dispatch of lower-emitting out-of-state resources. Powerex does not believe it is necessary or appropriate to accept an approach that is now broadly recognized as failing to meet the objectives of the CARB program.

Moreover, the proposed inter-temporal "balancing account" concept of Option 1 raises numerous new concerns. First, it appears to be inconsistent with CARB's regulations, which do not allow GHG liability for California imports in one hour to be offset by "credits" from California exports in other hours. Second, even if such an approach was permitted by CARB, it would be inconsistent with GHG compliance requirements for non-EIM transactions. In-state generators, for instance, cannot avoid liability for GHG emissions in one hour as a result of reducing their emissions in another hour. It is also unclear whether the "credit" derived from EIM exports would also be available to real-time exports outside the EIM that occur at CAISO intertie scheduling points, and/or to day-ahead exports.

Given that Option 1 would make no improvements to the market optimization and would raise new concerns, Powerex agrees with CAISO staff's conclusion that it should not be further pursued.