

Post-Workshop Comments of Powerex Corp. on EIM Offer Rules: Resource Sufficiency Evaluation

Submitted by	Company	Date Submitted
Mike Benn 604.891.6074	Powerex Corp.	May 14, 2018

Powerex appreciates the opportunity to comment on the April 30, 2018 Energy Imbalance Market (“EIM”) Offer Rules Technical Workshop (“April 30 Technical Workshop”). These comments address issues related to the resource sufficiency (“RS”) evaluations; Powerex is separately filing post-workshop comments regarding default energy bids in the EIM.

Resource sufficiency has been a core design principle of the EIM since its inception. Simply put, resource sufficiency requires that each EIM entity demonstrate its ability to meet its intra-hour balancing needs without relying—or “leaning”—on the resources of other EIM participants. The requirement for each EIM entity to be resource sufficient is critical to ensuring that all EIM transactions are for energy only; that is, for the purpose of economically displacing production that would otherwise occur at other, higher-priced, resources.

Powerex reiterates its strong support for the existing principles of the EIM’s resource sufficiency requirement, including its use of a 95 percent confidence standard in the design of the relevant tests. Powerex also continues to support the use of discrete tests to assess resource sufficiency from the perspective of:

1. Energy
2. Capacity; and
3. Flexibility (upward and downward)

Ensuring resource sufficiency is vital for several reasons.

First, and most importantly, it helps ensure the safe and reliable operation of the grid in real-time. If an EIM entity were to rely on supply being available from elsewhere in the EIM, and that supply did not materialize, the reliability of the grid could be undermined.

Second, by prospectively preventing EIM entities from relying on supply offered into the EIM to meet their reliability needs, EIM entities continue to have strong incentives to take the steps necessary to ensure resource sufficiency ahead of the operating hour, much as they did prior to participation in the EIM. In the case of EIM entities other than

the CAISO, this means procuring forward, day-ahead and real-time bilateral energy, capacity and/or flexibility to be positioned to meet the RS test. For the CAISO BAA, it means enhancing the products and services procured through the CAISO markets or that LSEs in the CAISO BAA are required to obtain. For example, this may include necessary enhancements to programs such as the Flexible Resource Adequacy program.

Third, it promotes equity between EIM participants and between regions participating in the EIM. Absent a robust EIM resource sufficiency framework that is applied to all EIM entities ahead of each hour, EIM entities and regions that are experiencing capacity and/or flexibility challenges would be able to lean on the capacity and/or flexibility investments made by other entities and other regions, without explicitly contracting for it. Were this to be permitted, the value proposition of EIM participation would be substantially altered, potentially jeopardizing the long-term viability of the EIM.

Powerex believes that the most transparent and effective way to ensure resource sufficiency, and hence promote appropriate procurement of resources in advance of EIM operations, is through the design of appropriate tests for each RS attribute. Specifically, a capacity test should be designed to evaluate whether an EIM entity has sufficient capacity to meet its peak 15-minute net load (including uncertainty) within the upcoming hour with a 95% confidence level. Similarly, an upward flexible ramping sufficient test (“FRST”) should evaluate whether an EIM entity has sufficient flexible capacity to meet the maximum difference between the hourly base schedule and the peak 15-minute net load, again at a 95% confidence level. An analogous downward FRST should evaluate the ability to meet the maximum difference between the hourly base schedule and the *minimum* 15-minute net load, at a 95% confidence level. Further details on a potential approach to making the RS tests more workable and accurate is found in Appendix A to these comments.

Based on Powerex’s understanding of the way the current RS tests are formulated, and its experience with the actual application of these tests during parallel operations and since the start of binding operations in April, Powerex believes the current design of the RS tests are failing to accomplish the above objectives.¹ Specifically, Powerex believes there are aspects of the way these tests are currently designed, and applied, that:

¹ While Powerex believes its understanding and description of the current RS tests to be accurate, it acknowledges that technical details may not always be clear from available documentation, and that certain aspects of these assessments are subject to change. Powerex welcomes greater discussion and clarification by CAISO on any aspect of the RS tests.

- Cause EIM entities to periodically fail the tests even though they are, in fact, resource sufficient at a 95% confidence level; and
- Cause EIM entities, and particularly the CAISO BAA, to periodically pass the RS tests when they are not resource sufficient at a 95% confidence level.

Powerex believes significant improvements can and must be made to the RS tests so they more accurately gauge resource sufficiency of all EIM entities and the CAISO BAA. In particular, Powerex believes that a stakeholder process is necessary to examine and address the following challenges of the current RS evaluations:

Issue 1: Certain RS Tests Are Needlessly Challenging For EIM Entities To Pass

Certain tests are needlessly challenging for EIM entities to pass, leading to erroneous RS test failures and limitations on EIM transfers, as well as increased costs as entities over-procure resources in order to pass the RS tests. These challenges include:

1. Information needed to calculate the specific volumetric requirements to pass the RS tests is being made available too late for EIM entities to take necessary actions to pass the RS tests.
2. The design of the RS tests commingles concepts of capacity and flexibility. That is, the ability to meet intra-hour capacity needs is not fully assessed by the current capacity test, while the flexibility test is not limited to assessing the ability to meet intra-hour flexibility needs.
3. The calculation of flexibility requirements associated with uncertainty of wind output forecasts is inaccurate, as it is driven by deviations observed in a similar operating hour in prior days. This is a step backward from how reserves for wind output uncertainty are generally determined by BAAs outside of the EIM context, where greater levels of upward flexible capacity are carried during hours of high wind forecast output (*i.e.*, reflecting the increased potential for wind output to decline) while greater levels of downward flexible capacity are carried during hours of low wind forecast output (*i.e.*, reflecting the increased potential for wind output to increase).

Issue 2: RS Tests Should Be Measured Relative To Base Schedules, Not To The Previous Hour

The FRST improperly assesses flexibility relative to the fourth 15-minute interval of the *previous* hour, whereas Powerex believes that the proper measure of resource sufficiency is whether an entity has sufficient capacity and flexibility *relative to base schedules*. This current design makes the test inherently complex and difficult for EIM entities to calculate their requirements and capability in a timely manner. More importantly, to the extent existing EIM transfers encumber some of the capacity or

flexibility of an EIM entity for an upcoming operating hour, this should not alter the determination of whether an EIM entity is resource sufficient.

Issue 3: Double-Counting Of EIM Transfer Credits Is Flawed, Undermines RS, And Is Enabling The CAISO BAA, In Particular, To Lean On The EIM For Flexibility

The current FRST provides “credits” associated with prevailing EIM transfers in the previous hour, which increase the flexible capacity calculated in both the importing and export BAAs and results in the double-counting of flexible capacity. While all EIM entities receive these additional credits from time to time, Powerex believes the CAISO BAA may be improperly receiving a credit of as much as 3,500 MW toward its own flexible capacity needs during the evening ramping period. The large swings in CAISO BAA EIM transfers during the evening hours are driven by the steep decline in California solar output at the same time that load is increasing rapidly. To balance the rapid change in EIM transfers, other EIM entities must increase output from their own flexible resources (in addition to increases in output needed to meet their own evening load ramps). Consequently, during evening net load ramps the CAISO BAA *consumes* large amounts of flexibility from *other* EIM BAAs, and yet the CAISO BAA appears to simultaneously receive large credits toward its flexible ramping sufficiency test during these hours.

Issue 4: CAISO BAA Should Not Be Permitted To Include Speculative Intertie Supply In Its RS Tests

The inclusion of all CAISO market intertie bids and awards in the RS tests for the CAISO BAA results in inclusion of supply that is not “real” at the time of the RS tests. This is because the CAISO day-ahead and real-time market rules permit sellers to submit bids and receive CAISO market awards without having procured physical supply and/or necessary transmission rights. This can and likely does result in the RS tests for the CAISO BAA including intertie supply that ultimately is not physically available; this is particularly problematic during periods of tight conditions across western markets. The key cause of this issue is that the CAISO does not become aware which market awards or bids will or will not be delivered until as late as 20 minutes prior to the operating hour, when e-Tags are due. The RS tests for the CAISO BAA should not include supply that has not been e-Tagged at the time of the tests (alternatively, the CAISO could develop a validation process whereby the seller of external supply is required to identify the physical generation source and the transmission delivery path prior to the application of the RS tests).

Issue 5: The Capacity Test Should Be Applied To All EIM Entities In All Hours

Entities that either use their own load forecast (e.g., Powerex), or that are perfectly balanced to the CAISO load forecast (e.g., the CAISO BAA) appear exempt from the

application of the capacity test. This exemption results in certain BAAs avoiding the application of a key element of the RS tests. This issue is further compounded by the fact that historical interchange deviations are *only* included in the capacity test (and not in the FRST). By avoiding application of the capacity test, the ability of BAAs exempt from the capacity test to meet imbalance energy needs due to interchange deviation is not assessed. All EIM entities, as well as the CAISO BAA, should be required to demonstrate sufficient capacity to meet the maximum intra-hour peak net load with a 95% confidence level.

Issue 6: RS Tests Must Include Historical Average Load Bias If It Is Materially And Systemically In One Direction In Certain Operating Hours Of The Day

The load forecast used in the RS tests for the CAISO BAA may be materially and systematically different from the load forecast that is used in the binding real-time market runs. It is well documented that there is systematic upward manual load biasing that occurs in the CAISO BAA, particularly during the evening hours. The RS tests for the CAISO BAA cannot be accurate if they are being performed without including this chronic upward load bias. It is critical that the load forecast used to assess whether an EIM entity is resource sufficient not diverge in a systematic and material way from the load forecast that is used in the EIM market solution, since that is the load forecast that drives the dispatch of resources and determines EIM transfers.

Issue 7: Improved Metrics And Transparency Are Needed, Including For The CAISO BAA

Standardized metrics and reporting are necessary to assess the accuracy of the requirements calculated for capacity and flexibility, in both directions, for each EIM entity as well as for the CAISO BAA. In addition, the CAISO and DMM regularly issue reports on the performance of the EIM, including the frequency of failures of the RS tests for each BAA, as well as the occurrence of price spikes and power balance constraint violations. Notably, however, the CAISO BAA is typically not included in these reports. Given that resource sufficiency requirements expressly apply to the CAISO BAA, just like to other EIM entities, Powerex urges CAISO to include the CAISO BAA on all reports that provide metrics on EIM performance.

Each of these issues is explained more fully in Appendix A, which also outlines potential approaches to refining the capacity and flexibility tests that Powerex believes would be considerably more workable and accurate. However, Powerex does not believe that a single round of comments can provide sufficient detail or discussion to support the changes to the RS tests that are clearly necessary. Powerex therefore requests that CAISO conduct a stakeholder process to more fully consider necessary enhancements to the RS tests.

Appendix A

I. Challenges With Current RS Tests

This section identifies seven key areas where Powerex believes the current RS tests could be improved to be more workable for EIM entities and to be more accurate. The discussion below is based on Powerex's close review of relevant technical material as well as its experience with the RS tests during parallel operations and since the start of binding operations in April. While Powerex believes its description of the RS tests to be accurate, it is cognizant that the full technical details of these procedures may not be clear from the available documentation, and that these procedures may continue to evolve. Powerex therefore welcomes any corrections or clarifications from the CAISO regarding any aspect of the RS tests discussed below.

Issue 1: Certain RS Tests Are Needlessly Challenging For EIM Entities To Pass

The objective of the RS tests is to accurately gauge the ability of an EIM entity to meet the potential range of imbalance energy needs on a standalone basis. It is appropriate and necessary for EIM entities to fail the RS tests if they do not demonstrate sufficient resources to be able to achieve this objective. But it is harmful to both individual EIM entities and to all EIM participants if an entity fails the RS tests for any other reason, including complexity of the tests, unworkability, or unnecessarily compressed timelines for administering the tests. When an entity that is, in fact, resource sufficient fails the RS tests, they are restricted in their ability to procure energy from other EIM participants; by the same token, other EIM participants face reduced opportunities to transact energy with these entities. For this reason, there is a real economic harm from "false positive" outcomes, (*i.e.*, from failures of an RS test even when an EIM entity is resource sufficient). The risk of false positive outcomes can lead an EIM entity to incur additional costs and "over comply" with anticipated RS requirements in order to reduce the risk of false positive outcomes. In such cases, even though the EIM entity may pass the RS tests, it incurs excessive costs to do so, which reduces the diversity benefits of EIM participation.

Powerex believes there are at least three specific shortcomings of the RS tests that make them unduly complex or challenging for EIM entities to pass:

First, the RS tests involve unduly compressed timelines for submitting updated resource information. More specifically, the FRST uses a "snapshot" of resources from the binding FMM solution for interval 4 of the current hour. This market run initializes 37.5 minutes prior to the start of that interval, or at T-52.5, with the results completed and communicated approximately 10 minutes later. In practice, this gives EIM entities only

a few minutes to adjust their resource plans in light of the FMM results for interval 4 that play a critical role in determining the resource requirements to satisfy the FRST. Even if an EIM entity is able to adjust its resource plan in light of this information, it is still too late to make changes to the economic bids and offers from participating resources, as the bidding deadline is at T-75.

Second, the capacity test and the FRST commingle concepts that should be evaluated separately. The capacity test is not really a test of intra-hour capacity sufficiency at all. Rather, it compares an EIM entity's capacity resources to the CAISO's forecast of load for the hour. In other words, it evaluates whether the base scheduled resources plus upward offer range are sufficient to meet the CAISO's *expected* level of load over the course of the hour. It does *not* evaluate whether these resources are sufficient to meet the potential load that might be experienced, nor does it evaluate whether there are sufficient resources to meet the maximum level of load within the hour. The FRST, however, does test for sufficient capacity to meet intra-hour peak net load with 95% confidence, but unlike the capacity test, the FRST does not include potential imbalance needs due to interchange schedule deviations. Moreover, the FRST *also* tests for sufficient flexible capacity to meet the potential *changes* in net load from one interval to the next. By combining these two concepts of capacity and flexibility into a single test, the current RS evaluation is forced to apply the same remedy (*i.e.*, freezing of EIM transfers) to two distinct resource sufficiency shortfalls. By separating the test for intra-hour capacity from the tests for intra-hour flexibility, the consequences of insufficiency could be more narrowly tailored to the specific shortfall being experienced.

Third, the uncertainty calculations for wind resources are flawed, as they are based on forecast deviations experienced in the same hour on other days. While uncertainty may reasonably be linked to the time of day for some resources (*e.g.*, solar) and for load, wind output deviations do not generally exhibit patterns based on the time of day. That is, the accuracy of the wind forecast for Hour Ending 7 yesterday is not indicative of the accuracy of the forecast for Hour Ending 7 today. At the April 30 Technical Workshop, Powerex proposed that wind uncertainty could instead be more accurately estimated as a function of the level of forecast wind output. This would emulate how Powerex understands reserve for wind output is determined for BAAs outside of the EIM. Namely, upward flexible reserves are increased during periods of high forecast or scheduled wind output, reflecting that the potential forecast error is primarily on the "down side." Similarly, downward flexible reserves are increased during periods of low forecast or scheduled wind output, as the potential forecast error is primarily on the "up side."

Issue 2: RS Tests Should Be Measured Relative To Base Schedules, Not To The Previous Hour

Powerex understands that the FRST is intended to evaluate the flexible ramping capability of resources in an EIM entity's resource plan to ensure it is sufficient to balance the potential changes in net load that might arise within the upcoming operating hour. The current FRST evaluates flexible capacity using a starting point based on the binding FMM result for the fourth interval of the prior hour. This creates significant complexity, and Powerex believes it is not consistent with the objective of the RS tests.

First, as noted above, the results of the binding FMM run for interval 4 of the prior hour are not known until a few minutes before the final deadline for an EIM entity to adjust its resource plan, at T-40.

Second, the results of the FMM do *not* represent the flexible capability of an EIM entity on a stand-alone basis. Rather, the binding results also reflect the economic dispatch that occurs through the EIM, including EIM transfers into or out of an EIM entity's area. Therefore, any snapshot of resources that includes EIM transfers must somehow "unwind" the effect of those transfers in order to assess the capabilities that would exist on a stand-alone basis. The defects and double-counting associated with how those adjustments are currently performed is discussed in the next section. But even if performed correctly, Powerex does not see any reason why such an approach is necessary or appropriate. The core question behind FRST is relatively simple: given a set of resource base schedules that match *expected* conditions, does the EIM entity *also* have sufficient resources to manage *unexpected changes* in those conditions? This question is entirely forward-looking, and does not appear to require or benefit from reliance on information from a prior interval (especially where the relevance of that information is itself unclear).

Issue 3: Double-Counting Of EIM Transfer Credits Is Flawed, Undermines RS, And Is Enabling The CAISO BAA, In Particular, To Lean On The EIM For Flexibility

As discussed above, the FRST begins with the results from the binding FMM run for the fourth interval of the prior hour. It then proceeds to make certain adjustments based on the volume of EIM transfer in that interval. Currently, however, all such adjustments serve only to reduce flexible ramping requirements, in either the upward or the downward direction. For instance, an EIM entity with a 100 MW EIM transfer out would receive a flexible ramping up credit of 100 MW; and EIM entity with a 100 MW EIM transfer in would receive a flexible ramping down credit of 100 MW. These adjustments are flawed in at least two ways.

First, the exporting BAA receives a credit of 100 MW for upward flexibility, but there is no offsetting increase in the upward flexibility requirement for the importing BAA. As a

result, the combined upward flexible ramping capacity of the two BAAs will exceed the actual physical upward flexible capacity by 100 MW. Such a result unambiguously represents double-counting, and the sufficiency of one of the two BAAs is clearly overstated.

Second, even though the above credits appear intended to “unwind” the effect of EIM transfers, this approach is not applied in a comprehensive manner. For example, absent an EIM export of 100 MW, the “credit” mechanism appears to assume that generating units in the exporting BAA would be backed down by 100 MW, and hence would have an additional 100 MW of upward flexibility. But the credit mechanism does not recognize that the 100 MW EIM export also creates additional *downward* flexibility, and it does not unwind this effect by applying a “negative credit” for downward flexible capacity.

To the extent that EIM transfers represent genuine imbalances and or unpredictable opportunities for economic displacement, then it might be expected that the above double-counting of flexible capacity would benefit all EIM entities in a roughly equal manner. However, data on EIM transfers shows that there are some highly predictable—and large—patterns to these transfers. Specifically, a major driver of EIM transfers is the large net load ramps experienced in the CAISO BAA, particularly in the evening as load increases at the same time that large amounts of solar output decline sharply. In this circumstance, it is clear that the double-counting of flexible capacity results in the CAISO BAA receiving the improper credits for the flexible capacity of other EIM entities. For example, at the start of the evening net load ramp, the CAISO BAA is often exporting up to 2,500 MW of EIM transfers (or more). These transfers rapidly decline as California solar output falls off and load rises, such that by the end of the evening ramp, the CAISO BAA is often *importing* up to 1,000 MW of EIM transfers (or more). Over this period, it is flexible capacity in *other* EIM entity areas that is rapidly increasing output, not only to balance their own load ramp, but to replace the rapid decline in energy imported from the CAISO BAA and subsequently to increase energy exports to the CAISO BAA. In such circumstances, it is unambiguously the flexible physical resources in other EIM entities that are adjusting to conditions in the CAISO BAA. It is equally unambiguous that the double-counting of flexible capacity is improperly over-stating the sufficiency of flexibility in the CAISO BAA.

Issue 4: CAISO BAA Should Not Be Permitted To Include Speculative Inertial Supply In Its RS Tests

The RS tests can be satisfied by the resources included in an EIM entity’s resource plans. These resource plans include physical generation located within the EIM entity’s area, as well as net interchange schedules sinking in that EIM entity’s area. For entities other than the CAISO BAA, interchange schedules are typically the result of bilateral

arrangements under which both the supplier and the purchaser are aware of the physical generation source as well as the transmission delivery path that will support the transaction. For the CAISO BAA, however, the interchange schedules included in the resource plan often consist merely of financial awards to marketers at an intertie scheduling point, but where the physical resources and transmission service necessary to ensure physical delivery of the energy being relied upon has not been identified or communicated to the CAISO. In short, the different framework used by the CAISO for scheduling of external supply means that the interchange resources included in the resource plan for the CAISO BAA may include substantial supply that has not been verified as genuinely supported by physical generation, and hence is exposed to considerably greater uncertainty of not actually being delivered.²

Powerex believes that all EIM entities, including the CAISO BAA, should be required to demonstrate resource sufficiency based on resources that have actually been identified as being committed to meet the needs of the particular entity being evaluated. This means including only those interchange transactions where the physical generation and transmission service have been identified. Under the current rules and practices governing external supply in the CAISO organized markets, this occurs for the CAISO BAA only when a valid e-Tag has been received and implemented. Powerex therefore believes an accurate assessment of the resource sufficiency of the CAISO BAA should include only those interchange schedules that have been e-Tagged at the time of the RS tests. CAISO could alternatively develop additional validation measures to identify the physical generation and transmission of intertie awards in its markets that could provide a comparable degree of delivery certainty as other EIM entities' interchange schedules.

Issue 5: The Capacity Test Should Be Applied To All EIM Entities In All Hours

Under the current design of the RS tests, Powerex understands the capacity test is not performed for all EIM entities, nor is it performed in all hours. Specifically, Powerex understands the capacity test is *not* conducted if:

- An EIM entity uses its own load forecast, rather than the CAISO's forecast of load for that entity; or
- An EIM entity's resource base schedule balances *precisely* to the CAISO's forecast of load.

² The CAISO BAA has experienced recent high-profile events in which a substantial volume of intertie market awards were not actually delivered, either causing or exacerbating tight grid conditions. The CAISO has convened a separate stakeholder process to explore ways to ensure that intertie market awards perform according to their schedules.

This inconsistent application of the capacity test is problematic because, as currently implemented, the capacity test is the *only* aspect of the RS tests that incorporates an EIM entity's historical interchange deviations. Changes to interchange schedules included in resource plans represent a potential driver of energy imbalances that an EIM entity must be prepared to balance. Absent manual dispatches, these imbalances will be balanced through the EIM, and hence an EIM entity, and the CAISO BAA, should need to demonstrate it has the resources necessary to manage interchange schedule deviations.

Powerex believes that all EIM entities, and the CAISO BAA, should be required to demonstrate sufficient capacity resources to meet peak intra-hour net load (including uncertainty) with a 95% confidence level.

Issue 6: RS Tests Must Include Historical Average Load Bias If It Is Materially And Systemically In One Direction In Certain Operating Hours Of The Day

EIM entities and the CAISO BAA commonly engage in manual adjustments to automatically-generated load forecasts. Generally, this is done when operators are aware of certain grid conditions that are either not considered in the automated forecast, or where the information has not yet been communicated to the automated forecasting tools. In such cases, manual adjustments tend to be random both in the direction of the adjustment and in the timing of when adjustments are necessary. For the CAISO BAA, however, load biasing is systemic and has a strong directional bias. In 2017, for example, CAISO operators entered manual load adjustments in the Fifteen Minute Market of up to 800 MW *on average* during certain evening hours.³ In Q3 of 2017, these hourly load biases were as high as 1,100 MW *on average*.⁴

It is unclear to Powerex whether these the RS tests for the CAISO BAA are performed based on the load forecast *without* the load bias, or the load forecasts that include the load bias. Powerex believes an accurate assessment of the resource plan for the CAISO BAA (or any EIM entity) must not diverge materially and significantly from the load forecast that is used to dispatch resources and determined EIM transfers. It is, after all, the ability of an EIM entity's resource plan to meet the load forecast used in the

³ See, e.g., CAISO Department of Market Monitoring, *Department of Market Monitoring Comments on Imbalance Conformance Enhancements Proposal*, (May 9, 2018) at Fig. 1. Available at: http://www.caiso.com/Documents/Decision_ImbalanceConformanceEnhancementsProposal-DMMComments-May2018.pdf.

⁴ CAISO Department of Market Monitoring, *Q3 2017 Report of Market Issues and Performance*, (December 8, 2017) at Fig. 1.7. Available at: <http://www.caiso.com/Documents/2017ThirdQuarterReport-MarketIssuesandPerformance-December2017.pdf>.

market run that the RS tests are intended to gauge. Performing the RS tests based on load forecasts that systematically differ in one particular direction from the actual load forecasts used in the binding market runs means that an EIM entity may appear to be resource sufficient, but only as a result of using a skewed load forecast. For this reason, Powerex believes the RS tests should include historical average load bias in cases where such load biasing is frequent, is systematically in one direction, and is of a significant quantity.

Issue 7: Improved Metrics And Transparency Are Needed, Including For The CAISO BAA

The above discussion regarding the current shortcomings of the existing RS tests is based on Powerex's understanding of the technical parameters of each test, and its evolving practical experience with these tests since the start of parallel operations and go-live. A more direct, objective, and comprehensive assessment of the accuracy of the RS tests is clearly necessary in order to gauge whether the RS tests do, in fact, ensure resource sufficiency with the intended 95% level of confidence, for each applicable BAA.

Powerex believes an objective measure of the accuracy of the RS tests can be readily compiled from information that is already available to the CAISO, as market operator. Namely, the RS requirements could be compared to the actual need for imbalance energy experienced in the associated operating hour. If the RS tests are designed properly, then the actual imbalance needs should be within the upper and lower RS requirements in approximately 95% of all operating hours, as measured over a suitably long period of time (*e.g.*, a quarter or a year). If actual imbalance needs are within the upper and lower RS requirements in substantially more than 95% of intervals, it could indicate that the RS tests overstate the capability necessary to ensure resource sufficiency (*i.e.*, the test is too strict, and is causing an EIM entity to fail despite actually being resource sufficient). Conversely, if actual imbalance needs are within the upper and lower RS requirements in substantially less than 95% of intervals, it could indicate that the RS tests understate the capability necessary to ensure resource sufficiency (*i.e.*, the test is too lenient, and is allowing an EIM entity to pass—and “lean” on other entities' resources—despite not actually being resource sufficient).

Powerex proposes that the actual imbalance energy needs of each EIM entity be calculated for each 15-minute interval as the sum of:

- VER output base schedules minus RTD VER output forecast;
- RTD load forecast minus load base schedule;
- Uninstructed interchange deviation; and

- Uninstructed generation deviation

The maximum 15-minute positive imbalance would determine the peak net load deviation for the hour (from base schedules). The maximum increase in imbalances across an hour would be retained as the maximum upward ramp for the hour, and the largest decrease in imbalances across the hour would determine the maximum downward ramp for the hour.

It would then be straightforward to tabulate how frequently actual imbalance needs exceeded the values used to apply the RS test. This frequency should be reported separately for each EIM entity, including for the CAISO BAA; it may also be useful to report the frequency separately for each hour of the day. This can help highlight situations where the existing RS test is accurate, as well as circumstances where the RS test is either overly conservative or overly permissive.

Powerex recognizes that some amount of reporting on RS performance has occurred in the past. This has been limited to the frequency with which EIM entities pass or fail the RS test, which does not directly address the question of whether or not the RS tests were accurate assessments of an EIM entity's resource sufficiency. Additionally, this type of reporting has generally not been provided for the CAISO BAA. It is imperative that all reporting regarding RS performance—as well as all other types of performance analytics—include results for the CAISO BAA as well. The RS test has been explicitly made applicable to the CAISO BAA, and concerns over “leaning” are not limited just to concerns that other EIM entities might lean on CAISO resources. Indeed, there is considerable concern that the current design and application of the RS tests may be resulting in substantial leaning by the CAISO BAA on capacity and flexibility resources in other EIM entities. In order to apply the resource sufficiency requirements in a uniform and non-discriminatory manner, it is vital that all RS-related reporting and analysis, whether by CAISO staff or by DMM, provide transparency into all EIM entities, including the CAISO BAA.

II. Proposed Revisions To Make RS Tests More Workable And Accurate

Powerex strongly supports the CAISO convening a stakeholder process to enhance the RS evaluation. The goals of the stakeholder process should include:

- Identify and implement enhancements that make the RS tests more workable and provide EIM entities greater certainty regarding the resource requirements needed to pass the RS test.
- Improve the accuracy of the calculations for RS requirements (e.g., measurement of wind uncertainty, consistent integration of interchange deviations and material, systemically directional manual load adjustments)

- Ensure that resources in the resource plan are accurately assessed relative to anticipated conditions (e.g., eliminate use of a “snapshot” from a binding market run that does not and cannot reflect capability of an EIM entity on a stand-alone basis, and use base schedules as the relative measurement point)
- Ensure RS tests are applied to the CAISO BAA in a manner that is consistent to external BAAs

The objectives of increased accuracy and transparency of the RS tests is likely to require reformulating the capacity test and the FRST. Powerex proposes to revise these tests, such that they more clearly test a discrete attribute, in turn allowing the consequences of failure to be more narrowly tailored to the specific circumstances or intervals of insufficiency:

- The **capacity test** should assess whether an EIM entity’s resource plan has sufficient capacity to meet the maximum net load (plus uncertainty) within each 15-minute interval of the upcoming operating hour, at a 95% confidence level.
 - The capacity requirement should represent the maximum level of net load that is expected to be experienced within each 15-minute interval in all but 5% of cases.
 - The distribution of intra-hour net load should reflect all potential sources of imbalance energy needs, including load and VER output and interchange deviations.
 - A failure of the capacity test should result in limiting EIM transfers into the EIM entity’s area, but only for the specific 15-minute intervals in which it failed the capacity test.
- The **flexible ramping sufficiency test** should test only whether an EIM entity has sufficient flexible resources to balance the maximum upward and downward difference in net load relative to base schedules. The capacity test, above, will already test that the EIM entity resource plan contains sufficient total capacity; hence the FRST only needs to test the ability to move the resources from their base schedule level up to the maximum level (upward flexibility) as well as the ability to move the resources from their base schedule level down to the minimum level (downward flexibility), with 95% confidence.
 - The FRST is proposed to be simplified into an *hourly* test, as this avoids the complexity of defining potential ramps between one, two, or more successive intervals within the hour.
 - The FRST is proposed to define the flexible upward ramping requirement as the maximum upward ramp, at a 95% confidence level, to be attained over 60 minutes. Similarly, the FRST is proposed to define the flexible

downward ramping requirement as the maximum downward ramp, at a 95% confidence level, to be attained over 60 minutes.

- Powerex believes this approach is greatly simplified, workable, yet still sufficiently robust, as localized ramps that occur over shorter durations can be met through transient inadvertence interchange and/or through diversification of the timing of intra-hour ramps. Ongoing assessment upon implementation will reveal if any modifications are necessary to this simplified approach.
- A failure of the FRST should result in freezing of EIM transfers in the direction in which the FRST was failed. In such cases, EIM transfers could not be increased in the failing direction beyond the level during the prior hour. This ensures that any net load ramps that are steeper than the flexible resources in the EIM entity's resource plan are not met by increases in EIM transfers.

Powerex believes that the results of such enhancements will be to greatly reduce both false positive and false negative outcomes. Moreover, such enhancements will provide EIM entities more timely and accurate information regarding their resource requirements, enabling them to take the actions necessary to pass. Powerex believes the development of more accurate RS tests is likely to result in increased RS failures for the CAISO BAA. This should provide a clear signal for the CAISO to take additional measures to ensure it passes the RS test, such as developing a day-ahead imbalance reserve product to hold back flexible capacity in its day ahead market (already being explored in a separate stakeholder process) as well as developing mechanisms for EIM entities to transfer flexibility or capacity bid range prior to EIM deadlines. More broadly, a more accurate assessment of resource sufficiency of the CAISO BAA—and restrictions on its ability to lean on the capacity or flexibility of other EIM entities to make up any shortfalls—may also result in more robust *forward* procurement of resources commitments, such as through the Resource Adequacy (“RA”) or Flexible RA programs. Such measures will ultimately help ensure that CAISO operators have access to sufficient flexible resources to safely and reliably operate the grid in the real-time, and hence contribute to reliability of the entire EIM market footprint.

Finally, ensuring that the mechanisms intended to ensure resource sufficiency and prevent leaning is vital not only to the durability of the EIM itself, but to other efforts to increase inter-regional coordination. Without pre-judging what form the resource sufficiency measures of CAISO's Enhanced Day Ahead Market proposal will take, any such design effort would seem to require a solid real-time framework to build upon.