

**Comments of Powerex Corp. on
Flexible Resource Adequacy Criteria and Must Offer Obligations Phase 2
Revised Flexible Capacity Framework**

Submitted by	Company	Date Submitted
Mike Benn 604.891.6074	Powerex Corp.	February 21, 2018

Powerex appreciates the opportunity to provide comments on the January 31, 2018 Flexible Resource Adequacy Criteria and Must Offer Obligation – Phase 2 Revised Flexible Capacity Framework (“Revised Framework”). Powerex appreciates the extensive dialogue and engagement in this stakeholder process to date. The current proposal reflects input from a wide range of stakeholders, and Powerex believes the proposal includes a sound approach for quantifying the CAISO’s need for flexible capacity in its day-ahead, 15-minute, and 5-minute markets.

But while the *need* for flexible capacity has been carefully evaluated and quantified, the Revised Framework indicates there may be significant gaps in the assessment of the available *supply* of flexible capacity. Any resource adequacy framework—whether for conventional RA or for Flexible RA—will fail to meet its core objectives if demand is significantly *understated* or if supply is significantly *overstated*. Without further revisions to the Draft Framework that ensure the supply of flexible capacity is accurately determined, Powerex cannot support the CAISO moving forward with this initiative.

In these comments, Powerex:

- explains the basis for its concern that the Revised Framework significantly overstates the flexibility of existing supply;
- proposes a robust two-prong process of technical certification and periodic performance assessments to ensure the accuracy of the amount of Flexible RA product(s) each resource is qualified to provide; and
- identifies a necessary modification to the calculation of 15-minute flexibility need.

I. Estimates of Available Flexible Capacity are Inconsistent with CAISO Operational Experience and Statements of Flexibility Challenges

Of greatest concern to Powerex is the Revised Framework’s estimate of the amount of Flexible RA products estimated to be “available” from existing in-state resources. This

assessment is found on page 45, Table 4 of the Revised Framework; a slightly different table appears on slide 76 of the CAISO's February 7, 2018 presentation.¹ These tables suggest that existing in-state resources are capable of providing over 10,000 MW of 5-minute flexible capacity; over 14,000 MW of 15-minute flexible capacity; and approximately 33,000 MW of day-ahead load shaping flexibility. These estimates of "MW Available" are two to three times the estimated need of the corresponding flexible capacity products. This table appears to imply that the CAISO grid already has abundant flexibility just from its internal fleet to meet the estimated need.

The Revised Framework's estimates contradict the multiple statements that CAISO has made in this stakeholder process, and elsewhere, regarding its growing operational challenges and its urgent need for additional flexibility. For example:

- In August 2017, CAISO staff presented its substantial re-framing of this stakeholder initiative, and explained that "controlling CPS1 scores has been a recurring operational challenge."² CAISO's presentation underscored the potential implications for reliability, explaining that "intra-hour variability and uncertainty can result in inability to control the interconnection frequency in real-time."³
- In December 2017, CAISO staff provided a detailed discussion of one challenging episode from April 25, 2017, in which renewable production exceeded the Dispatch Operating Target by as much as 985 MW.⁴ CAISO's downward regulation reserve was fully deployed, the CAISO's Area Control Error increased to 1,215 MW, and interconnection frequency reached 60.06 Hz. This episode, and others like it, illustrates the operational challenges associated with balancing moment-to-moment variation and uncertainty on the CAISO grid, and

¹ CAISO presentation at February 7, 2018 stakeholder meeting on FRAC-MOO Revised Draft Flexible Capacity Framework Proposal, at 76. Available at: <http://www.caiso.com/Documents/Agenda-Presentation-RevisedDraftFlexibleCapacityFrameworkProposal-FlexibleRACriteria-MustOfferObligationsPhase2-Feb72018.pdf>

² CAISO presentation at August 2, 2017 FRAC-MOO Working Group, at 17. Available at: http://www.caiso.com/Documents/Agenda_Presentation_FlexibleResourceAdequacyCriteria_MustOfferObligations.pdf

³ *Id.* at 19.

⁴ CAISO presentation at December 18, 2017 Market Performance and Planning Forum, at 6-13. Available at: http://www.caiso.com/Documents/Agenda-Presentation-MarketPerformance-PlanningForum-Dec18_2017.pdf

the CAISO's need for additional flexible capacity in its markets to maintain such balance.

The need for additional flexibility beyond what is routinely available from internal resources is also apparent from the measures taken by CAISO to manage the grid during the solar eclipse on the morning of August 21, 2017. The eclipse resulted in the loss of approximately 3,600 MW of solar production over approximately 70 minutes.⁵ To put this in context, the eclipse-related downward ramp was somewhat less than the maximum one-hour downward ramps actually observed in most months of 2016;⁶ that is, the ramping associated with the eclipse was substantial, but by no means extreme. Eclipses are known years in advance, of course, allowing CAISO to plan ahead how it would manage the grid during this event. It seems highly unlikely that CAISO would undertake significant advance planning to manage this event if, as suggested in the Revised Framework, existing in-state resources had far more than enough flexibility to manage the anticipated ramps. Powerex also notes that CAISO identified that approximately half of the lost solar output during the eclipse was made up by additional imports, which were largely from the Northwest.⁷

In addition to the apparent inconsistency with CAISO operational experience, the Revised Framework's estimates of flexibility available from existing in-state resources are several times larger than the actual maximum historical interval-to-interval movements of the CAISO fleet. More specifically, CAISO data shows that in 2017, the largest increases in output from in-state thermal and large hydro resources were equal to only a small fraction of the "MW Available" estimated in the Revised Framework.⁸ The table below compares the Revised Framework's *lowest* monthly estimate of "Need" and of "MW Available" for each product to the *largest* increase in output observed from in-state thermal and large hydro resources during 2017 over the respective timeframes.

⁵ CAISO presentation at October 5, 2017 Market Performance and Planning Forum, at 10 and 14. Available at: http://www.caiso.com/Documents/Agenda-Presentation-MarketPerformance-PlanningForum-Oct5_2017.pdf

⁶ CAISO August 2, 2017 presentation, at 15.

⁷ CAISO August 2, 2017 presentation, at 9 and 11-12.

⁸ CAISO Production and Curtailments data includes information on load and output by type of resource (*i.e.*, renewable, nuclear, large hydro, thermal) and imports with 5-minute granularity. See <http://www.caiso.com/informed/Pages/ManagingOversupply.aspx>

	5-minute	15-minute	3-hour
Need (min. monthly)	3,326	5,264	10,728
MW Available (min. monthly)	10,033	14,347	32,525
2017 Max Movement - Thermal	1,113	2,007	8,555
2017 Max Movement - Large Hydro	564	980	2,386

Powerex does not contend that the observed changes in output necessarily reflect the maximum possible flexibility of the fleet. However, the discrepancy between the estimated flexibility and the maximum observed changes in output is so large that it raises serious concerns about the validity of the estimated “supply” of flexible capacity. Indeed, the Revised Framework’s estimate of “MW Available” appears contrary to the very premise of this stakeholder process, since it seems to imply that it is the CAISO’s *positioning* of resources—rather than the overall quantity of flexible resources participating in the market—that is responsible for CAISO’s operational challenges.⁹

It therefore appears to Powerex that there is a significant inconsistency between CAISO’s repeated statements regarding the need for additional flexible resources to participate in its markets and the Revised Framework’s calculations, which suggest that the existing fleet provides far more flexibility than is needed across each of the identified products.

Powerex therefore believes that further dialogue is necessary to address the following specific issues:

- What is the basis for the estimated “MW Available” from each resource?
- How do the 5-minute, 15-minute, and 3-hour “MW Available” ratings for each resource compare to the maximum increase in output actually achieved by each individual resource in 2017?
- Are there other analytical approaches that can more appropriately measure the ability of the existing in-state fleet to meet CAISO’s need for flexible capacity in each of the three operational periods (5-minute, 15-minute, and 3 hours)?

⁹ While Powerex supports continued pursuit of improvements to unit commitment and scheduling, it does not believe that these improvements, on their own, will eliminate CAISO’s flexibility challenges.

II. A Robust Process is Necessary to Ensure Accurate Qualification of Resources to Provide Flexible RA Products

The Revised Framework establishes the demand for each Flexible RA product that must be procured based on a detailed analysis of actual “real-world” conditions experienced on the CAISO grid. Powerex believes it is critically important that the supply of Flexible RA also be based on actual, “real-world” resource capabilities, and not on theoretical attributes.

The proper and rigorous qualification of Flexible RA supply is critical to achieving the objectives of the Revised Framework. Under the Revised Framework, the procurement requirements are based on the precise quantity of each product that the CAISO may actually need to reliably and safely operate the grid. That is, there is no “buffer” built into the calculation of the procurement requirement. Consequently, Powerex believes it would be inappropriate—and leave the CAISO grid significantly short of the flexibility it needs—if resources’ qualification to provide Flexible RA over-stated their actual real-world flexibility during the periods that the CAISO relies on that flexibility to balance supply and load on the grid. There are numerous potential reasons why resources may have real-world capabilities that are significantly less than the theoretical attributes associated with the resource. These reasons include forced outages, lead times and ramp rates that may be overstated in the CAISO’s master file, unavoidable uninstructed deviations, and uninstructed deviations that the market participant elects not to control (*i.e.*, deliberate or voluntary uninstructed deviations).

Powerex believes that CAISO needs to develop a process for qualifying or certifying the quantity of each Flexible RA product that each resource may provide. Such a process needs to fully take into consideration all of these factors, such that CAISO can be highly confident that the Flexible RA product provided by a resource will actually be available and responsive to CAISO’s instructions through its operational markets. Powerex believes this can be achieved through a process consisting of an initial technical certification based on the demonstrated capabilities of a resource, combined with a periodic assessment of the performance of each resource to adjust the amount of each Flexible RA product the resource is qualified to provide going forward. Each of these processes is discussed more fully below.

Initial technical qualification of a resource’s demonstrated ability to provide Flexible RA products

Powerex believes the initial step should be to test a resource’s ability to provide each of the Flexible RA products for which a qualification is sought. This technical qualification process would be designed to measure, under real-world conditions, how fast a resource can ramp from one 5-minute interval to the next; from one 15-minute interval

to the next; and how far it can ramp in total over the 3-hour net load ramping period. This process would set an upper limit on the maximum amount of each Flexible RA product the resource can provide. This technical qualification process would be similar to the certification process that already exists for resources that provide regulation reserve. As discussed above, the demonstrated capability established through this process may be less than the resource attributes currently included in the master file.

Adjusting qualified Flexible RA quantity based on periodic assessments of performance

The initial technical qualification process, discussed above, will provide an important real-world demonstration of a resource's *potential* flexibility. That is, it addresses the need for an accurate assessment of resource lead times, ramping, and ability to follow dispatch instructions and avoid uninstructed deviations. However, it does not address two important factors: (1) forced outages and derates; and (2) deliberate or voluntary uninstructed deviations from dispatch. Powerex believes the initial qualification process must therefore be complemented by a periodic assessment of resource performance.

The goal of the periodic assessment is to more accurately identify the actual quantity of flexibility that the CAISO can rely upon to perform in its market processes with a high degree of confidence. For this reason, the assessment should be designed to identify the performance that can be expected even under conditions of relatively "poor" performance. More specifically, Powerex recommends that a periodic assessment examine all intervals in which a resource providing a Flexible RA product was deployed for energy for some or all of its Flexible RA capacity.¹⁰ The amount of energy actually provided would be compared to the quantity of energy dispatched by the CAISO in that interval, with all intervals in the review period ranked from best-performing to worst-performing. The average performance during the worst-performing quartile of intervals would establish the performance factor of the resource for a given product.

For example, a 100 MW resource may initially be qualified to provide 80 MW of 5-minute Flexible RA capacity during Year 1, based on the initial technical certification process discussed above. During Year 1, the resource was dispatched for 80 MW of energy in each of 400 intervals. Its actual response, however, ranged from 0 MW (*e.g.*, the unit tripped) to 200 MW (*i.e.*, the unit exceeded its instructed dispatch). During the 100 intervals with the worst performance—that is, during the worst-performing quartile—the resource's actual response was, on average, 60 MW. In this example, the amount

¹⁰ A modified assessment framework that is more appropriate to the specific circumstances of renewable resources is discussed in the following section.

of 5-minute Flexible RA that the resource is qualified to provide during Year 2 would be reduced to 60 MW.¹¹ Stated differently, the actual performance of the resource during Year 1 would indicate that, in the majority of intervals in which it was deployed for energy, the resource could only be relied upon to provide 60 MW in response to a CAISO instruction. Going forward, the quantity of 5-minute Flexible RA provided by the resource would therefore be limited to 60 MW. This performance assessment would be repeated on a regular basis (e.g., annually), and may result in either an increase or a decrease to a resource's qualified capacity to provide a Flexible RA product.

The use of the average performance during the worst-performing quartile of intervals is intended to reduce the number of intervals in which the amount of flexibility expected and needed by CAISO is likely to exceed the resource's actual performance. That is, by setting a deliberately conservative bar, this approach reduces the likelihood that a resource would fail to clear that bar, since such outcomes may have important reliability consequences. At the same time, this approach is sufficiently permissive that rare, uncontrollable events such as forced outages or derates will not, on their own, prevent a resource from being eligible to provide Flexible RA capacity.

Performance assessments for variable energy resources

Powerex supports efforts to enable Flexible RA products to be provided by all resources capable of providing the necessary service. This will ensure CAISO has the flexibility it needs to reliably manage the grid while doing so in a cost-effective manner.

At first glance, it seems counterintuitive that resources whose output falls during the CAISO's largest three-hour net load ramps—and indeed contributes to that ramp—would be eligible to provide Flexible RA. However, upon closer examination, the ability of those resources to deliberately produce *less* energy than the full amount possible does offer a mechanism to reduce the CAISO's need for upward flexibility. For instance, a solar resource could deliberately “hold back” its output during each of the intervals or hours ahead of the evening three-hour net load ramp. This will reduce the magnitude of that net load ramp, and therefore reduce the CAISO's need for upward flexible capacity.

The manner in which VERs help address CAISO's need for flexibility is therefore fundamentally different than for conventional resources. Whereas the key to

¹¹ This process would need to account for the fact that deployments are unlikely to be for the full amount of Flexible RA in every interval. Hence, the periodic performance assessment will likely need to be normalized for the quantity of energy deployed by CAISO.

performance by a conventional resource is the response following a CAISO instruction to produce additional energy during a ramping event, the key to performance by a VER is to curtail output during each of the intervals and hours *prior* to the ramping event. Without this pre-emptive curtailment of output, the ability of the VER to reduce the CAISO's flexibility challenges will be diminished or eliminated.

The foregoing implies that the performance assessment for VERs providing Flexible RA must reflect the specific circumstances of those resources. Specifically, Powerex suggests that the performance of VERs providing Flexible RA be based on the maximum positive uninstructed energy during the "curtailment" period of each day (*e.g.*, during the mid-afternoon hours preceding the evening net load ramp). Each day in which a VER was dispatched by CAISO below its forecast "naturally occurring" production level in order to reduce the magnitude of a ramping event would be part of the review period. Days would be ranked from lowest quantity of positive uninstructed energy (*i.e.*, best performance) to the highest quantity (*i.e.*, worst performance). The uninstructed energy metric during the worst-performing quartile of days would establish the amount by which the resource's qualified Flexible RA quantity would be reduced for the following year.

For example, consider a 100 MW solar resource that is initially qualified to provide 100 MW of 5-minute Flexible RA capacity during Year 1, based on the initial technical certification process discussed above. When instructed by CAISO, the solar resource would limit its output to 100 MW below its naturally-occurring output level (*i.e.*, to 0 MW of production) during the mid-afternoon hours prior the evening net load ramp. For each such day during Year 1, the maximum hourly positive uninstructed energy during the mid-afternoon hours for the resource is identified, which ranges from 0 MW (*i.e.*, actual output matched CAISO dispatch, which is below the forecast output in order to reduce the subsequent net load ramp) to 100 MW (*i.e.*, output was not curtailed at all, and therefore the subsequent net load ramp was not reduced). The days during Year 1 are sorted from best performance to worst performance. For the worst-performing quartile of days, the average of the daily maximum uninstructed energy is calculated. In this example, the solar resource had, on average, a maximum positive uninstructed output of 20 MW during the worst-performing quartile of days. Based on this result, the qualified 5-minute Flexible RA capacity of the resource would be reduced to 80 MW during Year 2 (*i.e.*, the initially-qualified 100 MW reduced by the 20 MW of uninstructed energy during the worst-performing quartile of days).

Summary of proposed qualification process

Powerex offers the foregoing only to illustrate the concept of using actual performance to refine the assessment of the amount of each Flexible RA product that a resource can

be relied upon to provide. The specifics of any such process would need to be developed through further discussion with stakeholders and CAISO technical staff. However, Powerex believes that a two-pronged qualification process—consisting of both a demonstration of real-world capabilities as well as periodic assessments of actual performance—is vital in order for the FRAC-MOO program to function properly. Such an approach provides the necessary confidence to ratepayers that Flexible RA will only be procured from resources that are genuinely capable of performing—and that actually do perform. By the same token, this approach provides the appropriate incentives to resources that receive a Flexible RA contract to actually perform in accordance with the requirements of the product. Powerex believes that these complementary and reinforcing attributes are necessary to ensuring that the Flexible RA resource fleet is capable, willing, and able to perform, thus helping ensure that CAISO has the tools it needs to reliably and safely operate the grid.

III. Refining the Requirement for 15-minute Product

In the Revised Framework, CAISO proposes to calculate the required quantity of 15-minute Flexible RA based on the maximum forecasted uncertainty between the Integrated Forward Market and the Fifteen Minute Market. The estimated quantity is based on the distribution of differences between the CAISO's day-ahead forecast and its 15-minute market forecast for the same operating hour.

Powerex agrees that the difference between the day-ahead and the 15-minute load forecasts will need to be met through the Fifteen Minute Market, and hence properly increases the requirement for 15-minute Flexible RA. However, there is an additional driver of the need for 15-minute Flexible RA that is not addressed by this approach. Namely, the day-ahead energy market does not clear supply against the CAISO's day-ahead forecast of load, but against bid-in demand, which may be higher or lower than the CAISO's forecast. In addition, the day-ahead market may satisfy bid-in demand using virtual supply resources. The net result is that the day-ahead energy market may frequently result in schedules of physical resources that fall short of the CAISO's day-ahead forecast of load.

Powerex recognizes that CAISO also has a Residual Unit Commitment ("RUC") process that occurs on a day-ahead basis, through which it can schedule additional physical resources to ensure its day-ahead forecast of load can be reliably met. But even any additional physical resources committed through this process need to be dispatchable in the 15- and 5-minute markets, as resources committed in the RUC process are required, among other things, to submit bids into the Real Time Market. For this reason, Powerex believes that the requirement for 15-minute Flexible RA product should be increased to account for the additional need for resources to be available for commitment through the RUC process. Specifically, the 15-minute Flexible RA product

needs to account for (1) differences between bid-in demand in the day-ahead market and the CAISO's day-ahead load forecast; and (2) the amount of net virtual supply that clears the day-ahead market, which will need to be replaced by physical supply in a subsequent market process.