



**Comments of the California Energy Storage Alliance (CESA) on the FRACMOO
Phase 2 Working Group Meeting
October 10, 2017**

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CESA appreciates the opportunity to comment on the Flexible Resource Adequacy Capacity and Must-Offer Obligations ("FRACMOO") Phase 2 Initiative Working Group meeting on September 26, 2017.

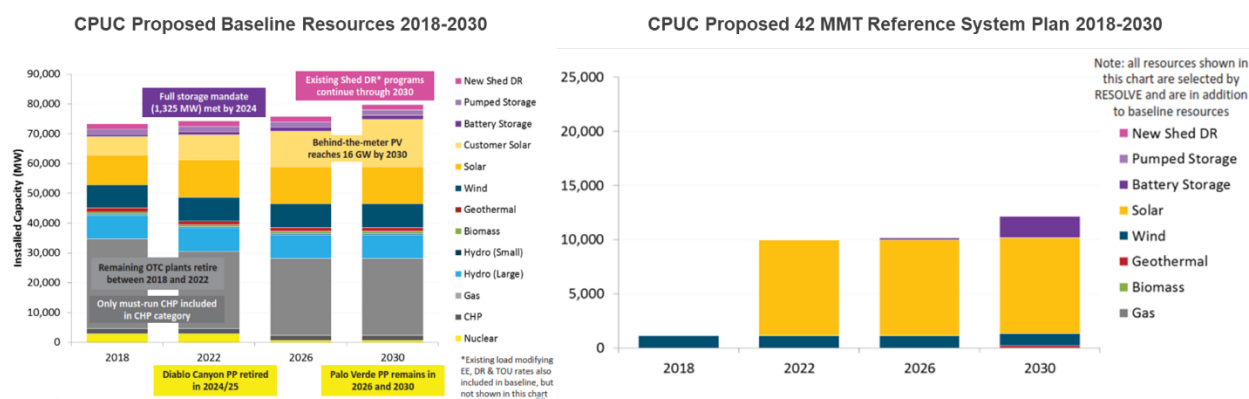
Flexible Ramping Needs Analysis

CESA supports the findings by the California Independent System Operator ("CAISO") on the real-time operational needs of the CAISO grid, which show how the Flexible Resource Adequacy Capacity ("Flex RA") product needs to be reformed to ensure system reliability in the future. Overall, the Working Group meeting highlighted how the current Flex RA product is important but insufficient in to meet all flexible ramping needs going forward. The CAISO importantly distinguished the need for ramping for variability (which is typically known) as well as for uncertainty, which may materialize via intermittency in some generation, outages, weather uncertainty, missed forecasts, etc. A fleet that meets both variability and uncertainty needs is important, and the fundamental goal of the RA program should be to ensure a fleet is lined up and bid with must-offer obligations to reasonably operate the grid in all circumstances of a given month.

CESA appreciates the CAISO’s and stakeholders’ efforts to understand and vet the flexible capacity challenge. While we should continue to seek an ideal solution, CESA cautions that we should not let the perfect be the unreasonable enemy of the good. To address grid needs, the CAISO should likely develop a plan to move forward even with mixed stakeholder support, as some stakeholders may never support changes to the current FRACMOO paradigm, despite the CAISO-shown concerns over grid reliability and how our capacity planning tool and must-offer obligations are functioning inadequately.¹

Building off the CAISO’s analysis which has focused on ramping needs and how they fit or not with the three-hour Flex RA ramp period, CESA’s own preliminary analysis also shows that intra-hour and three-hour ramping needs will grow as the California Public Utilities Commission (“CPUC”) executes the state’s Renewable Portfolio Standard (“RPS”) and greenhouse gas (“GHG”) emissions reduction goals going forward.

Figure 1: CPUC Proposed Reference System Plan



Source: E3 RESOLVE Model and CPUC IRP Workshop²

CESA’s preliminary analysis uses the Proposed Reference System Plan from the CPUC’s Integrated Resources Plan (“IRP”) proceeding, which includes adding approximately 9,000 MW of utility-scale solar and 1,100 MW of utility-scale in-state wind in addition to the assumed 16,000 MW of additional rooftop solar. With this data, CESA projects the expected one-hour

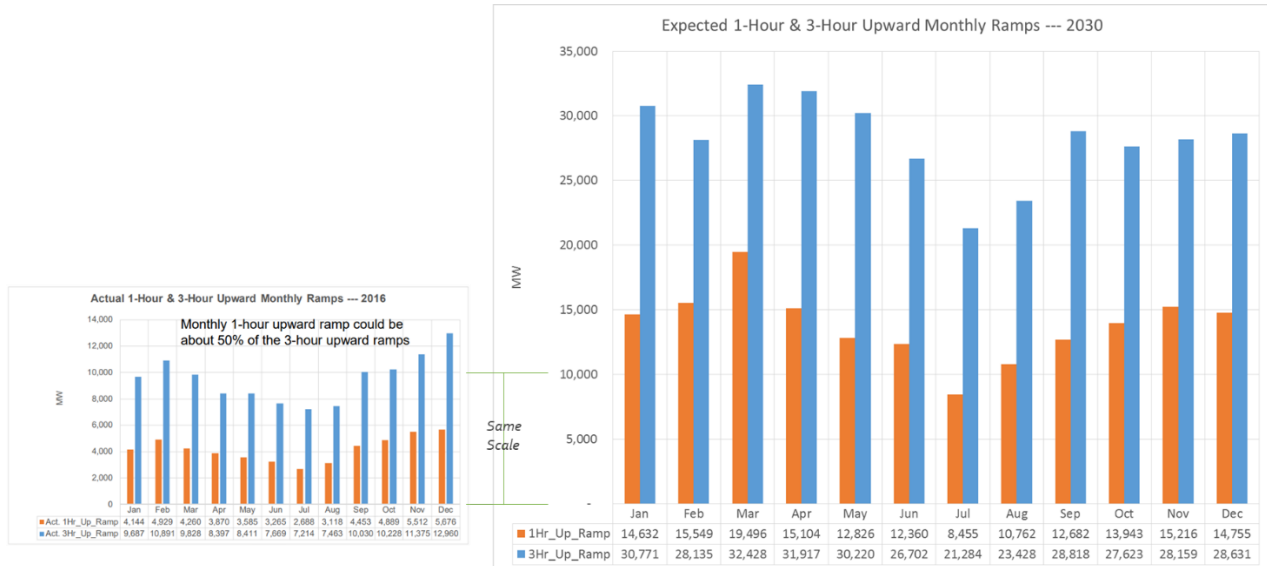
¹ At the Working Group meeting, and in presentations at other meetings, (CAISO Inverter-Based Generation Issues Workshop on July 24, 2017. <https://www.caiso.com/Documents/Agenda-Presentation-Operational-Opportunities-to-Minimize-Renewables-Curtailments.pdf>), the CAISO has consistently highlighted how the three-hour ramping product, as initially designed, is not providing adequate services for the CAISO grid reliability, even as ramping needs are showing substantial increases over the past three years, as are one-hour and sub-hourly ramping requirements that are not addressed at all by the current product. The CAISO also demonstrated that ramping needs are daily concerns, not just spring-time or extreme-day issues, that downward ramps are comparable to upward ramps in terms of speed and magnitude, and that the net load forecast error varies substantially day by day

² *Administrative Law Judge’s Ruling Seeking Comment on Proposed Reference System Plan and Related Commission Policy Actions* filed on September 19, 2017. See Attachment A: *Proposed Reference System Plan*, pp. 30 and 52, http://cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/ElectPowerProcurementGeneration/irp/AttachmentA.CPUC_IRP_Proposed_Ref_System_Plan_2017_09_18.pdf and Attachment C: Summary of Model Inputs and Outputs, http://cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/ElectPowerProcurementGeneration/irp/AttachmentC.PropRSP_InputsOutputsSummaryTable_2017-09-22.xlsx.

and three-hour upward monthly ramps to increase by more than two times what they are in 2016.

This preliminary analysis is based on a simple scaling of the actual 2016-2017 solar, wind, and load data downloaded from the CAISO OASIS database such that the peak generation and load from those sources are equal to the baseline assumptions in the IRP listed above.

Figure 2: Monthly 1-Hour and 3-Hour Upward Ramps in 2016 vs. 2030



Source: CESA and LS Power analysis using CAISO OASIS data and IRP Proposed Reference System Plan

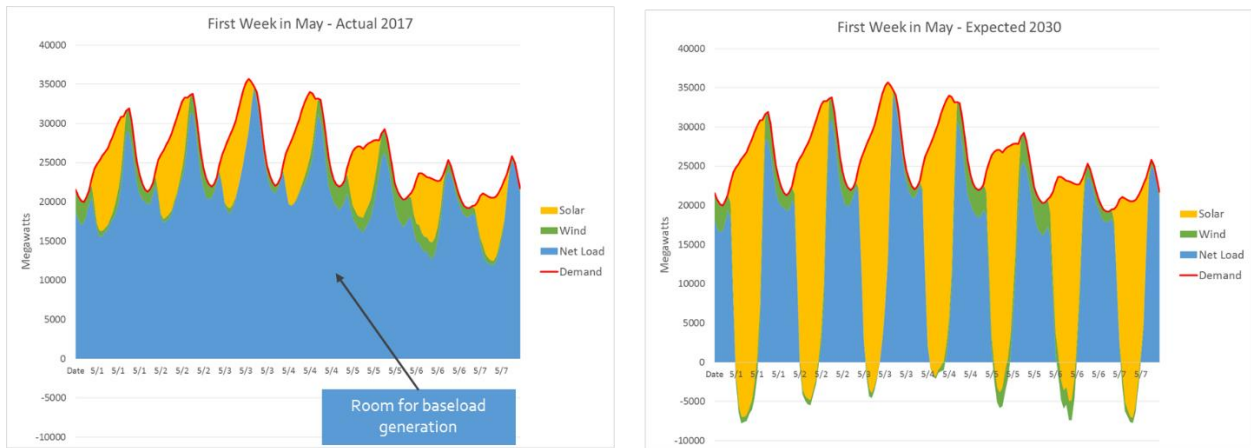
In left-side chart of Figure 2, CESA scaled the CAISO’s 2016 actual one-hour and three-hour upward ramps by month³ to roughly align with the y-axis scale from the right-side chart of Figure 2, which layers the portfolio mix from the Proposed Reference System Plan on top of the actual 2016 net load ramp data from OASIS to generate what the approximate upward ramping needs will be in 2030. Using this extrapolation, the grid in California could see three-hour ramps potentially upwards of 30,000 MW and one-hour ramps upwards of 15,000 MW in several months by 2030. By comparison, those numbers are around 12,000 MW and 4,000 MW respectively in the month of March in 2016.

As the CAISO highlighted in the Working Group meeting, these ramping challenges are expanding to seasons beyond the spring and fall, as the summer months from June to August are also seeing significant one-hour and three-hour upward ramps, even though they are smaller relative to the other months. The summer months in 2030 project to be double what is needed in the spring and fall months in 2016.

³ FRACMOO Phase 2 Working Group Meeting, presentation on September 26, 2017. p. 12. https://www.caiso.com/Documents/Presentation-FlexibleResourceAdequacyCriteria_MustOfferObligationSep26_2017.pdf

When looking at net load curves for 2017 versus those projected in 2030 using the same assumptions, it becomes clear that the ramps become even more pronounced to the point where net loads drop below zero, presumably leaving no room for inflexible generation absent an ability to add load at the right time. In this vision of the 2030 future, the preliminary analysis shows that the CAISO’s fleet must consist primarily of highly flexible resources with low to zero minimum operating levels (“Pmin”) and fast-ramping, quick-start capabilities to manage daily ramps.

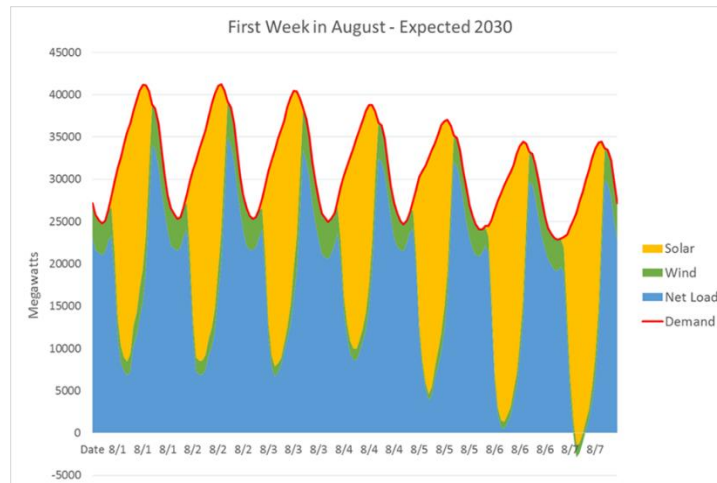
Figure 3: Net Load Curves in May 2017 vs. May 2030



Source: CESA and LS Power analysis using CAISO OASIS data and IRP Proposed Reference System Plan

The net load curves show significant ‘duck curve’ effects in not only the spring months but also the summer months, demonstrating how the future fleet needs to massively increase flexibility in all months of the year.

Figure 3: Net Load Curves in August 2030



Source: CESA and LS Power analysis using CAISO OASIS data and IRP Proposed Reference System Plan

Overall, CESA’s preliminary analysis only augments CAISO’s analysis in concluding that the CAISO needs a Flex RA fleet that is fast-ramping, quick-starting, and has low (or negative) Pmin levels. While CESA understands that the future remains uncertain, that policy directions may change, and that CESA’s preliminary analysis is not finalized, the themes of the types of ramping needs in the future continue to coalesce, and today’s FRACMOO or other planning capacity frameworks should signal what is needed, at least directionally. Depending on whether the CPUC chooses to procure the needed RPS resources much earlier than 2030 to take advantage of expiring federal tax credits for solar and wind projects, the CAISO grid may even find the above upward ramps and net load curves earlier than 2030, potentially as early as 2022 or 2026. CESA therefore stresses the importance of moving quickly to reform the RA program to properly incentivize and ensure that a fleet with the right flexibility characteristics are online and available at the CAISO’s disposal.

CAISO’s Proposal for New Flex RA Products and CESA’s Recommendations

The CAISO proposal clarifies and confirms the roles of RA as a signal for resources, not as a payment designed to minimally keep generation around, e.g. a life-support payment to cover costs not otherwise covered by CAISO energy and Ancillary Services markets. The CAISO proposal also defines flexibility in smart and operational ways. Given the anticipated operational issues, the CAISO then proposes four new Flex RA products: (1) day-ahead ramping range capacity; (2) 15-minute dispatchable flexible capacity; (3) 5-minute dispatchable flexible capacity; and (4) regulation certified capacity.

CESA supports multiple aspects of the CAISO's proposal. First, CESA supports the CAISO's recommendation that the Flex RA fleet needs to cover the entire ramping range over any given month, to have faster ramp rates with potentially shorter notice in real-time, and to be capable of greater frequency of use. Second, CESA also agrees with the CAISO that net load should be redefined, and that the Flex RA resources should be able to provide sufficient economic bid range for the CAISO to dispatch around inflexible capacity. Finally, given that the current Flex RA product is not incentivizing investment to supply the fleet necessary to manage all the ramping needs in each month, CESA supports the exploration of more complicated product suites, including consideration of the four products proposed by the CAISO, which align our capacity capabilities with the shorter-duration ramping challenges and weekend ramping needs expected now and in the future.

While the four new proposed products are conceptual in nature and represent a major shift from the status quo, CESA believes that these shorter-duration products could help transform the fleet effectively over time to meet system needs. That said, if there are concerns about the fungibility and transactability of the four proposed products, CESA also recommends that the framework consider reforming the existing (simpler) Flex RA product. For instance, the existing product could perhaps be retained but modified to pay for short-duration, high-speed ramping capabilities in ways that align with actual performance with the capacity made available, like the pay-for-performance payments as ordered from FERC Order No. 755.

As the CAISO moves forward with developing this proposal, there are a number of areas that will need to be specified and clarified. The CAISO will need to ensure that must-offer obligations align with the CAISO grid needs, which will need to be done in close coordination with the CPUC's new RA proceeding. For example, as ramping needs become more prevalent on the weekends as well, it will be critical for the new products to more highly value resources are available on all days of the week. Eligibility requirements will also need to be specified to account for start-up times and Pmin values to ensure that not all resources, such as long-start units, are counted the same toward Flex RA requirements, when they are not providing the same level of flexibility as fast-starting units with low Pmin. A principal shortcoming of the current Flex RA product is that it is defined too broadly, such that all resources essentially count toward Flex RA, diluting the value of product while not serving CAISO flex needs sufficiently. This broad definition prevents the CAISO from resolving its flexibility needs. It makes sense that the initial 3-hour product is due for an overhaul, as this 3-hour concept resulted from a compromise process driven in part by helpful stakeholders such supportive of and interested in addressing the CAISO's needs

In addition, as it pertains to energy storage, CESA recommends that bi-directional resources be counted for Flex RA under this new proposal for the full range of their charge and discharge

capabilities. The ability to smartly add load should be valued as ‘counting’ for Flex RA in the downward direction, not just the generation portion of an energy storage resource’s discharge capabilities. Specifically, full counting of energy storage resources should apply in the Non-Generator Resource (“NGR”) and Proxy Demand Resource (“PDR”) models for any energy storage resource with the right flexibility characteristics. In other words, resources in all market participation models should be allowed to qualify based on their technical capabilities.

Finally, CESA has one area of concern with the CAISO’s proposal. While CESA supports their consideration as planning capacity, further review on the roles of interties counting for planning capacity should be developed. In the proposal, interties may ‘count’ for flexibility under this new framework, but this may deviate from historical norms and definitions of planning capacity, by which capacity resources are identified, contracted for, and made available. Intertie resources, as CESA understands it, are not pre-determined and linked to ‘steel in the ground’ known and reserved to provide the needed capacity – an issue during California’s energy crisis in the early 2000s. For these reasons, careful consideration is needed for how and when we count interties as capacity, if at all.

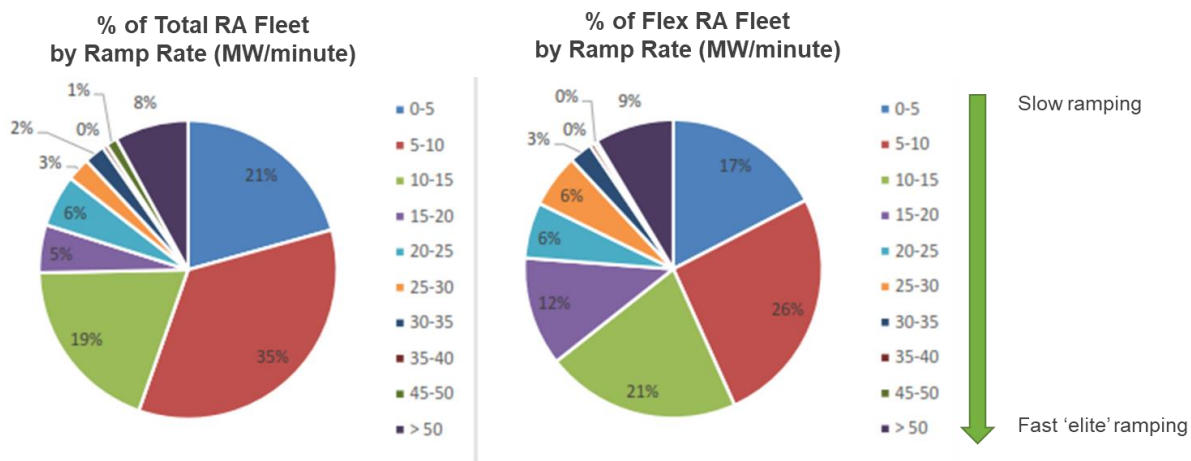
CESA recommends that the CAISO move forward with this new framework to inform the CPUC in a timely way in the RA proceeding.

FRACMOO is well-positioned to inform the next RA proceeding. Collaboration with the CPUC is key. The CPUC must design and approve any RA reforms, and CAISO engagement is important. At the same time, any de-coupling between the entity responsible for grid operations and the entity responsible for procuring resources, as was the case when the CAISO first started operations in conjunction with a Power Exchange (PX) responsible for the procurement of energy resources, potentially creates reliability if misalignment between the two entities yields an inadequate solution for the grid operator. Careful coordination and a robust response to the needs of the grid operator is of course key.

In considering whether to move forward with the CAISO’s proposal or some revised version of the proposal, CESA also cautions against any unreasonable oversimplification of the current Flex RA performance. For example, if ‘RA showings’ seem to indicate that there is enough Flex RA on the CAISO grid, some may conclude that there is no problem with flexibility, even if grid operations continue to be more challenging. The fact that the current RA fleet that includes both Standard and Flex RA looks no different from the Flex RA fleet alone in terms of ramping capabilities should not imply there is no problem with grid flexibility, merely that the definition and current structure of flexible capacity is likely insufficient, e.g. the perhaps overly permissive eligibility rules for Flex RA combined with the broad three-hour focus are contributing to the

inability of the CAISO to meet its Control Performance Standard (“CPS”) during certain hours and days of the year.⁴

Figure 4: Total RA Fleet vs. Flex RA Fleet by Ramp Rate



Source: CAISO FRACMOO Phase 2 Supplemental Issue Paper⁵

Point-counterpoint responses by the CAISO are needed to move the discussion forward in some instances.

While CESA cannot speak for all stakeholders, CESA believes there may be great merit in a point-counterpoint response to some stakeholders who have participated in FRACMOO over the past two years. Specifically, CESA observes that some stakeholders have shared views that cast doubt on the CAISO’s path or that could be construed as opposing changes or ideas floated by the CAISO. These stakeholders may have provided their own ideas, and the CAISO should address which ideas best serve the market and the CAISO’s grid needs. Additionally, these stakeholders should be used as problem solvers.

One ongoing issue, as CESA understands it, is that an ‘on paper’ count of flexibility should be used to augment the existing three-hour system to allow for backstopping of incremental Flex RA capacity (in place of any new product). While the CAISO is best positioned to respond to these points, CESA believes that any response to should assess how actual multi-interval dispatch algorithms work in a manner where ‘on-paper’ flexibility may not be actually available.

⁴ CAISO Inverter-Based Generation Workshop, presentation on July 24, 2017. pp. 16-24. <http://www.caiso.com/Documents/Agenda-Presentation-OperationalOpportunitiesToMinimizeRenewablesCurtailments.pdf>

⁵ CAISO FRACMOO Phase 2 Supplemental Issue Paper, published on November 8, 2016. p. 7. <http://www.caiso.com/Documents/SupplementalIssuePaper-FlexibleResourceAdequacyCriteria-MustOfferObligationPhase2.pdf>

A clear example of this is when, due to uncertainty, more flexibility is needed, yet a Flex RA resource cannot be committed in time to meet the need. This shows how the 'on-paper' count of flexibility overstates the actual amount. Additionally, outages, local capacity needs, and other factors may require the positioning of some flexible units in a way where the flexibility is not available. An engineering-based explication of these operational aspects could resolve any views about the pros or cons of an 'on-paper' counting exercise. Such a response may also help stakeholders to identify what other CAISO changes and initiatives are needed – *e.g.*, to vote for an initiative to extend the look-ahead of Real-Time Unit Commitment (“RTUC”).

Another point occasionally but repeatedly raised is that no near-term changes should be pursued if the changes mostly yield the same fleet of RA resources in the near term. To this, CESA offers only that the CAISO's principles for Flex RA, which include the concept of a market signal, should be emphasized. In past comments, CESA has expressed that a signal to the market can and does change how resources are maintained, built, updated, configured, etc. Others, if CESA recalls, expressed that the fleet will not materially change in response to such signals in the short-run, even though CESA disagrees and provided alternative views. CESA suggests that data or testimonials be considered on where and how some resources may have reduced their capability to provide Primary Frequency Response due to a lack of a price signal for this service, or on how maintenance and resource upgrades are informed by capacity planning market signals. This example could show how even in the short run, signals do in fact transform the amount of flexibility or services available from even the same fleet of resources. Such a discussion, in addition to data on the CAISO's growing grid operation challenges, should help set the stage for action with the help of thoughtful stakeholders.

Finally, CESA recalls that some points have been raised which imply that real-time energy prices historically may have sufficiently incited real-time flexibility and that flexibility is not truly a problem that can be resolved in capacity planning tools. Many market aspects have changed to the point where historical comparisons may be invalid, but a recognition that the fleet's capabilities indubitably constrain grid operations is essential. Would the 'old grid' have run effectively with just wind and nuclear resources, for example? Further, CESA notes that changes in market rules and other factors also make some historical data point less relevant to today's discussion. One example is that rule changes and the use of the Flexible Ramping Constraint and Product have, in part, reduced real-time price-spikes, without which, some resources have become less inclined to offer real-time flexibility. With the many changes in the market, CESA believes we should focus, as the CAISO proposes, on a principled approach that features a robust capacity planning tool that ensures reliability for the CAISO, and that stakeholders should evaluate matters carefully and not blur correlations with causations.

Conclusion

We appreciate CAISO's consideration of CESA's comments and look forward to ongoing participation in the CAISO's FRACMOO Phase 2 Initiative. CESA reiterates its support for the CAISO's analysis and proposal and recommends that the CAISO work with the CPUC to move quickly on reforming the Flex RA program given the current and future operational needs.