California ISO

Flexible Resource Adequacy Criteria and Must Offer Obligation – Phase 2

Second Revised Flexible Capacity Framework

April 27, 2018

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1. Executive Summary

The original FRACMOO proposal was an initial step toward ensuring that adequate flexible capacity was available to the ISO to address the needs of a more dynamic and rapidly transforming grid. The FRACMOO proposal represented the first ever flexible capacity obligation in any ISO market, recognizing that a resource adequacy program should include both the size (MW) of resource needs and the flexible attributes needed (e.g., dispatchability and ramp rate). The ISO anticipated making enhancements to the original FRACMOO design and tariff provisions once it had experience operating under a flexible capacity paradigm and better understood the system's flexible capacity needs, especially in light of the ISO's changing operational needs as the system relies more on variable and distributed energy resources. The ISO's assessment of the current flexible capacity product shows that it is overly inclusive and risks exacerbating the ISO's operational challenges by sustaining largely inflexible resources (long starting, long minimum run times, and high Pmins) at the expense and financial viability of more flexible resources.

The current flexible RA product results in fundamental gaps between the ISO's markets and operational needs. The ISO seeks to close these gaps by developing a new flexible RA framework that more intentionally captures both the ISO's forecasted operational needs and the predictability (or unpredictability) of ramping needs. Changes to the flexible capacity product and flexible capacity needs determination should align forward procurement with the ISO's actual operational needs and how the ISO commits and dispatches resources through the various market runs (i.e. Day-ahead market, fifteen-minute market, five-minute market runs).

Success of a flexible RA program must include meeting anticipated ramping uncertainty within the time scales of the real-time market. The most efficient way to address this anticipated uncertainty is to develop flexible capacity rules and products that are tied directly to two types of ramping needs:

1) Predictable: known and/or reasonably forecastable ramping needs, and

2) Unpredictable: ramping needs caused by load following and forecast error.

Any new flexible RA framework should address both predictable and forecastable ramping needs as well as the unpredictable and uncertain ramping needs. This may be achieved by: first, requiring there is sufficient capacity economically bid into the ISO day-ahead market to establish a market solution (as opposed to solutions that rely on penalty parameters) that properly shapes resources in the day-ahead to the forecasted load shape, and second by ensuring enough fast ramping and responsive resources are procured and available in real-time to address uncertainty.

The ISO conducted an assessment of the distribution of historical real-time uncertainty. These distributions provide the basis for what kind of granularity of uncertainty that must be addressed and how much real-time uncertainty should be addressed in the planning horizon. The results of the assessment show that the ISO must manage a significant amount of imbalance between the day-ahead and real-time markets. These imbalances can lead to redispatching up to 9,000 MW between the day-ahead market and real-time markets. Therefore, the ISO requires flexible RA products that include eligibility criteria focused on the ramping speed and dispatch capabilities that are aligned with the ISO's proposed changes in the Day-Ahead Market Enhancements stakeholder initiative.

To address these needs, the ISO proposes to develop three flexible RA products:

1) Five-minute Flexible RA

2) Fifteen-minute Flexible RA

3) Day-Ahead Shaping RA

The ISO must be prepared to address the largest uncertainties that occur with the shortest timeframes. Therefore, flexible RA needs should first plan for the uncertainty that occurs between Fifteen Minute Market (FMM) and Real-Time Dispatch (RTD) and then between day-ahead market to FMM. Resources capable of addressing FMM to RTD needs are also capable of addressing the uncertainty between day-ahead market and FMM, but additional capacity should be procured to address the additional uncertainty that occurs between day-ahead market and FMM. As such, these flexible capacity requirements will be structured such that procuring higher quality resources will meet other identified needs.

The ISO proposes to establish the overall flexible capacity requirement in a manner similar to the current practices: the largest three-hour net load ramp plus contingency reserves. However, there are two notable differences. First, the ISO will update the portion required for contingency reserves to align with the new BAL- 002 requirements. Second, the ISO will reconstitute the curtailed wind and solar resources into the three-hour net load ramp value. This will allow the new framework to include improved opportunities for imports and VERs to provide flexible RA capacity. The ISO's overall flexible capacity need will therefore be defined as:

Maximum Forecasted 3-Hour ramp (including reconstituted renewable curtailments) + ½ Max(MSSC, 6% of the monthly expected peak load) + ε

Given the consistency of the distributions of the uncertainty, it is reasonable to expect flexibility needs at the highest end of the distribution during each month. For all

real-time flexible capacity products,[1] the ISO proposes to establish monthly flexible capacity needs at the forecasted maximum absolute value of imbalance reserves identified for a given month. Additionally, as load and resource variability continue to increase, this requirement will include an additional growth factor based on the relative changes to each of the contributing factors (i.e. increasing in wind or solar or changes to load due to behind-the-meter-solar penetration). Finally, the ISO proposes that 100% of the monthly needs be procured for year ahead showings.

In order to ensure sufficient flexible capacity is procured to meet these requirements, the ISO identifies basic eligibility criteria for the three Flexible RA products. Then the ISO details the must offer obligations and counting rules to provide each of these products. This is done separately for internal resources, EIM resources, and purely external resources (i.e. resources external to both the ISO BAA and any EIM entity). Finally, the ISO describes its proposed assessment of flexible RA capacity showings and backstop cost allocations.

Proper allocation of flexible capacity requirements must be based on reasonable causation principles. The current ISO flexible capacity requirement allocation methodology is based on LSEs procurement practices. Further, the ISO proposes to maintain its current practice of allocating flexible capacity requirements based on an LRA's jurisdictional LSEs' contribution to the flexible capacity requirement.

The ISO proposes to allocate flexible capacity requirements based on the primary contributing factors to each product. Specifically, the ISO will allocate based on the predictable and unpredictable ramping needs. All imbalances attributable to load, wind, and solar will be allocated directly to that LRA, while all other factors contributing to the need for real-time flexible RA capacity will be allocated to an LRA based on load ratio share. For allocating day-ahead load shaping requirements, the ISO proposes to rely on current practices of allocating based on each LRA's contribution to the three hour net-load ramp.

2. Stakeholder Comments on Draft Flexible Capacity Framework

The ISO received 29 sets of comments to the Revised Draft Flexible Capacity Framework.[2] The ISO has summarized stakeholder comments based on the central themes identified throughout the comments. While general responses to stakeholder proposals are provided in Appendix A, additional details may be provided in subsequent relevant sections of this proposal. Additionally, the ISO also addresses any substantive

[1] However, the ISO recognizes that anomalies may be identified that warrant a lower percentage. If anomalies are identified, then those data points will be discarded.
[2] SCE did not submit comments for this iteration of the proposal.

proposals put forward by stakeholders, including why such proposals were accepted or rejected.

Based on comments and additional ISO analysis, the ISO made the following material changes from the Revised Flexible Capacity Framework:

- The basis for real-time flexible capacity needs will align with the need for imbalance reserves identified in the ISO's Day-Ahead Market Enhancements, including the data used for the analysis.
- The ISO has removed start-up times as an eligibility criteria for providing flexible RA capacity.
- Must-offer obligations will be limited to day-ahead. All real-time must offer obligations will be determined through day-ahead market awards, consistent with what has been proposed in the Day-Ahead Market Enhancements.
- VER EFCs will be determined based on PG&E's "simple" option. This option scales VER EFC relative to the resource type's contribution to the three hour net load ramp.
- For purposes of real-time flexible capacity counting, storage resources will be limited to the resource's instantaneous maximum output, but would be allowed a 15 minute transition time for a storage resource to count the full charge and discharge range for the day-ahead load shaping product.
- RAAIM for flexible RA capacity will be assessed only on day-ahead bidding, and will be assessed over all 24 hours.

Stakeholders including PG&E, SDG&E, Calpine, and AReM request the ISO pause the FRACMOO2 initiative until further development of the day-ahead market enhancements. This FRACMOO initiative is aligned with and the Day-Ahead Market Enhancements initiative is using the same data for analytical purposes. Additionally, the ISO delayed this iteration of FRACMOO2 revised framework until after the revised straw proposal in Day-Ahead Market Enhancements was published. These actions will ensure the FRACMOO2 design and procurement needs are consistent and aligned with the Day-Ahead Market Enhancements imbalance reserve needs.[3]

3. Stakeholder Engagement Plan

The FRACMOO2 flexible capacity framework initiative schedule is shown below. The ISO's intent is to move this framework into the CPUC's resource adequacy proceeding where parties can further discuss how the framework informs needed

[3] http://www.caiso.com/informed/Pages/StakeholderProcesses/FlexibleResourceAdequacyCriteria-MustOfferObligations.aspx

resource capabilities, and how it should be incorporated into the CPUC's resource adequacy program.

Milestone	Date
Second Revised Flexible Capacity Framework posted	April 26, 2018
Second Revised Flexible Capacity Framework stakeholder Meeting	May 3, 2018
Stakeholder Written Comments Due	May 17, 2018
Draft Final Flexible Capacity Framework posted and submitted to the CPUC RA proceeding	June 6, 2018
Draft Final Flexible Capacity Framework stakeholder Meeting	June 13, 2018
Stakeholder Written Comments Due	June 27, 2018
Complete coordination with CPUC's RA proceeding prior to Board Approval of final flexible RA Framework	Q4 2018

4. Background

In 2014, the ISO filed, and FERC subsequently approved, tariff revisions to implement the ISO's FRACMOO proposal. The ISO developed the original FRACMOO proposal and accompanying tariff provisions through an extensive stakeholder process in collaboration with the CPUC, municipal utilities, investor-owned utilities, generators, environmental groups, and other market participants. The FRACMOO proposal was a first step toward ensuring that load serving entities procured and offered resources to the ISO that would ensure the ISO had sufficient flexible capacity to reliably operate a transforming grid that was growing more reliant on distributed and variable energy resources. The tariff provisions resulting from that effort provided the ISO with a flexible capacity framework. Specifically, the FRACMOO tariff provisions established:

- A study methodology for determining flexible capacity needs and allocating those needs to local regulatory authorities;
- Rules for assessing the system-wide adequacy of flexible capacity showings;
- Backstop procurement authority to address system-wide deficiencies of flexible capacity; and
- Must offer obligations to ensure the ISO has the authority to commit and dispatch flexible resources through its markets.

When the ISO filed the tariff revisions to implement the FRACMOO proposal with FERC, the ISO stated:

> This simplified initial approach provides a smooth transition to establishing durable flexible capacity requirements. The ISO has committed to re-evaluating the effectiveness of the flexible capacity requirements in 2016 to consider, among other matters, whether enhancements are needed to meet system flexibility needs or to allow resources that are dispatchable on a fifteen-minute basis to fulfill a portion of the flexible capacity needs.[4]

The original FRACMOO proposal was an initial step toward ensuring that adequate flexible capacity was available to the ISO to address the needs of a more dynamic and rapidly transforming grid. The FRACMOO proposal also represented the first ever flexible capacity obligation in any ISO market, recognizing that a resource adequacy program should include both the size (MW) of resource needs and the attributes of the resources providing them (e.g., dispatchability and ramp rate). The ISO expected to make enhancements to the original FRACMOO tariff provisions once it had experience with a flexible capacity paradigm and better understood the system's flexible capacity needs, especially in light of the ISO's operational needs.

One of the initial FRACMOO goals was simplicity and an opportunity for a variety of resource types to provide flexible capacity. The rules allowed for virtually all technology types to offer flexible capacity, regardless of operational attributes like start-up time and minimum run-time. These rules also did not impose requirements on the dispatch frequency of resources. This highly inclusive set of eligibility criteria gave LSEs broad discretion over how to meet their flexible capacity requirements. It has also allowed the ISO to gain important insights into how well-suited the flexible capacity resources shown would meet future ISO reliability needs, and what signals were being sent to the market for mid-term and long-term flexible resource procurement. The ISO's assessment shows that the flexible capacity product as currently structured is overly inclusive, and risks exacerbating the ISO's operational challenges by sustaining largely inflexible resources (long starting, long minimum run times, and high Pmins) at the expense and financial viability of more flexible resources. Modification to the day-ahead market, in conjunction with the changes proposed in the current stakeholder process, will ensure this is no longer the case. The addition of imbalance reserves in the Day-Ahead Market Enhancements ensures sufficient flexible capacity is maintained through to real-time. Any necessary commitments of long-start resources to maintain that flexibility will be ensured through the day-ahead market and needed short-start resources will remain available for dispatch in through the real-time markets. Further, the addition of flexible

[4] Transmittal letter at p. 19.

capacity products that accounts for resources' five and fifteen minute ramp rates will ensure sufficient ramping speed is available to procure adequate imbalance reserves.

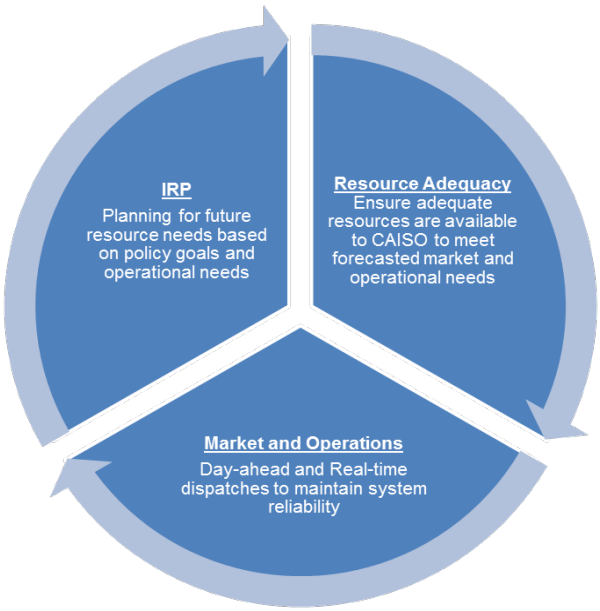
Ultimately, ISO grid operations and operational needs are determined by resource planning decisions, including resource additions and retirements. The selection of resources to build, maintain, and retire all impact the ISO's ability to reliably operate the grid with RA resources. Figure 1 shows how resource planning and procurement are critically connected to ISO operations. Any enhancements to the flexible RA program should inform both the Integrated Resource Plan at the CPUC and RA programs across all LRAs. Therefore, the ISO's flexible RA framework should achieve the following overarching goals:

1) Provide signals to help ensure the efficient retention and retirement of existing resources; and

2) Provide the ISO a resource portfolio that meets grid reliability needs through economic market dispatch, including a Flexible RA program that ensures access to sufficient flexible capacity of the fleet to ensure the ISO is able to procure all market products necessary for reliable grid operation during all hours of the year.

The current flexible RA product does not ensure either of these goals is met. For example, over 4,000 MW of once-through cooling (OTC) resources have been shown as flexible RA resources. These OTC resources are planned to retire over the next couple years and are infrequently dispatched in day-ahead and, therefore, unavailable to address real-time market needs.

Figure 1: A unified vision guiding planning, procurement, and operations



Given the need to create a more interconnected market, the ISO is also exploring additional market enhancements to enhance reliability, improve system control, and address real-time supply and demand uncertainty. Specifically, the ISO will:

- Develop a fifteen-minute day-ahead market: This product will make day-ahead market schedules more granular and allow the ISO to better shape dispatches, reducing the amount of load following capability required between day-ahead market and FMM.
- Develop day-ahead imbalance reserves: This product is similar to the existing real-time flexible ramping product; however, it is designed to ensure there is sufficient load following capabilities (both up and down) reserved between day-ahead and real-time markets.
    - ISO plans to conduct these two processes on parallel tracks.
    - The ISO believes both stakeholder processes are necessary (FRACMOO2 to ensure sufficient flexible capacity is available, the day-ahead load following reserve product to help ensure an efficient use of these resources) and has identified the interdependencies between them, including how much of the day-ahead imbalance reserves are needed relative to availability and offer obligations for flexible capacity.

5. Proposed Flexible Capacity Framework

In November 2016, the ISO published a supplemental issue paper to expand the scope of the FRACMOO2 stakeholder initiative. As part of the supplemental issue paper, the ISO conducted a preliminary assessment of historic flexible RA showings finding "that the flexible capacity product is not sending the correct signal to ensure flexible capacity will be maintained long-term."[5] The ISO identified numerous issues and potential enhancements to mitigate these concerns in the supplemental issue paper, and explored these issues more thoroughly in the Revised Straw Proposal – Short-Term Solutions.[6]

The current flexible RA product fails to address fundamental gaps between the ISO's markets and operational needs. The ISO seeks to close this gap by developing a new flexible RA framework that more deliberately captures both the ISO's operational needs and the predictability (or unpredictability) of ramping needs. Changes to the flexible capacity product and flexible capacity needs determination should closely align with the

[5] http://www.CAISO.com/Documents/AgendaandPresentation-FlexibleResourceAdequacyCriteriaMustOfferObligationPhase2-SupplementalIssuePaper.pdf
[6] http://www.caiso.com/Documents/RevisedStrawProposal-FlexibleResourceAdequacyCriteriaandMustOfferObligationPhase2.pdf

ISO's actual operational needs for various market runs (i.e. day-ahead market, fifteen-minute market, five-minute market runs).

Success is not simply whether the flexible RA fleet can meet an *ex-ante* known determined ramp, but whether it also can meet anticipated ramping uncertainty within the time scales of the real-time market through economic bids. Under the current flexible RA paradigm, there is no assurance flexible RA resources procured are capable of meeting real-time ramping uncertainty. Enhancing the flexible RA product to incorporate ramping speed and real-time availability sends an important longer-term procurement signal to the market to ensure that resources procured are available to satisfy anticipated, yet unpredictable, ramping needs. The most efficient way to address this anticipated uncertainty is to develop flexible capacity rules and products that are tied directly to both known and unknown ramping needs. The ISO will work with stakeholders to achieve the following objectives:

A. Develop critical links between RA and energy markets to ensure the ISO is able to meet grid reliability needs through its markets, accounting for uncertainty (including load forecast error, VER forecast error, and outages and other resource deviations);
B. Provide a framework for intertie, Energy Imbalance Market (EIM) and VER resources to be part of the flexible capacity solution; and
C. Provide LSEs and LRAs flexibility to meet system, local, and flexible capacity needs in ways that best align with their business and policy objectives.

The remainder of this section provides the basis of a new flexible RA framework in five steps.

1) Identify the ramping needs that flexible RA must address;
2) Define the product to be procured;
3) Quantify the flexible capacity needed to address all identified needs;
4) Establish criteria regarding how resources qualify for meeting these needs including:
    a. Basic eligibility criteria;
    b. Must-offer obligations and RA Availability Incentive Mechanism Requirements;
    c. Counting rules; and
    d. Establish rules necessary to determine if sufficient capacity has been procured or if additional procurement is needed. This includes any necessary backstop procurement rules.
5) Allocation of flexible capacity requirements based on a sound causal principles.

Once a complete flexible capacity program is established that achieves objectives A-C, above, the ISO believes it will then be possible to replace the existing flexible capacity products with this new design construct. This includes eliminating the existing flexible capacity categories in favor of this proposed framework.

5.1. Identifying Ramping Needs

The ISO reviewed the day-to-day operational system needs pertaining to flexible capacity.[7] The ISO observes the need for two categories of flexible capacity:

1) Predictable: known and/or reasonably forecastable ramping needs, and

2) Unpredictable: ramping needs caused by load following and forecast error.

These two types of flexible capacity needs ─ predictable and unpredictable ─ drive different forms of flexible capacity procurement needs. Predictable and reasonably forecastable ramping needs require a set of resources economically bidding into the ISO's day-ahead market to properly shape the day-ahead market to meet forecastable ramps. This allows the ISO to create a feasible market dispatch in the day-ahead market without relying on penalty parameters or exceptional dispatches. However, once the ISO produces a day-ahead dispatch solution the ISO must rely on real-time market dispatches to account for unpredictable ramps caused by uncertainty.

The ISO's flexible capacity framework is based on connecting these two ramping needs into a single larger framework. The remainder of this section describes each type of ramping need in greater detail.

5.1.1. Predictable and forecastable ramping needs

The current flexible RA product needs determination is based on the largest forecasted three-hour net load plus 3.5 percent expected peak load.[8] The greatest net load ramps are largely driven by the sunset during the non-summer months. Numerous stakeholders have questioned the need for a specific RA product predicated on ramps that are largely predictable. The ISO agrees that these ramps are largely forecastable on a day-to-day basis; however, this does not mean forward procurement to meet these ramps is not important for continued reliable operations. Setting up a fleet of resources with economic bids to meet day-ahead net load ramps allows the ISO to better shape day-ahead commitments. Specifically, a deeper pool of resources that can be flexible in

[7] The ISO issued a revised straw proposal in the initiative on May 1, 2017. Based on stakeholder feedback and continued assessment of system operational needs, the ISO will not pursue further action on that proposal.

[8] The 3.5 percent portion of this equation was originally established to address overlap between flexible RA provisions and contingency reserves. However, the basis for determining the quantity of contingency reserves needed has since been revised.

the day-ahead market through day-ahead economic bids will improve the efficiency of the ISO dispatch and management of renewable resources.

To date, the ISO manages most resource commitments through the day-ahead market process. The ISO does not expect this to change. However, the ISO expects net load ramps to grow and minimum net load to decrease over time. This will likely lead to ramp constraints within the RA fleet and require additional exceptional dispatches if not addressed through forward planning. As such, the ISO proposes to maintain a product for, and assessment of, flexible capacity that ensures there is sufficient bid range to cover the forecasted maximum three-hour net load ramps. The ISO envisions that this day-ahead shaping product will provide the resources the ISO needs to shape day-ahead market awards and commitments based on market solutions and should mitigate the need for exceptional dispatches and Capacity Procurement Mechanism (CPM) designations. The objective of this product will be to improve ISO market efficiency and send signals to the market about how well procurement profiles are able to facilitate increased VER penetration. Additionally, this tool will provide information about the likelihood and frequency of exceptional dispatch CPM designations.

5.1.2. Unpredictable and uncertain ramping needs

With the continued expansion of VERs and behind-the-meter solar photovoltaic systems, both load and generation output will continue to create greater uncertainty between the day-ahead and real-time markets. Under the current ISO market rules, no additional long-start resources are committed after the day-ahead market closes and RUC awards are made. All remaining uncertainty, including both load following and forecast error, must be addressed by resources previously committed in the day-ahead market or faster starting resources available for commitment in the real-time market.

The ISO is developing market rules to procure imbalance reserves as part of its Day–Ahead Market Enhancements stakeholder process.[9] The objective of imbalance reserves is to ensure the day-ahead market has sufficient resources awarded with upward and downward ramping capabilities to address real-time imbalances. Resources that receive an imbalance reserve award will have a must offer obligation in the real-time market. The energy bids associated with the imbalance reserve award will enable the real time market to address uncertainties that materialize between the day-ahead market and real-time market through economic bids.

The ISO proposes to develop flexible resource adequacy capacity products to align with the proposed imbalance reserves to address uncertainty needs between day-

[9] The Day-Ahead Market Enhancements straw proposal is available at http://www.caiso.com/Documents/RevisedStrawProposal-DayAheadMarketEnhancments.pdf.

ahead market and real-time dispatch. While the benefits of having sufficient ramping capabilities to address the three-hour net load ramp were addressed in great detail through the initial FRACMOO process, the challenges with uncertainty in the forward planning horizon did not receive comparable attention. Therefore, the ISO provides here the additional details and descriptions of the challenges and magnitude of issues that must be addressed.

5.1.3. Description of real-time uncertainty

Uncertainty between day-ahead and real-time can be addressed at three levels of granularity: between the day-ahead market's hourly dispatch to Fifteen-Minute Market (FMM), the FMM to the RTD, and the RTD and actual operations. The ISO's first full market run is its day-ahead market. This market is currently run at an hourly granularity using a forecast between 14 to 36 hours ahead of actual operations. Given the large increments of time and the gap between the market run and operations, there can be significant differences between this commitment and actual operations based on forecast error and the lack of granularity. This is particularly true during the times surrounding sun rise and sun set. While the ISO currently operates an hourly day-ahead market, it has proposed to reduce this interval to fifteen minutes as part of the Day-Ahead Market Enhancements stakeholder initiative.

The next ISO market iteration is the FMM. It runs every fifteen minutes and uses more up-to-date forecasts and covers shorter time intervals. The FMM should improve on day-ahead market commitments and awards and ensure faster ramping resources are committed in instances were forecast error and/or load following requires it. The FMM represents a more temporally proximate and more granular forecast than the day-ahead market.

The RTD is more granular and is the final market solution run to serve actual load. The RTD is run every 5 minutes, which occurs 12.5 minutes prior to real-time, with actual dispatches sent 7.5 minutes prior to real-time. The objective of each of these iterations is to refine the resource commitment and dispatches, once through day-ahead market, then FMM and again in the RTD.

Once RTD has run, forecast errors are still present. Thus, the ISO now relies on regulation to balance the system post RTD. Regulation is procured in the day-ahead market for upward and downward balancing needs.

5.2. Defining the Flexible RA Products Needed

The ISO needs flexible capacity products that address both predictable and unpredictable ramping needs. To address these needs the ISO proposes three flexible capacity products.

1) Day-ahead load shaping
2) Fifteen-minute flexible RA capacity
3) Five-minute flexible RA capacity

The day-ahead load shaping product should ensure the ISO is able to meet its three-hour net load ramps. The real-time products – the five and fifteen minute flexible RA capacity – will be designed to address real-time uncertainty, including imbalances between day-ahead market and RTD.

Imbalance reserves are needed to cover FMM imbalances and the FMM flexible ramping product requirement. The drivers of FMM imbalances are caused by load and resources whose FMM schedules change from the day-ahead market, and must be accommodated by economically scheduling other flexible resources. These drivers are provided in Table 1, below.

Table 1: Drivers requiring imbalance reserves

Upward imbalance reserve Drivers	Downward imbalance reserve Drivers
Load that is higher than IFM schedule	Load that is lower than IFM schedule
Virtual supply	Virtual demand
Conventional generators that are unable to meet their IFM schedule	Conventional generators that self-schedule above their IFM schedule
Variable energy resources that are unable to meet their IFM schedule	Variable energy resources that self-schedule above their IFM schedule
Imports that that don't tag their IFM schedule	Imports that self-schedule above their IFM schedule
Exports that self-schedule above their IFM schedule[10]	Exports that don't tag their IFM schedule

The ISO has conducted analysis on the overall imbalance between the day-ahead market and RTD for 2017 using the above drivers. The distribution of the overall imbalances observed in 2017 are shown in Table 2. These distributions are drawn from the same data used in the Day-Market Enhancements stakeholder initiative.

[10] If the export submitted an economic bid rather than submitting a self-schedule this would not cause imbalance reserves to be deployed to address uncertainty. This is because the real-time market can evaluate both export bids and supply bids to determine if it is economic to increase the export schedule. If the market determines it is not economic based upon current system conditions, the export will not clear the real-time market.

Table 2: Distribution of 2017 Historical imbalances

Percentile	100%	99%	95%	90%	75%	50%	25%	10%	5%	1%	0%
Jan	2,933	2,337	1,783	1,380	456	-1,224	-2,269	-3,717	-4,524	-5,360	-7,208
Feb	3,253	2,028	1,339	935	-779	-1,672	-2,730	-4,393	-5,291	-7,142	-9,541
Mar	2,584	1,825	1,001	493	-1,003	-1,976	-3,339	-4,372	-5,127	-6,526	-7,827
Apr	4,989	2,637	1,482	868	-1,082	-2,188	-3,624	-5,087	-6,022	-6,992	-7,997
May	3,322	1,994	1,024	379	-1,494	-2,534	-3,608	-5,030	-5,857	-7,324	-8,848
Jun	2,377	1,258	-526	-1,106	-1,800	-2,617	-3,673	-5,282	-6,286	-7,628	-9,051
Jul	3,383	2,131	1,327	940	-1055	-1,824	-2,542	-3,279	-3,917	-5,209	-6,120
Aug	5,559	3,900	2,430	1,701	455	-1,582	-2,527	-3,556	-4,366	-5,839	-7,140
Sep	5,381	3,369	2,100	1,520	0	-1,458	-2,732	-4,138	-5,446	-7,076	-8,713
Oct	4,366	2,809	2,116	1,658	973	-719	-2,059	-3,412	-4,343	-6,147	-7,906
Nov	3,201	2,505	1,779	1,288	367	-1,217	-2,182	-3,292	-4,079	-5,224	-7,235
Dec	3,286	2,190	1,565	1,234	410	-1,129	-1,886	-2,669	-3,291	-5,201	-7,791

The ISO must be prepared to address the largest uncertainties that occur with the shortest notice. Therefore, flexible RA needs also include the need for incremental real-time flexible ramping product. Resources capable of addressing FMM to RTD needs are also capable of addressing the uncertainty between day-ahead market and FMM, but additional capacity should be procured to address the larger remaining uncertainty that occurs between day-ahead market and FMM.

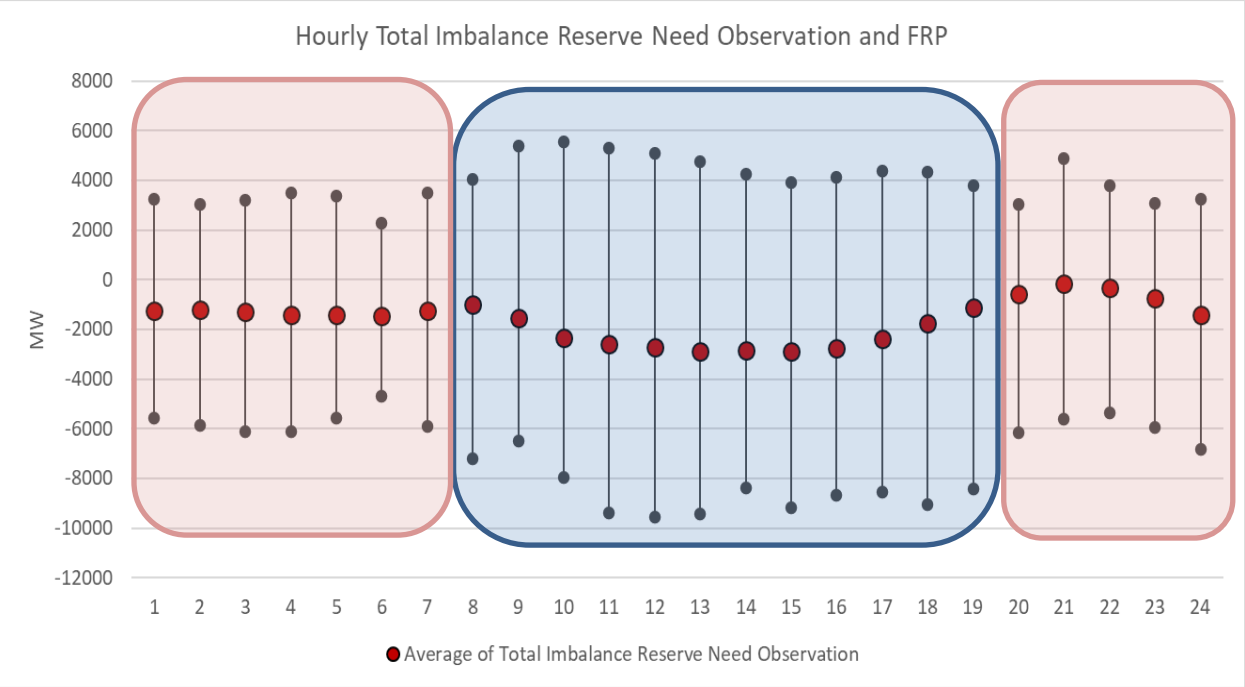
Although the ISO does not know if the uncertainty will be due to net upward or downward imbalances, the ISO has determined that it is not necessary to establish flexible RA needs to cover both upward and downward uncertainty ranges. The ISO's procurement of imbalance reserves in the day-ahead market will ensure the correct mix of upward and downward imbalance reserves are available in real-time. Flexible RA capacity requirements simply need to ensure sufficient flexible capacity is available to provide for the largest imbalances in a single direction. Therefore, the ISO proposes to set flexible capacity requirements for the real-time flexible capacity at the maximum absolute value of forecasted monthly imbalances.

5.2.1. Assessing the timing of uncertainty

While this uncertainty can occur at any time, the greatest potential uncertainty occurs during daytime hours while load and solar output have the greatest potential for change, including during the largest three-hour net load ramps. Figure 5 clearly demonstrates that more forecast error occurs during daylight hours. This is simply a function of more load and VER output leading to greater levels of uncertainty occurring

between market runs. Additionally, Figure 2 shows that a fair amount of error occurs during net load ramping intervals, including upward ramping needs.

Figure 2: Timing of Observed Imbalances



The ISO has conducted additional analysis regarding the relative ranges of the largest MW needs between day-time and night-time hours.[11] This difference demonstrates that there are opportunities for resources, like solar, that may not have a fuel source during night-time hours to provide flexible RA capacity.

5.3. Quantifying Flexible Resource Adequacy Needs

The previous section defined the flexible capacity products needed. This section quantifies how much of each flexible RA capacity is needed to address each type of ramping need.

5.3.1. Determining the overall flexible capacity need

The ISO believes maintaining the existing flexible capacity needs determination using the maximum forecasted three-hour net load ramp plus contingency reserves should continue serving as the preliminary starting point since the interplay between contingency reserves, which are flexible resources that must be reserved for contingency dispatch, and flexible capacity identified in the original FRACMOO process still exists. However, with the modifications to NERC standard on calculating

[11] Daytime hours are defined generally as hours ending 7-19. Night-time hours are hours ending 1-7 and 20-24.

contingency reserve "WECC Standard BAL-002-WECC-2a "Contingency Reserve", the means for determining the quantity of contingency reserves has changed. Contingency Reserve is determined by the greater of either:

- The amount of Contingency Reserve equal to the loss of the most severe single contingency;
- The amount of Contingency Reserve equal to the sum of three percent of hourly integrated Load plus three percent of hourly integrated generation.

Based on the new requirement, the Operating Reserve – Spinning is approximately 50% of the Contingency Reserve requirement. As such, the ISO will modify the existing 3.5 percent expected peak load portion of the flexible capacity requirement to be consistent with the revised standard. Specifically, the ISO proposes to change the flexible requirement formula to the following:

Maximum Forecasted 3-Hour ramp + ½ Max(MSSC, 6% of the monthly expected peak load[12]) + ε

Finally, since the inception of the flexible capacity product there has been an increase in ISO dispatches of VER resources, both through economic bidding and curtailed self-schedules. This makes forecasting the three-hour net load ramp more challenging. As a result, the ISO will enhance its forecasting study to account for these dispatches. Therefore, the ISO will reconstruct overall available wind and solar output and include this quantity into the formulation of the three-hour net load ramp. This eliminates the concerns of double counting VERs – once through the dispatch reduce the three-hour net load ramp and again through counting the resource as flexible – towards meeting flexible capacity needs. The ISO will modify how wind and solar resources are considered in meeting the flexible RA requirements. The ISO's proposed changes to the treatment of wind and solar resources for Effective Flexible Capacity (EFC) are discussed in greater detail below.

Combining all off these elements yields an overall flexible capacity needs determination of:

Maximum Forecasted 3-Hour ramp (including reconstituted renewable curtailments) + ½ Max(MSSC, 6% of the monthly expected peak load) + ε

[12] 6% of the monthly expected peak load is approximately equivalent to the sum of three percent of hourly integrated load plus three percent of hourly integrated generation.

5.3.2. Determining the need for real-time flexible capacity

As noted above, the ISO seeks to align the procurement of flexible RA with the need for imbalance reserves. Therefore, ISO proposes to establish monthly flexible capacity needs at the forecasted maximum absolute value of imbalance reserves identified for a given month. Table 3 shows what the need for real-time flexible RA based on observed imbalances for 2017.

Table 3: Observed Monthly Maximum Absolute Values for Imbalance Reserves

Month	Real-Time Flexible RA Capacity need	Month	Real-Time Flexible RA Capacity need
Jan	7,208	**Jul**	6,120
Feb	9,541	**Aug**	7,140
Mar	7,827	**Sep**	8,713
Apr	7,997	**Oct**	7,906
May	8,848	**Nov**	7,235
Jun	9,051	**Dec**	7,791

It should be noted, that the above values reflect both the need for fifteen minute and five minute flexible RA capacity. The ISO will define the need for flexible based on expected need for the flexible ramping product uncertainty requirement. Only resources that are five-minute dispatchable can meet this requirement. This frequently reaches 1,000 MW, and does so each month as shown in Figure 3, below

Figure 3: Historic Monthly Range for Five Minute Flexible Ramping Product

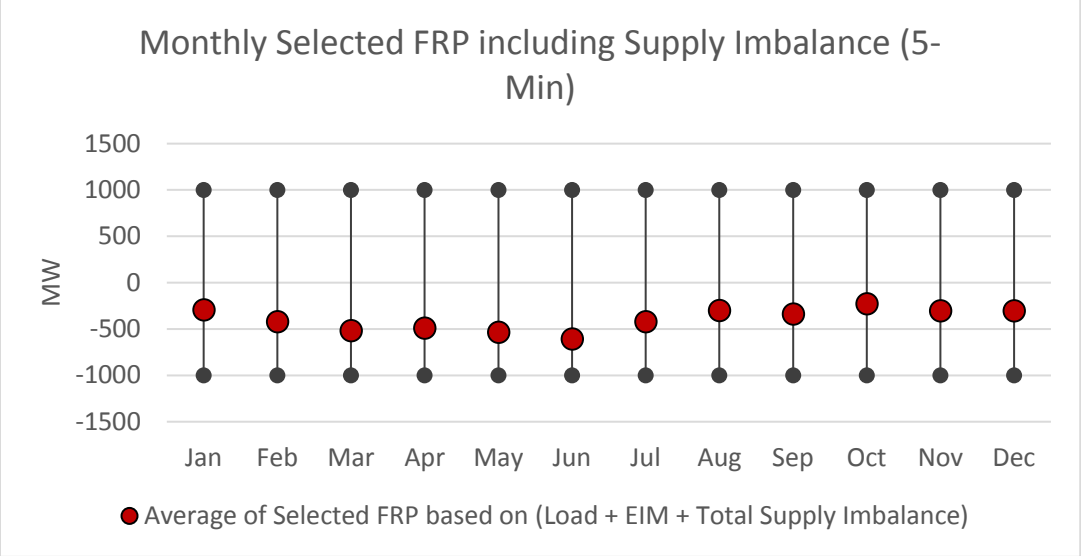
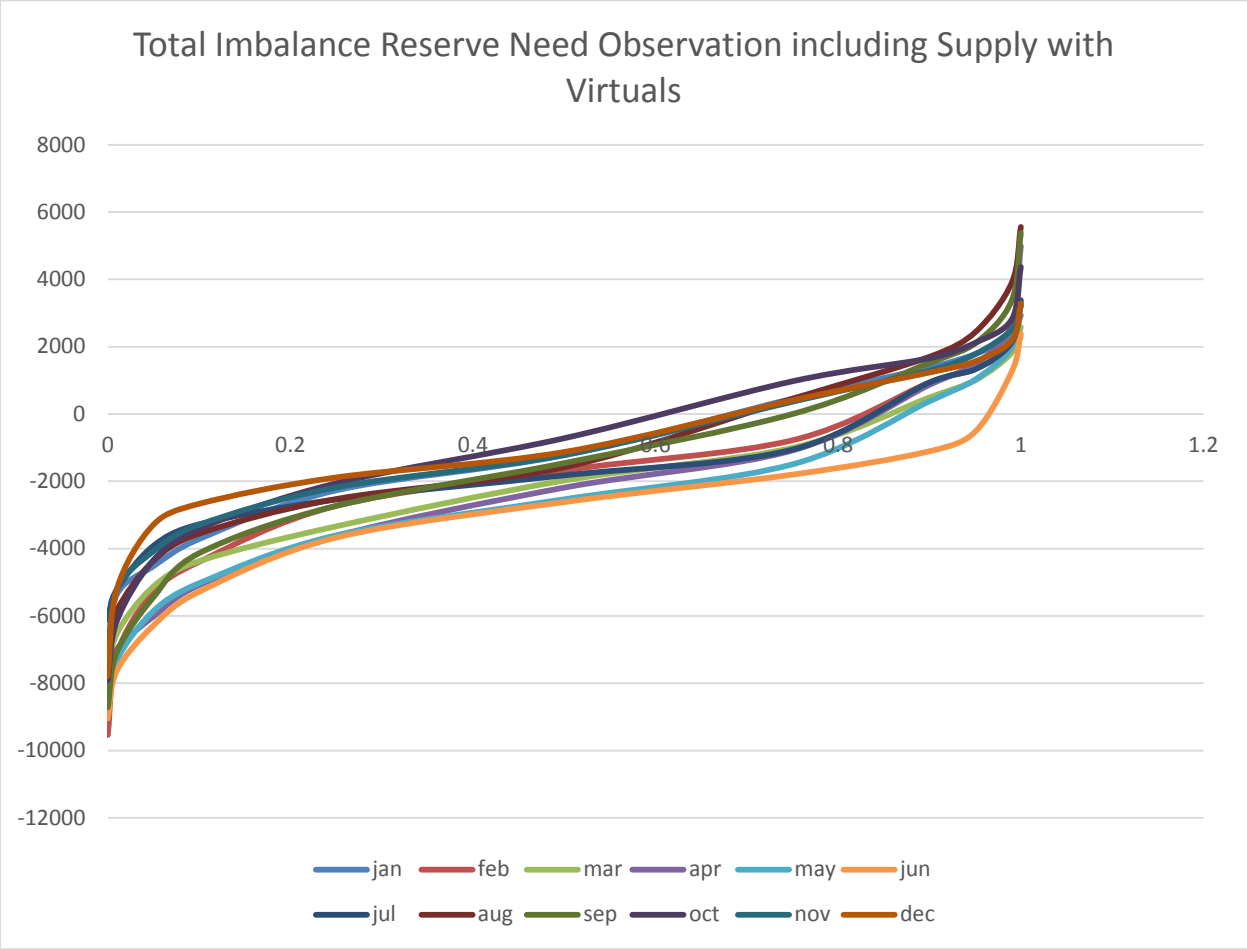


Figure 4**,** below, shows the complete distribution of the observed imbalance ranges. As these figures show, currently, the levels and distributions of imbalance are fairly consistent across months. While there are observations with high quantities of imbalance, these observations are infrequent, as shown by the steep drop off in each of the tails in the figures below. These distributions also show that average imbalance is approximately -2,000 MW, meaning the imbalance is asymmetric (i.e. the imbalance is more likely to require redispatching resources downward.

Figure 4: Distribution of Imbalance Needs



In conclusion, the ISO must manage a significant amount of imbalances between the day-ahead and real-time markets. These imbalances can lead redispatches of up to 9,000 MW between the ISO's reliability forecast and what the ISO observes from supply. The ISO is developing a market for imbalance reserves to ensure sufficient flexibility is maintained through the day-ahead market awards to address these uncertainties. Flexible resources adequacy requirements should ensure there is sufficient capacity to provide the imbalance reserves. However, given the consistency of the distributions of the uncertainty (i.e. that is shown in Table 3, above), it is

reasonable to expect flexibility needs at the highest end of the distribution almost monthly.

The ISO proposes to set flexible capacity requirements to encompass the widest range of uncertainty for all real-time flexible capacity products.[13] For unpredictable ramping needs, the ISO is currently exploring methodologies for forecasting year ahead flexibility needs driven by imbalances that mirror the day-to-day drivers of imbalances as specified in the Day-Ahead Market Enhancements stakeholder process. Specifically, the ISO is exploring the following options:

Methodology #1 – Near Term Approach:
Utilize a methodology that is similar to what is used for the Flexible Ramping Product (FRP) procurement. Requirement will be determined based on differences between the day-ahead market and RTD. Additional information describing the FRP methodology can be found in the Flexible Ramping Product draft final proposal, Section 4.3.1.[14]

Methodology #2 – Mid Term Approach:
Utilize a statistical regression technique to estimate the variation for individual components of load, wind and solar. After completion of the regression estimates, combine the results into the total imbalance reserve requirement. This methodology will analyze differences between the day-ahead market and RTD.

Methodology #3 – Long Term Approach:
Utilize probabilistic forecasting in combination with a statistical regression technique (methodology #2) to estimate the variation for individual components of load, wind and solar. Combine these results to determine the total imbalance reserve requirement.

Probabilistic forecasting uses numerical weather prediction ensembles; this is a good way to determine weather variability for individual days looking at future forecasted information. Though there is some availability of probabilistic forecasting coming from the weather vendors and research community, further development of probabilistic forecasting for the energy industry are ongoing to assist with addressing inherent biases that have been seen in Numerical Weather Prediction models.

[13] However, the ISO recognizes that anomalies may be identified that warrant a lower percentage. If anomalies are identified, then those data points will be discarded.
[14] Reference section 4.3.1 for a description of the flexible ramping product procurement methodology: http://www.caiso.com/Documents/Addendum-DraftFinalTechnicalAppendix-FlexibleRampingProduct.pdf.

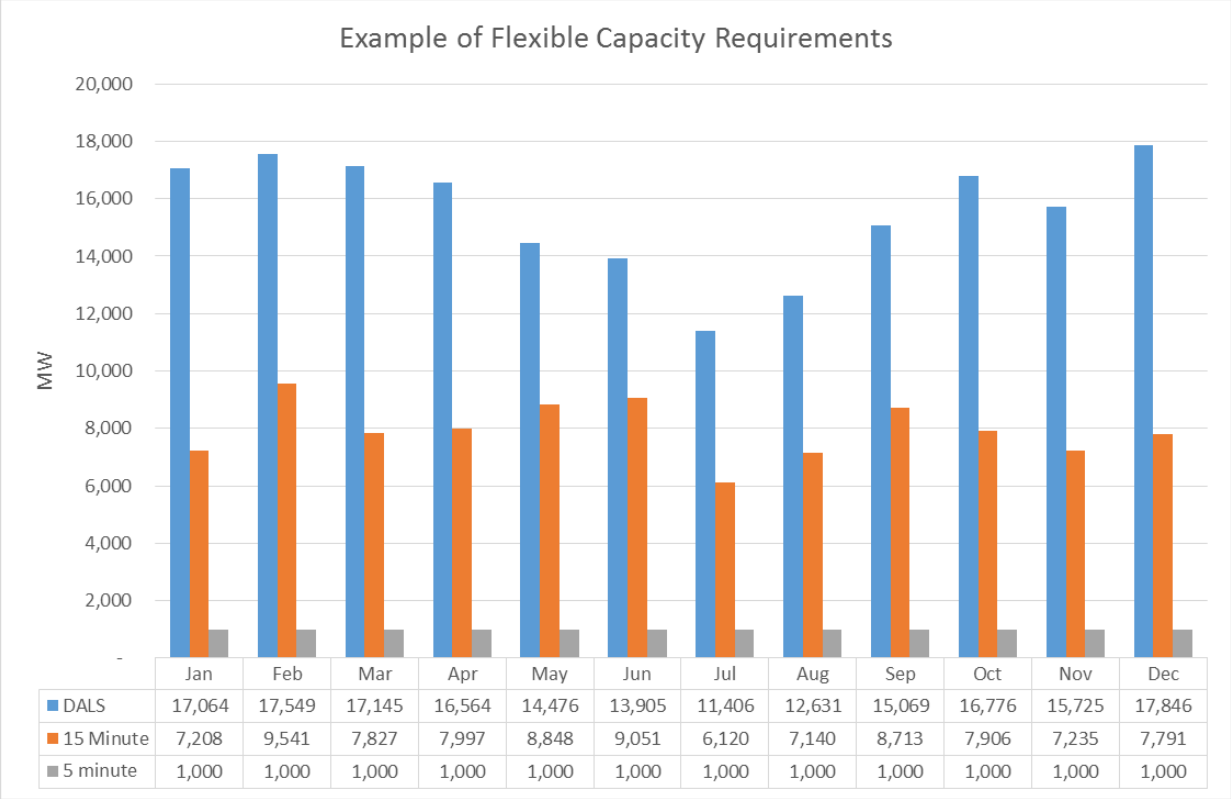
Additionally, integration of the new technology into the CAISO systems would involve more complexities in comparison to the other two methodologies.

Finally, the ISO proposes that 100% of the monthly needs be procured for year ahead showings. The ISO has done an assessment of the existing capacity available to meet each of these requirements and finds that there is sufficient capacity available, though not necessarily procured as flexible RA capacity. The availability of flexible resources should mitigate the costs of procuring at the high ends of the distributions.

5.3.3. Example of flexible capacity requirements

The ISO has estimated the flexible capacity requirements for each of the proposed flexible capacity products in Figure 5, below. The Day-Ahead Load Shaping product estimates rely on the ISO's Draft 2019 Flexible Capacity Technical Needs Assessment, adjusted to account for the new contingency reserve requirement. The 15-minute and 5-minute product requirements match the data used in the Day-Ahead Market Enhancements stakeholder initiative.

Figure 5: Estimated Flexible Capacity Needs



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
DALS	17,064	17,549	17,145	16,564	14,476	13,905	11,406	12,631	15,069	16,776	15,725	17,846
15 Minute	7,208	9,541	7,827	7,997	8,848	9,051	6,120	7,140	8,713	7,906	7,235	7,791
5 minute	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000

5.4. Criteria for Resources to Meet the Identified Need

Given the short lag between realizing the need for flexible capacity and actual market operations, the ISO addresses the need for real-time flexibility and then the need for day-ahead shaping. Based on stakeholder comments the ISO proposes to keep eligibility criteria simple, based on operational attributes (as opposed to technologies), and reasonably inclusive.

The ISO will start by identifying basic eligibility criteria for the three basic Flexible RA products: The Five-minute Flexible RA product, Fifteen-minute Flexible RA Product, and Day-Ahead Load Shaping product. Then the ISO details the must offer obligations and counting rules to provide each of these products. This is done separately for internal resources, EIM resources, and purely external resources (i.e. resources external to both the ISO BAA and any EIM). Then the ISO describes its proposed assessment of flexible RA capacity showings and backstop cost allocations.

5.4.1. Eligibility Criteria

Given the eligibility criteria defined below, the ISO envisions that VERs and other use-limited resources will be eligible to provide any of the flexible RA capacity products. However, these resources will be subject to new replacement and availability rules. Specifically, the ISO proposes to require replacement capacity for all use-limited resources providing flexible RA that reach their use-limitation.[15]

5.4.1.1. Real-time products

Internal Resources

The five-minute and fifteen-minute flexible RA products, the two products designed to address real-time uncertainty, must be dispatchable within the ISO real-time market timeframe. Resources procured for imbalance reserves will be self-committed based on their cleared energy schedule or issued a start-up instruction by the ISO to ensure timely delivery of imbalance reserve awards. As such, resource eligibility criteria should reflect these needs. The ISO considered numerous operational attributes to determine resource eligibility to provide this product.[16] However, in conjunction with the imbalance reserves, the ISO determined, as recommended by Calpine, NRG, and ORA, that it is

[15] The ISO filed its Commitment Cost Enhancements – Phase 3 Tariff language on March 23, 2108- found here: http://www.caiso.com/Documents/Mar23_2018_TariffAmendment-CommitmentCostEnhancementsPhase3_ER18-1169.pdf. This policy is assumed to be in place when this FRACMOO2 policy goes into effect. The ISO is not proposing any changes to the daily start requirements established in Commitment Cost Enhancements – Phase 3.

[16] Operational attributes the ISO considered include minimum and maximum ramp rates, Start-time, cycle time, capacity factor, start frequency, PMin, and Pmin-Pmax ratio.

not necessary to limit eligibility based on start-up time given the ISO will optimize and commit resources as necessary to address its operational needs.[17]

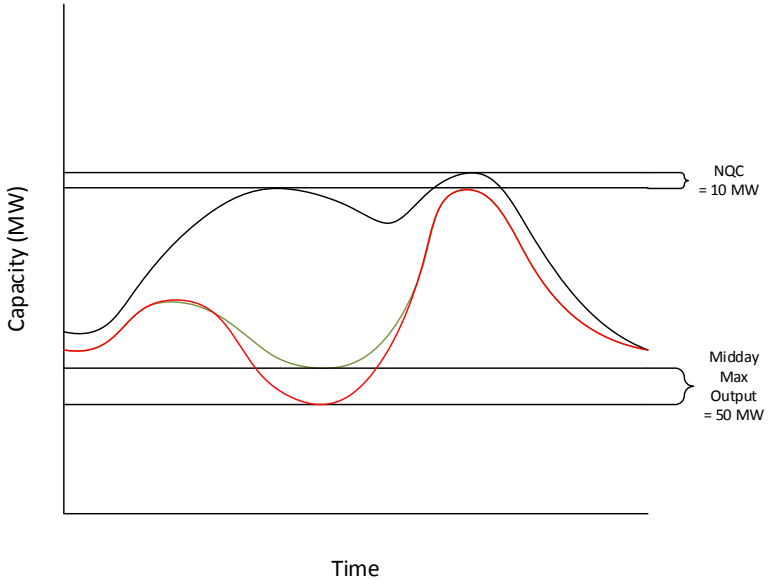
Several stakeholders also request additional analysis of the proposed eligibility criteria and counting rules to assure the new requirements are not overly inclusive or alter procurement practices in a way that impacts the adequate availability of flexible resources. For example, BPA, Powerex, and Seattle City Light suggest a pre-qualification process that requires suppliers to demonstrate the flexible RA capabilities of their resources. The ISO declines to adopt additional pre-qualification processes. The development of the imbalance reserves in the Day-Ahead Market Enhancements stakeholder process will ensure that all necessary flexibility is maintained through the day-ahead market and the stated Masterfile ramp rates provide for accurate operational ramping capabilities in real-time.

The ISO will still require that all flexible RA resources have an EFC. The EFC for all resources, with the exception of storage, is currently capped at the resource's Net Qualifying Capacity (NQC). The NQC is determined based on a resource's output during peak load hours and tested based on the ISO's deliverability study, which confirms a resource's qualified capacity is deliverable to the aggregate of load during stressed system conditions.

In non-summer months, the NQC value for a solar resource is very small relative to the resource's potential output during early afternoon hours when net load is at its lowest and the largest net load ramps are imminent. However, VER resources that economically bid into the day-ahead market help the ISO shape day-ahead market commitments and, as a result can address the net load ramp at quantities that far exceed the NQC of the resource. This is demonstrated in Figure 6.

[17] Previously, the ISO proposed that a resource must have a start-up time of less than 60 minutes to be eligible to provide this product.

Figure 6: Flexible Capacity Available for Solar Resource Midday versus Daily Peak



In this example a solar resource may have an NQC of 10 MW in March, but a maximum output during the middle of that March day of 50 MW. By economically bidding this 50 MW into the day-ahead market, the ISO can now dispatch the resource to less than full output during these hours, helping the ISO to better manage ramp constraints using economically-bid RA resources, instead of pro rata curtailments or exercising CPMs for non-RA resources.

Just as NQC may not fully align with a resource's ability to provide flexible capacity, the ISO's current deliverability assessment may not fully capture a resources ability to deliver capacity during times of greatest flexible capacity need. For example, it is possible that the resource shown in Figure 6, may not be deliverable for 50 MW in the middle of the day. Therefore, the ISO proposes to modify its existing EFC eligibility to include a flexible capacity deliverability study to confirm that the flexible capacity is deliverable during the times of greatest flexibility needs.[18] Many stakeholders, including CESA, CEDMC, ECE, LS Power and NextEra support the ISO's proposal to conduct separate generic and flexible capacity deliverability studies,

Flexible capacity deliverability shall mean the output of a flexible resource can be ramped from Pmin to (Pmin + EFC) simultaneously with other flexible resources in the same generator pocket to match the net load ramping need without being constrained by the transmission capability. The specific conditions that will be studied (i.e. the most

[18] In comments to the Draft Flexible Capacity Framework, several stakeholders, including ECE, CEDMC, and Nextera argue that flexible RA resources should not require full capacity deliverability status to provide flexible RA.

stressed conditions) must be determined through a separate stakeholder process, and are beyond the scope of the current stakeholder process.

The addition of a separate EFC deliverability study has two main benefits. First, just as the ISO's deliverability studies provide a confirmation that the NQC is deliverable under stressed grid conditions, a flexible capacity deliverability study will provide the same confirmation for EFC. Second, the ISO will no longer have to rely on the use of the "dispatchable" flag in Masterfile as a primary qualifying attribute to provide flexible capacity. Instead, the resources willingness to accept the requirement to economically bid into the market provides a better measure of "dispatchability" and flexibility.

Because the ISO will conduct two separate deliverability studies, NQC and EFC can be reasonably and reliably unbundled.[19] This allows a resource to have:

- An NQC with no EFC;
- An EFC with no NQC;
- Both an NQC and EFC equal to one another; and
- Different NQC and EFC.

The EFC deliverability study will study all flexible resources.

EIM resources

In the day-ahead market, a bid-in import sourced from an EIM balancing area authority is modeled as an intertie resource at an ISO scheduling point at the balancing area authority boundary. In the real-time market, the EIM participating resources are modeled and dispatched at their resource specific locations. In other words, EIM resources are considered external resources in the day-ahead market, but are treated as internal resources in the real-time market. For providing flexible capacity, a mechanism is needed to pair the intertie schedule at the ISO balancing area authority boundary with an internal participating EIM flexible RA resource.

Any LSE using an EIM resource for flexible capacity must demonstrate that it has sufficient Maximum Import Capability (MIC) capacity.[20] The MIC capacity is how LSEs demonstrate that the resource's output, and therefore flexibility, is deliverable to the ISO. While the MIC ensures the flexible capacity is deliverable, the ISO will still need to ensure the flexible capacity is credited to the ISO balancing area authority for purposes of the EIM sufficiency tests. Therefore, the ISO will also change all EIM sufficiency

[19] Many of the benefits of unbundling have been covered by SDG&E in previous RA iterations at the CPUC. SDG&E's presentations detailing these benefits can be found at http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6539.
[20] The Maximum Import Capability allocation process is described in section 40.4.6.2 of the ISO tariff.

tests to credit the ISO with any capacity from resources based in an EIM BAA shown as flexible RA capacity and remove the resources from any EIM entity's sufficiency tests.

Purely External Resources

External resources can provide the fifteen-minute, but not the five-minute flexible RA product. The exception to this limitation is for dynamic and pseudo-tie resources. The reason for this is simply that purely external resources are not dispatchable on a five-minute basis, while dynamic and pseudo-tie resources are five-minute dispatchable.

Any LSE using an import resource for flexible capacity must demonstrate that it has sufficient Maximum Import Capability capacity as described above. Having sufficient MIC is a requirement for any import resources to provide RA capacity. It is equally important that flexible capacity be deliverable into the ISO and therefore appropriate to maintain this standard for flexible capacity.

From a tracking standpoint, purely external resources have the benefit of maintaining a consistent resource ID between the day-ahead market and real-time markets. However, this also means purely external resources cannot be resource specific in the same way that internal and EIM resources can be. However, the ISO will require that the Resource SC provide to the ISO the physical resources used to support the resource ID along with any information necessary to determine if the resources are capable of providing the flexible capacity for which it has been procured. These combinations have to be submitted prior to the ISO issuing the final EFC list in order to be eligible to provide flexible RA capacity from a purely external resource.

5.4.1.2. Day-ahead shaping

Internal Resources

The ISO proposes that, like the real-time flexible RA products, any resource providing the day-ahead flexible shaping product must be studied for EFC deliverability. Further, this product is designed to ensure the day-ahead market has sufficient ramping capabilities all day, not simply during a subset of hours. Therefore, the ISO proposes to eliminate the three categories of flexible capacity currently being used for three-hour net load ramps, including the MOO, in favor of a single product. Elimination of the existing flexible capacity categories and various MOOs should help simplify flexible RA procurement and understanding of the obligations. Because the ISO can make commitments of long-start resources in the day-ahead market, there is no need to impose a start-time requirement on day-ahead shaping flexible capacity resources.

EIM resources

The eligibility criteria detailed above for EIM resources to provide real-time flexible RA capacity will also apply to any resources wishing to provide the day-ahead load shaping product.

Purely External Resource

The ISO proposes to allow purely external resources to provide the day-ahead shaping product. As with the 15-minute flexible RA product, the ISO will require 15-minute bids. All physical resources supporting these imports must be identified. Finally, any LSE relying on such a resource would have to have sufficient MIC allocation to support the import.

5.4.2. Must-offer obligation

As a general rule, all flexible RA resources will be required to submit economic bids into the day-ahead market all 24 hours for all flexible capacity for which the resources have been shown. The ISO's day-ahead market energy, ancillary service, and imbalance reserves awards will determine which resources will be subject to real-time must offer obligations. As a result, the ISO has removed specific real-time offer obligations from the flexible RA capacity proposal. Only resources that receive awards in the day-ahead market will be subject to a real-time must-offer obligation. The applicable real-time must-offer obligations are described in the Day-Ahead Market Enhancements stakeholder process.

The exceptions the ISO has identified to the above rule are VERs and some demand response resources. For example, VERs may not be capable of providing the full shown EFC value during all hours. However, as noted above in Section 5.2.1, this does not mean VERs are not able to provide flexible capacity benefits. However, to minimize the number of flexible RA products procured, the ISO has elected to not define multiple must offer obligations (i.e. 24 by seven vs. daytime only). Instead, the ISO proposes to hold VERs to a 24 by seven must offer obligation. However, VER and demand response resources must offer obligation will be to the lower of the shown EFC value or the resource's forecasted output. This means a solar resource would have to bid up to its shown EFC during daylight hours and 0 MW overnight.

EIM resources

The eligibility criteria for EIM resources allows the ISO to track resources from day-ahead market through the real-time markets. While this facilitates similar must-offer obligations to internal resources, there are some minor differences.

Additionally, the ISO proposes that transmission capacity must be secured prior to the day-ahead market and must be shown in the e-tag from the EIM Participating Resource all the way to the ISO Scheduling Point. Further, this transmission capacity must be specified in the day-ahead market and real-time market bid for the System Resource. The OASIS field on the e-tag must specify the System Resource name, as registered in the Master File and with an association to the EIM participating resource ID shown for flexible RA capacity.

Purely External Resources

For purely external resources, all bids must be submitted in 15-minute intervals and cannot be submitted as hourly block schedules. Additionally, only a System Resource or Intertie Generating Resource (TG) is needed with the required e-tag. In this case SIBR will validate the bid from the System Resource or the TG, but it will not validate the external resource because it does not participate in the market.

5.4.2.1. Resources Adequacy Availability Incentive Mechanism

The Resources Adequacy Availability Incentive Mechanism (RAAIM) is a mechanism designed to ensure RA resources are available to the ISO consistent with its must-offer obligation. As noted above, the ISO, in the Day-Ahead Market Enhancements, has proposed to modify RA must offer obligations to a day-ahead requirement. As a result, the ISO has proposed to modify RAAIM calculations to assess these day-ahead bidding obligations.

Given the proposed need identification (i.e. predictable and unpredictable ramping needs), the ISO is also proposing modifications to the RAAIM Availability Assessment hours (AAH). Currently, the AAHs differ by flexible capacity product. The ISO proposes to apply consistent AAH for both the Day-Ahead Load Shaping Product and the real-time products. More specifically, because the flexible RA capacity is to ensure the ISO can efficiently shape day-ahead market awards and address uncertainty, the ISO proposes to apply a 24 hour AAH for flexible RA capacity. As noted above, resources such as VERs may not be able to meet its EFC during all hours, but the resources are required to bid to their EFC or forecast during all hours.

5.4.3. Flexible RA counting rules

A foundational counting rule for meeting flexible RA requirements is that capacity procured to meet a higher quality product will automatically be counted towards meeting the lower quality requirements. For example, the fifteen-minute flexible capacity requirement will be stated individually, but any capacity procured towards meeting the five-minute flexible RA requirements will count towards meeting the fifteen-minute requirement. If the total fifteen-minute flexible RA requirement was 7,500 MW and the five-minute flexible RA requirement was 1,000 MW, then the total incremental procurement needs to fulfill the requirement for fifteen minute flexible capacity would an additional 6,500 MW of fifteen minute flexible capacity.

Due to fact that a substantial amount of the ISO's uncertainty can occur at any time, the ISO proposes to limit the quantity of solar capacity providing any single real-time flexible RA product to 25 percent.[21] This limitation provides a somewhat conservative

[21] In Revised Flexible Capacity Framework, this cap applied to all flexible capacity products.

estimate of the need for 24 hour uncertainty. However, it will provide a reasonable opportunity to allow solar resources to provide flexible RA capacity while allowing the ISO to establish greater comfort with both the capacity and energy market tools designed to address uncertainty. To the extent these tools work effectively, the ISO may explore modifications to this limitation. Proxy demand resources typically have similar production profiles as solar resources. However, because this may not be universally true, the ISO is not, at this time, including proxy demand resources in this cap. Finally, wind resources are explicitly not included in this limit as these resources may have 24 hour fuel available and could meet over-night uncertainty.

5.4.3.1. Real-time products

Internal Resources

At the most basic level, resource counting for this product would be based on the number of MWs the resource can ramp in the relevant time interval: five or fifteen minutes. For example, a 100 MW resource with a 10 MW/minute ramp rate would be eligible to provide 50 MW of five-minute RA flexible capacity, but 100 MW of the 15-minute product. Additionally, while the ISO will not prohibit long- and medium-start resources from providing flexible capacity, the ISO proposes to limit the EFC value to the ramping capability above PMin for these resources. As a result, a 200 MW resource with a start-up time of eight hours and a PMin of 50 MW would only be eligible to provide a maximum of 150 MW of EFC, depending on ramp rates.

While the operating characteristics and EFC for many resources are fairly predictable, VERs have additional uncertainty caused by daily weather patterns. This makes determining their reliably deliverable EFC more challenging. PG&E submitted two proposals for calculating the EFC for VERs. The ISO explored two others.

The ISO believes PG&E's "simple" approach offers a potential option for VER EFC calculation.[22] However, the ISO's initial assessment of the "complex "option is that it seems fairly data intensive and the benefits may be limited. For example, it is not clear how or if an EFC could be developed for a VER resource for each product. However, as an initial step, PG&E's simple approach would facilitate an EFC for each product. Further, as shown in section 5.5, this proposal is not significantly dissimilar to the allocation methodology the ISO proposes.

In addition to the proposals put forward by PG&E, the ISO considered the following two options for calculating the EFC for VERs:

1) An ELCC-like assessment of only ramping hours

[22] PG&E's proposal can be found at http://www.caiso.com/Documents/PG_EComments_DraftFlexibleCapacityFramework.pdf.

2) An exceedance methodology for hours only ramping hours

Both options allow for an effective unbundling of the EFC and NQC, primarily for non-summer months. However, there are significant trade-offs between these two options. Option 1 relies on a methodology similar in nature to that which is used for system RA counting rules. However, developing an ELCC for only a subset of hours and conditions would make for a complex and time consuming process. Option 2, while somewhat inconsistent with NQC counting rules is much easier and can be implemented on a much quicker time frame.

Based on stakeholder feedback, the ISO explored the challenges associated with developing an exceedance methodology compared to the PG&E "simple" approach. There is not a "clearly better" option. As a result, the ISO proposes to establish EFC for VERs based on the technology's contribution to the three-hour net load as determined by the ISO's annual flexible capacity needs assessment. This is consistent with the PG&E "simple" approach. PG&E's example is replicated in Figure 9, below, to demonstrate the proposed EFC calculation.

Figure 7: Example of the EFC calculation for VERs

Nameplate Capacity of Solar Resource 1	200 MW
Aggregate Nameplate Capacity of all solar resources	10,000 MW
3-hour net load ramp + 3.5 Percent of Forecast Peak Load in December 2018	15,000 MW
Total solar resources' contribution to 3-hour net load ramp in December 2018 (%)	48%
Total solar resources' contribution to 3-hour net load ramp in December 2018 (MW)	15,000 MW * 48% = 7,200 MW
Solar Resource 1 contribution to 3-hour net load ramp in December 2018 (MW)	7,200 MW * 200 MW/10,000 MW = 7,200 * 0.02 = 144 MW

Using the ISO's Draft Flexible Capacity Needs Assessment,[23] examples of EFC estimates for 1 MW of wind and solar would be as follows:

1 MW installed solar:

[23] Available at http://www.caiso.com/Documents/2019DraftFlexibleCapacityNeedsAssessment.pdf.

January EFC = (1/10,095)*16,092*0.5269 = 0.84 MW

July EFC = (1/10,095)*10,052*0.8063 = 0.80 MW

1 MW installed wind:

January EFC = (1/4,761)*16,092*0.1894 = 0.64 MW

July EFC = (1/4,761)*10,052*0.8063 = 0.63 MW

Numerous parties requested additional details regarding EFC counting rules for storage resources, including storage resources with transition times. Storage resources have the ability to address uncertainty by either charging or discharging, depending on system needs. Although the full range of charge and discharge can be used when addressing predictable ramping needs (which is addressed in greater detail below), it is not clear that the same can be said when trying to address more uncertain needs. Therefore, the ISO proposes that for purposes of real-time flexible capacity counting, storage resources will be limited to the resource's instantaneous maximum output. This applies to all resources, regardless of transition time or not.

EIM resources

The ISO proposes to use the same counting rules for EIM resources as are used for internal resources. The primary difference, is that EIM resources will be deemed deliverable for purposes of EFC calculations. However, as noted above, all resources must have an associated MIC allocation for an LSE to actually count the resources towards its flexible RA requirements.

Purely External Resources

The ISO does not have detailed access to the operational attributes of purely external resources. However, because the ISO proposes to require details regarding the purely external resources, the ISO expects to have sufficient information to count external resources comparable to internal resources.

5.4.3.2. Day-ahead load shaping product

Internal Resources

The basic counting rules for the day-ahead shaping product will remain generally the same as those used today for the Effective Flexible Capacity (EFC) value for most resources. However, the ISO proposes to remove the start-time as a means to determine if the PMin is flexible. Instead, the ISO proposes to allow a resources to provide EFC for the full range of the resource, as recommended by Calpine.[24] Again,

[24] As noted in the fifteen-minute product, additional changes will be required to identify EIM resources providing flexible RA capacity to ensure the EIM Balancing Area Ramping Requirement is properly

the ISO is able to make this modification to the proposal due to the development of the imbalance reserves in the Day-Ahead Market Enhancements.

As noted above, The ISO can utilize the full charge and discharge range of storage resources to address predictable ramping needs. Therefore, for purposes of providing the day-ahead load shaping product, storage resources may receive an EFC based on the full charge-to-discharge range a resource is capable of performing over three-hours. Additionally, the ISO will extend this counting rule to resources that are capable of transitioning from charge to discharges between two sequential 15-minute dispatch intervals. Put another way, the ISO would allow a 15 minute transition time for a storage resource to count the full charge and discharge range for the day-ahead load shaping product.

EIM resources

The ISO proposes to use the same counting rules for EIM resources as are used for internal resources. The primary difference, is that EIM resources will be deemed deliverable for purposes of EFC calculations. However, as noted above, all resources must have an associated MIC allocation for an LSE to actually count the resources towards its flexible RA requirements.

Purely External Resources

As noted above, the ISO expects to have sufficient information to count external resources comparable to internal resources.

5.4.4. Determination of adequate flexible RA and need for backstop procurement

The ISO proposes to continue using current practices for determining the adequacy for flexible RA showings. Specifically, the ISO will continue to assess if sufficient flexible RA capacity has been shown by looking at all showings and for each product first. If there is sufficient flexible capacity shown system wide for a given flexible RA product, then the ISO will not assess individual showings. If there is a deficiency, then the ISO will look to determine which LRA(s) is deficient and then which of its jurisdictional LSEs are deficient. The ISO will notify LSE's of any deficiency and provide an opportunity to cure the deficiency. If the deficiency is not cured, the ISO may conduct backstop procurement and allocate costs to any deficient LSE. If there are deficiencies in multiple products, and the ISO exercises its backstop procurement authority, then the ISO will look to procure capacity that meets that highest quality deficient product first and will allocate costs first to the LSE(s) that was deficient in the highest quality product. Any procurement needed to fill remaining deficiencies of lower

adjusted, crediting the ISO with that flexible capacity and avoiding double counting. Additional modifications may be needed to base scheduling processes to ensure all MOOs are followed.

quality products will be allocated to the entities deficient in that product. These costs will be allocated proportionally to the original deficiency.

5.5. Allocation

Proper allocation of flexible capacity requirements must be based on reasonable causation principles. The methodology currently employed by the ISO to allocate flexible capacity requirements is based on LSEs procurement practices. The ISO considered modifications to this practice, including allocating flexible capacity obligations to generating resources. However, the ISO has determined that the primary driver of operational needs identified here continue to be driven by LSE procurement to meet state policy objectives.[25] As a result, the ISO proposes to maintain its current practice of allocating flexible capacity requirements based on an LRA's jurisdictional LSEs' contribution to the requirement.

Many stakeholders recommended the ISO simply rely on the existing allocation methodology used for the current flexible RA allocation process. While this methodology may be a reasonable reflection of the need for three-hour net load ramps, it may not reflect the drivers of uncertainty. For example, reductions in solar output are a large driver of three-hour net load ramps. However, load may be the primary driver for uncertainty. As such, relying on the existing methodology could result in incorrectly allocating an uncertainty need to an LSE with stable and predictable net-load, but a significant impact on the three-hour net load ramp.

The ISO proposes to allocate flexible capacity requirements based on the primary contributing factors to each product. Specifically, the ISO will allocate based on the predictable and unpredictable ramping needs. For unpredictable ramping needs that drive the need for real-time flexible RA capacity, the ISO proposes to analyze LRAs' jurisdiction LSEs' load, wind, and solar profiles to determine their contribution to the need for real-time flexible RA capacity. All imbalances attributable to these factors will be allocated directly to that LRA. However, additional factors may also contribute to the need for real-time flexibility that may not be directly attributable to an LRA in the same way. The ISO proposes to allocate all other factors contributing to the need for real-time flexible RA capacity (excluding load, wind, and solar portfolios) to an LRA based on load ratio share.

For allocating day-ahead load shaping requirements, the ISO proposes to rely on current practices of allocating based on each LRA's contribution to the three hour net-load ramp. The proportion of each factor's contribution will be determined based on the

[25] In their comments, NRG summarized LSE procurement practices as the driving need. Specifically, NRG asserts "[i]nasmuch as the driver for the proliferation of variable resources is state policy, the costs associated with this procurement should be allocated in a manner to those that are deriving the benefits from the underlying state policy (e.g., to load)."

relative contributions to the most significant observations. The ISO uses the five largest forecasted three-hour net load ramps today to determine the contributions of load, wind, and solar. The ISO proposes to continue this practice for the day ahead load shaping product.

6. Next Steps

The ISO will discuss this Revised Draft Flexible Capacity Framework proposal with stakeholders during a Stakeholder meeting on May 3, 2018. Stakeholders are asked to submit written comments by May 17, 2018 to initiativecomments@caiso.com.

Appendix A

As illustrated in the following sections, stakeholders are divided on the necessity of new flexible capacity products and whether these proposed products will align with the ISO's operational needs. Many stakeholders are generally supportive of some aspects of the ISO's framework, including the identification of ramping needs as both predictable and uncertain, as well as the proposed products (day-ahead load shaping, fifteen-minute, and five-minute) that align with the ISO's market timeline. However, many stakeholders request additional clarity and discussion on many aspects of the proposal including resource eligibility criteria, must offer obligations, and the impacts of the Day-Ahead Market Enhancements on the quantification of flexible capacity needs.

Identification of Ramping and Uncertainty Needs

The ISO has identified two drivers of flexible capacity needs: general ramping needs and uncertainty. Most stakeholders, including BAMx/CCSF, BPA, Calpine, the CPUC, LS Power, NRG, PGP, Wellhead, and Six Cities believe both of the identified drivers contribute to flexible capacity needs. Others, including AReM and CLECA, still disagree with the use of the term uncertainty. As CLECA, SDG&E, and others suggest, while the ISO's day-ahead market currently runs at an hourly granularity and the FMM runs at fifteen-minute granularity, one can reasonably assume the proposed Day-Ahead Market Enhancements will reduce uncertainty attributable to the granularity differences between the day-ahead and real-time. However, the ISO notes that uncertainty between the day-ahead and real-time caused by forecast errors will remain and must be addressed through flexible capacity. As discussed above, the ISO has transitioned to fifteen-minute estimates for uncertainty in the day-ahead market. The ISO provides updated data estimating the impacts of this proposed change.

Definition of Products

The ISO has outlined the need for three different flexible RA products that align with the ISO's market timeline: a day-ahead load shaping product, a fifteen-minute product, and a five-minute product. Many stakeholders, including BPA, LS Power, National Grid, PGP, Seattle City Light, and Six Cities generally support the proposed products and their alignment with the market timeline. BAMx/CSSF reiterate that while they do not believe these are products, they do accurately characterize the ISO's needs.

Other stakeholders provide suggestions for the ISO to consider when defining its flexible RA products. For example, Cogentrix reiterates its position that the fifteen and five-minute products be combined into a single real-time product. Additionally, SDG&E believes the three different products create unneeded complexity to the bilateral market construct and suggests a single product that can meet operational needs. Similarly, the CPUC suggests that until the additional analysis planned by the ISO is complete, the

need for the fifteen and five-minute product is unclear. Further, they suggest the ISO should not add the additional complexity of two more flexible capacity products unless the ISO demonstrates their benefit. The ISO recognizes the importance of maintaining simplicity, and believes that compared to the three products in place under the current flexible RA construct, the proposed flexible capacity products are simpler alternatives because they align with our market timeline.

Calpine suggests the proposed products may not address the ISO's ability to manage changes in system conditions between the close of day-ahead market and the beginning of FMM through STUC. Similarly, Wellhead recommends the ISO add an hourly product to provide additional capabilities and incentivize new behaviors and investments in new flexible technologies that can sustainably meet reliability requirements. The ISO has considered the impacts of an hourly flexible capacity product, as suggested by Wellhead, but believes with the implementation of the day-ahead market enhancements, including fifteen-minute granularity in the day-ahead, an hourly product would not offer additional benefit.

AReM, WPTF, and VEA caution the ISO that the proposed products or their requirements could potentially put excess burden on small LSEs through added processes and complexities. The ISO understands these concerns and works to ensure the proposal is simple and transparent.

Quantification of the Flexible Capacity Needs

In the February 7, 2018 stakeholder meeting on the Revised Draft Flexible Capacity Framework, the ISO committed to considering a modification to its approach for quantifying flexible capacity needs. This modification would use *the greater* of the maximum upward or downward uncertainty for each month, instead of the summation of the maximum upward and downward uncertainty for each month.

BAMx/CSSF, the CPUC, and Six Cities support the ISO exploring this new approach. BAMx/CSSF also provide alternative approaches for the ISO to consider, including identifying the maximum daily combined upward and downward uncertainty for each month, or maximum upward and downward uncertainties that occur within 3 hours of each other. Calpine believes that while using the sum of the maximum of upward and downward uncertainty may overstate the need, it does not support the modification discussed at the February 7th meeting, as there may be some cases where this approach would be insufficient. NRG supports using the widest range of uncertainty for the real time products. Similarly, CESA and PGP support conservative estimations of flexible capacity needs, and the inclusion of regulation in the five-minute product. After considering these comments and analysis performed on conjunction with the Day-

Ahead Market Enhancements the ISO proposes to use the maximum forecasted imbalance reserve need, either upward or downward.

The ISO defines its overall flexible capacity needs determination as the Maximum Forecasted 3-Hour ramp (including reconstituted renewable curtailments) + ½ Max(MSSC, 6% of the monthly expected peak load) + ε. DMM encourages the ISO to explain how the error term is calculated. Error terms are determined in the annual Flexible Capacity Needs study process. DMM also requests explanation on why the ISO proposes to use half the total reserve requirement in its flexible RA requirement. DMM suggests that under the current requirement, both spin and non-spin would "compete for resources that could otherwise provide flexible capacity."[26] The ISO uses half of the total reserve requirement to include only contingency reserves and not operating reserves.

First Solar and SDG&E both recommend the ISO remove some portion of dispatchable/curtailable[27] wind and solar from the calculation of net load due their ability to provide flexibility. Specifically, First Solar asks that the ISO, "include the benefits of dispatchable VERs in the assessment of ramping needs, either through removing these dispatchable resources from the assessment of net load or through another means."[28] The ISO understands these concerns but believes the current calculation of net load is sound, as it avoids double counting of dispatachable wind and solar and ensures capabilities of dispatchable wind and solar are attributable to the LSE with whom they have the contract.

Eligibility Criteria

The ISO has stated that operational realities show the current flexible RA product is overly inclusive, and that based on the current requirements, the system, at times, struggles to meet flexibility needs. Several stakeholders, including Powerex, PGP, and Seattle City Light request clarity on what they see as an apparent contradiction between this statement and ISO's analysis in its Revised Draft Framework. These stakeholders suggest this analysis appears to show the ISO has a sufficient pool of resources to meet flexibility needs. Powerex believes these estimates could be overestimating the flexibility of existing supply from the ISO's internal fleet, and that further discussion and analysis is required regarding the flexibility of the ISO's existing fleet. BPA, Powerex, and Seattle City Light suggest a pre-qualification process that requires suppliers to demonstrate the flexible RA capabilities of their resources. Additionally, they support

[26] http://www.caiso.com/Documents/DMMComments-RevisedDraftFlexibleCapacityFrameworkProposal.pdf
[27] The ISO interprets this to be comparable capabilities and therefore, addresses these comments together.
[28] http://www.caiso.com/Documents/FirstSolarComments-RevisedDraftFlexibleCapacityFrameworkProposal.pdf

periodic monitoring of flexible RA resources' performance and modification of the amount of flexible RA those resources can provide if they under-perform.

While the ISO understands the concerns raised by Powerex and BPA, the ISO believes that the development of the imbalance reserves will ensure sufficient flexibility is maintained in day-ahead market to address flexible capacity needs in real-time. As a result, the ISO's current analysis allows shows that resource commitments and imbalance reserves awards can ensure flexibility is available in real-time. In short, imbalance reserves will provide for a more efficient use of system flexibility, while FRACMOO2 will ensure sufficient capacity is available to address the imbalance needs.

Calpine, NRG, and ORA oppose or question the ISO proposal that resources must have a start-up time of less than 60 minutes to provide flexible capacity, and believe the ISO has provided little evidence that this requirement is necessary. Similarly, DMM believes the ISO's justification for restrictive start times is unclear and does not offer any support for how the start-time criteria will efficiently manage PMins and the need for ramping capability. Alternatively, LS Power proposes the ISO limit the start time requirement further, to 10 minutes. After further consideration, the ISO agrees with the opinions put forth by Calpine, NRG, ORA, and DMM, and will remove the 60-minute start up time requirement for the fifteen and five-minute products, subject to the completion of the Day-Ahead Market Enhancements.

Counting Rules

Many stakeholders, including CESA, CEDMC, ECE,[29] LS Power and NextEra support the ISO's proposal to conduct separate generic and flexible capacity deliverability studies, allowing for the unbundling of EFC and NQC values. Several stakeholders, including SDG&E, Nextera, and CESA requested additional vetting of the flexible capacity deliverability study through this stakeholder process. The ISO reiterates that specific deliverability needs are more appropriately addressed through a resource's deliverability study.

In its Revised Draft Framework, the ISO requested stakeholder feedback on two methods for calculating EFCs for VERs: PG&E's simple approach[30] or a variation of an exceedance methodology. PG&E and First Solar both prefer PG&E's simple approach to an exceedance methodology, but First Solar requests additional consideration of how to most accurately characterize solar resources' flexibility. NRG suggests an exceedance methodology may work depending on the threshold used. In balance, the ISO believes that PG&E's "simple" approach provides a reasonable starting point for

[29] ECE's support is subject to the caveat that flex RA study is based on ramping not peak-load conditions.
[30] PG&E's proposal can be found at http://www.caiso.com/Documents/PG_EComments_DraftFlexibleCapacityFramework.pdf

determining VER EFCs. Additional details of this proposal are provided in Section 5.4.3.

CLECA requests clarification and examples on how changes in procurement will affect the allocation, specifically regarding renewables. CLECA suggests that if the entities that procure resources that reduce flexibility need, like solar with storage, do not receive the benefit in their allocation, it will limit the incentive to procure such resources. As the ISO understands CLECA's concern, it will be addressed through counting rules for VERs. The ISO will calculate how a VER counts for flexible capacity through the resource's EFC deliverability study process.

In its last iteration of the proposal, the ISO proposed to limit the quantity of solar capacity providing any single flexible RA product to 25 percent. PG&E does not support this limitation for the day-ahead load shaping product, suggesting that because this cap is required to address uncertainty, the limitation should only apply only for the real-time products. Alternatively, PGP appreciates the ISO's limitation on the quantity of flexible capacity solar can provide. After consideration of these comments, the ISO agrees with PG&E and proposes to remove the 25 percent limit on solar resources for the day-ahead load shaping product, as its purpose is load shaping rather than addressing uncertainty needs. The ISO will maintain the 25 percent limit for the real time products. PG&E also requests additional justification behind setting the limit at 25 percent. The ISO understands that it may be reasonable to adjust the limit in future years, and plans to reevaluate this value as needed.

Several stakeholders, including CESA, ECE, National Grid, and NextEra suggest the ISO allow storage (including batteries and hydro) with very short transition times to count for their full operating range reflecting both generation and demand capabilities. After considering these comments, the ISO will allow resources with transition times of 15-minutes or less to count for both generation and demand capabilities for the day-ahead load shaping product, but not for the real-time products.

Must-Offer Obligations

In the last iteration of the proposal, the ISO proposed a 24 by seven must-offer obligation for the full EFC value for both the day-ahead and real-time products in order to maintain simplicity and limit the number of flexible RA products. Six Cities opposes the uniform 24 by seven must-offer obligation for all non-VERs, suggesting a more granular approach could expand the pool of resources eligible to provide flexible capacity and enable use-limited resources to better manage their use limitations. Similarly, CDWR and CESA request further evaluation of the necessity of the 24 by seven must-offer obligation for the various products, to avoid unnecessarily preventing suitable resources from providing the product. BPA suggests limiting the day-ahead

load shaping product from 24 hour availability to 16 hour blocks. Although the ISO understands the requests to make more hour limited must-offer obligations, the issues the ISO seeks to resolve may occur at any time. However, the ISO is proposing to modify must-offer obligations to be day-ahead only, with day-ahead market awards driving real-time must-offer obligations (as per the Day-Ahead Market Enhancements).

For VERs, the ISO proposed a 24 by seven must-offer obligation for the lower of the shown EFC value or the resource's forecasted output. Fist Solar finds this a workable solution so long as there is not a bias towards resources that bid non-zeros for all 24 hours. NRG suggested further consideration of the 24 by seven must offer obligation is required, specifically given RAAIM implications. If the ISO requires a 24 by seven must offer obligation, NRG suggests a new RAAIM that resembles that of generic RA. The ISO is proposing to utilize a 24 hour RAAIM assessment to ensure flexible capacity resources are available to meet flexibility needs regardless of when those needs arise**.**

Additionally, the ISO proposed any resources that were not committed in the day-ahead market but can be committed in the real-time market must make its shown flexible RA capacity available in the real-time market. NCPA objects to this proposal, suggesting it is unreasonable to impose the same real-time must-offer obligation on the day-ahead load shaping product and the real time products, considering the real-time products are considered more valuable. PG&E requests the ISO justify why internal resources would be subject to this new requirement while external resources would not. DMM suggests that it appears reasonable to give flexible RA a real-time must offer obligation to cover potential shortfalls in day-ahead procurement, but the ISO should ensure these real-time must offer obligations are complimentary to the imbalance reserve product proposed in the Day-Ahead Enhancements initiative. Based on this stakeholder feedback, and through coordination with the Day-Ahead Market Enhancements initiative, the ISO is proposing to remove the real-time must offer obligation for all resources that are not committed in the day-ahead.

Equitable Allocation of Flexible Capacity Needs

The ISO proposes to maintain its current practice of allocating flexible capacity requirements based on LRAs' jurisdictional LSE's contribution to the requirement.[31] This allocation would apply to each flexible RA product based on the three primary contributing factors of uncertainty: load, wind, and solar. The ISO requested stakeholder feedback on this proposed methodology, as well as suggestions for alternative

[31] In their comments, the CPUC explains that they allocate flexible requirements based only on load ratio share, and will continue to allocate differently than the ISO unless and until the Commission adopts changes to this methodology. http://www.caiso.com/Documents/CPUCComments-RevisedDraftFlexibleCapacityFrameworkProposal.pdf

methodologies. Wellhead, CDWR, and Six Cities generally support the ISO's proposed allocation methodology.

BAMx/CCSF support an allocation methodology based on each entity's contribution to the flexible capacity need. However, they expressed concern that allocating based on load ratio share does not take into account the varying degree of load stability among LSEs. They suggest the ISO explore other methods for differentiating individual contributions to the real-time load requirement, including an analysis of real-time load forecast error for sub-areas within each TAC area, or the error across TAC areas.

BPA indicates that in their experience, load has been a relatively predictable amount of uncertainty, with uncertainty increasing with high penetration of variable resources. The ISO's proposal and current practice allocates requirements based on LSEs' gross load ratio share.

NCPA strongly believes the ISO should maintain tariff provisions that do not allocate flexible capacity requirements to Load Following Metered Subsystems, as they are contractually obligated to ensure sufficient energy and capacity and receive penalties if they do not. The ISO agrees and therefore, does not propose any changes to this rule under ISO tariff.

Some stakeholders requested additional clarification and/or examples regarding all or some aspects of the allocation methodology. Specifically, AReM requested clarification on how the ISO will aggregate the LSE-specific calculations to arrive at the Flexible Capacity Requirements attributable to an LRA. The ISO is currently exploring allocation methodologies that mirror the day-to-drivers of imbalances as specified in the Day-Ahead Market Enhancements stakeholder process and **seeks stakeholder feedback about how it could use the forecast tools detailed in section 5.3.2 to derive an LRA's allocable share of the real-time flexible RA capacity needs**.

Other

While Cogentrix directionally supports the ISO's Flexible Capacity Framework, it remains doubtful that the framework will be implemented in a timely manner. As such, Cogentrix has submitted a proposal[32], both in its comments to the ISO's framework and to the CPUC's Track 1 RA Proceeding, R.17-09-020, for an interim Fast Flexible RA program implemented in the 2019 RA year. WPTF supports the ISO evaluating proposals, such as Cogentrix's, to determine if aspects of such proposals would lead to a reasonable interim compromise. While the ISO understands concerns over prolonged timeline, this initiative is currently on track to reach its targeted implementation date of

[32] Cogentrix's proposal can be found at http://www.caiso.com/Documents/CogentrixComments-RevisedDraftFlexibleCapacityFrameworkProposal.pdf.

Fall 2019, effective for the 2020 RA year. As such, the ISO declines to adopt Cogentrix's proposal at this time.