



California ISO

2017-2019 Ancillary Service Scarcity Report

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I. Introduction

Through its markets, the California Independent System Operator Corporation (ISO) procures ancillary services (A/S), including regulation services (regulation up and regulation down) and operating reserves (spinning and non-spinning reserves), to meet NERC and WECC reliability standards and to support reliable electric system operations. In addition to the ISO system-wide procurement requirements, the ISO establishes minimum A/S procurement requirements in some of the A/S sub-regions, such as the ISO system (the entire CAISO excluding the interties), SP26, NP26 and expanded sub-regions.

On December 1, 2010, the ISO implemented an A/S scarcity pricing mechanism in its markets. The scarcity pricing mechanism is triggered when there is insufficient A/S supply to meet the targeted requirement. Under this mechanism, the price of the scarce A/S will automatically rise to a pre-determined scarcity price, as described in the ISO tariff.¹ For the first three years of A/S scarcity pricing, the ISO published an annual report reviewing the events that occurred and conducted an assessment that no changes were needed to the pricing mechanism.² This report presents the details and impacts of the scarcity events that occurred in 2017, 2018 and 2019 and fulfills the requirement in Tariff Section 27.1.2.3 that the ISO review the scarcity pricing mechanism every three years.

II. Frequency of Scarcity Events

Table 1 below shows the frequency of the 2017, 2018 and 2019 scarcity events by year, A/S region and A/S type. All scarcity events occurred in the real-time market (RTM) with the exception of two events of regulation up scarcity in 2019 in the integrated forward market (IFM)³.

Table 1: Count of Scarcity Events by Year, A/S region and Service

A/S Region and Service	Year		
	2017	2018	2019
CAISO Expanded			
Regulation Up	12	2	25
Regulation Down	9	13	28
Spin		1	3
Non-Spin	18	8	14
NP26 Expanded			
Regulation Up		18	15
Regulation Down		26	3

¹ See the ISO tariff section 27.1.2.3.

² The 2014-2016 report is located at:

<http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=0DB07C0D-A0F9-4B81-BD66-4903D05798D0>

³ The IFM scarcity event occurred on 5/5/2019 in HE 2 and 23 for regulation up.

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A/S Region and Service	Year		
	2017	2018	2019
Spin		1	
SP26 Expanded			
Regulation Up	5	90	50
Regulation Down	4	29	66
NP26 Internal			
Regulation Up		1	4
SP26 Internal			
Regulation Down	4		
Spin	2		
Totals	54	189	208

Table 2 shows the percentage of IFM and RTM intervals that have an A/S scarcity event.

Table 2: Frequency of A/S Scarcity Events

	2017	2018	2019
IFM Intervals with A/S Scarcity	0%	0%	0.02%
IFM Intervals without A/S Scarcity	100%	100%	99.98%
RTM Intervals with A/S Scarcity	0.15%	0.54%	0.59%
RTM Intervals without A/S Scarcity	99.85%	99.46%	99.41%

Although the number of A/S scarcity events have increase year after year, the relative frequency of scarcities continue to be small with 79% of the events representing a procurement shortage of less than 10 MW.

Table 3: Magnitude of A/S Scarcity Events

Scarcity Amount in MW	Total number of intervals	Percentage of Scarcity Intervals
Between 0.004 and 0.99 MW	198	44%
Between 1.00 MW and 9.99 MW	159	35%
Between 10 MW and 49 MW	54	12%
Over 50 MW	40	9%
Total	451	100%

III. Causes and Trends in Scarcity Events

Table 4 below shows the frequency of the 2017, 2018 and 2019 scarcity events by year and primary reason.

Table 4: Frequency of Scarcity Events by Cause

Issue impacting A/S procurement	Year		
	2017	2018	2019
Telemetered limits reduce resource capacity		116	77
Resource outage or Pmin re-rate	18	43	72
Transmission issues block A/S delivery	8	2	34
MSG transition issue	2	16	4
System conditions where energy is needed over A/S capacity	20		9
Increase in A/S requirements in RTM	4	5	12
Resource issues: shutdown, ramp, or exceptional dispatch	2	7	
Totals	54	189	208

Two of the 451 scarcity events for the three-year time period occurred in the IFM and 449 events occurred in the RTM. Generally, RTM experiences changing conditions with respect to the day-ahead market, such as load forecast changes, resource outages or transmission congestion, making system conditions in RTM generally tighter than IFM. The main categories leading to RTM A/S scarcities include:

- Telemetered limits reduce resource capacity – Resource can bid up to their certified amounts in the IFM and in the case of resources with a must offer obligation are required to bid their certified range in the IFM. The RTM uses the plant operating limits that are sent from the resource to the ISO’s EMS to determine how much capacity is available on the resource. If the resource sends an upper limit that constrains its ability to provide the IFM A/S award then that A/S is unavailable and has to be re-procured by RTM from other resources.
- Resource outage or Pmin re-rate – Resource outages, de-rates, Pmin re-rates or outages on the ability to provide A/S.
- Transmission issues block A/S delivery – in real-time, there can be transmission issues that necessitates that ISO operators block A/S from certain resources because the A/S cannot be delivered or having the resources deliver the A/S would exacerbate a transmission issue.
- MSG transition issue – MSG resources cannot provide A/S during transitions or an MSG can be transition to a configuration that has a reduced A/S capacity range.

- System conditions where energy is needed over A/S capacity – If large amounts of energy is needed to maintain power balance, spin and non-spin reserves could be dispatched to a level where the A/S requirements cannot be met.
- Increase in A/S requirements in RTM – ISO operations may increase A/S requirements in RTM based on the criteria in Operating Procedure 2340 or other system considerations.
- Resource issues: shutdown of a resource scheduled to provide A/S, ramp issues or the simplified ramp logic, or exceptional dispatch that limits capacity due to the need for energy on the resource

The top three causes for scarcity events over this period is 1) Telemetered limits reduce resource capacity 2) Resource outage or Pmin re-rate and 3) Transmission issues block A/S delivery.

The “Telemetered limits reduce resource capacity” category became an issue in 2018 due to a larger number of battery resources in the SP26 region providing regulation and interplay with ISO’s optimization software. Battery resources are susceptible to reduced capacity availability in RTM as indicated by the operating limits these resources send to the ISO in real-time. As a result of reduced capacity on battery resources, these resources cannot provide the full amount of regulation awarded in the IFM. Therefore, RTM often has to re-procure very small amounts of regulation to meet A/S requirements. However, the RTM has to run within certain time and finite MIP (mixed integer programming) parameters in order to obtain a solution. Often the “cost”⁴ of the small amount of A/S scarcity is lower than the MIP parameter and, as such, the RTM solution would include the A/S scarcity rather than solve the scarcity by starting or re-dispatching another unit, which can cost more to the solution. When the ISO observed this upward trend in 2018, the ISO addressed this issue in two ways. First, the ISO contacted Scheduling Coordinators with battery resources that were experiencing these small RTM rescissions to ensure these resources were aware of the lower operating limits in RTM. Second, the ISO assessed the increased model size of the RTM with new EIM entrants in 2018 and implemented enhancements to the MIP gap set-up to improve RTM performance.

The second top cause of scarcity events are reported resource outages, de-rates to maximum capacity, re-rates to minimum capacity and outages on equipment needed to provide A/S. It is important that resources that have issues report these outages in a timely manner so that the ISO does not count or rely on regulation and operating reserves that is not available.

The third top cause of scarcity events is transmission issues in real-time that cause A/S procured in the IFM to be unavailable. Through the review of several of these scarcity events, the ISO has improved its process to identify problem transmission areas before the IFM runs so that A/S from limited areas is not procured in the IFM timeframe. The ISO now publishes System Operations Messages on OASIS indicating when and what areas are limited from providing A/S.

Many these causes of lost A/S in the RTM highlight the importance of certain market design elements and process enhancements that improve the quality and quantity of A/S procured by the ISO. The ISO uses actual operating limits send by each regulation resource instead of relying on static Master File parameters to ensure the full capacity sold by each resource is available in

⁴ Per Section 6.6.5 of the BPM for Market Operations, the Scheduling Run penalty parameter for A/S Region Reg-Up and Reg-Down Minimum Requirements is \$1450. For example, a 0.1 MW scarcity would cost $(0.1 \text{ MW} * \$1450) / 4 = \36.25 for one fifteen-minute interval in an hour.

real-time. The ISO has improved its outage reporting software to ensure each resource can report changes to maximum output, minimum output and the ability to provide specialized services such as A/S. The ISO reviews transmission constrained areas before the IFM run so that A/S is not procured from regions where it cannot be delivered in real-time and avoid the subsequent need to re-procure large amounts of A/S in RTM. All of these elements ensure the quality, reliability and quantity of A/S procured by the ISO.

IV. Conclusion

In 2018 and 2019, the frequency of scarcity events increased for several reasons and as the ISO reviewed the trend of these events, the ISO made additional changes in software optimization and processes, where possible, to reduce scarcity events. The trend for scarcity events in 2020 is down with only 14 events in the first six months of 2020. The duration of scarcity events is generally short since many events lasted one or two intervals. Additionally, 79% of the 451 events represent a shortage of less than 10 MW. This indicates that the ISO experiences small, intermittent scarcity events and that the A/S market is robust enough to recover in a short amount of time. The current Scarcity Reserve Demand Curves in Tariff Section 27.1.2.3 provide adequate incentive to offer A/S in the ISO markets and the ISO does not see a need to change the Scarcity Reserve Demand Curves at this time. This ISO will review the Scarcity Reserve Demand Curves when the energy bid cap is adjusted for FERC Order No. 831 compliance.