2014-2016 Ancillary Service Scarcity Event Report

May 10, 2017

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I. Introduction

Through its markets, the California Independent System Operator Corporation (ISO) procures ancillary services, 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 ancillary service procurement requirements in some of its ancillary service sub-regions, such as the ISO system (the entire CAISO excluding the interties), SP26 and SP26 expanded sub-regions.

On December 1, 2010, the ISO implemented an ancillary service scarcity pricing mechanism in its markets. The scarcity pricing mechanism is triggered when there is insufficient ancillary service supply. Under this mechanism, the price of the scarce ancillary service will automatically rise to a pre-determined scarcity price, as described in the ISO tariff.[1] For the first three years of Ancillary Service 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 financial impacts of the scarcity events that occurred in 2014, 2015 and 2016 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 2014, 2015 and 2016 scarcity events by date, market and A/S region.

Table 1: Frequency of Scarcity Events by Market and A/S region

Date	Market	Ancillary Service Region				Total Intervals
		CAISO_EXP	SP26	SP26_EXP	NP26_EXP	
2/06/2014	HASP/RTPD	0	0	0	6	6
4/08/2014	RTPD	2	0	1	0	3
4/12/2014	RTPD	1	0	0	0	1
12/23/2014	RTPD	0	1	0	0	1
12/24/2014	RTPD	1	1	0	0	2
Total 2014 Intervals		**4**	**2**	**1**	**6**	**13**
2/15/2015	RTPD		1			1
4/21/2015	RTPD	2	2			4
5/17/2015	RTPD		2			2
5/24/2015	IFM		9			9
5/24/2015	RTPD		7			7
10/13/2015	RTPD	1				1
Total 2015 Intervals		**3**	**21**			**24**

[1] See the ISO tariff section 27.1.2.3.
[2] Prior year's reports are located at:
http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=FC0930D5-B1D2-452F-8DA0-3F55AB6C9C00

Date	Market	Ancillary Service Region				Total Intervals
		CAISO_EXP	SP26	SP26_EXP	NP26_EXP	
03/19/2016	RTPD			3		3
04/27/2016	IFM			1		1
05/20/2016	RTPD			1		1
05/22/2016	RTPD			7		7
05/23/2016	RTPD			8		8
09/22/2016	RTPD	1				1
09/28/2016	RTPD	1				1
10/14/2016	RTPD			1		1
11/17/2016	RTPD			1		1
11/20/2016	RTPD			1		1
Total 2016 Intervals		**2**		**23**		**25**

In 2014, 0.03% of IFM and RTPD market intervals had a scarcity event. For 2015 and 2016, 0.055% and 0.057% of market intervals, respectively, had scarcity events.

III. Causes of Scarcity Events

From 2014 to 2016, there have been 10 scarcity events in the Integrated Forward Market (IFM) and 52 scarcity events in the real-time market (RTM). Generally, RTM experiences constraints, which are not in the IFM such as load forecast changes or transmission congestion. In addition, the IFM ancillary service awards of some resources may be disqualified wholly or partially in the RTM due to forced outage or de-rate of the generating resources, which can make ancillary service scarcity more likely in the RTM than in the IFM. Table 2 lists the MW shortages and causes of the scarcity events.

Table 2: Summary of Scarcity Events and Causes

Trade Date	Trade Hour	Trade Interval	AS Region	Market	Ancillary Service	Shortage MW	Causes
2/6/14	17	1-3	NP26_EXP	RTPD	Non-Spin	60.5	ISO activated the NP26 region because there were limitations in procuring A/S capacity in southern California due to low gas supply.
	17	1-4	NP26_EXP	RTPD	Regulation Down	61	
	18	n/a	NP26_EXP	HASP	Non-Spin	208	
	18	n/a	NP26_EXP	HASP	Regulation Down	17	
	19	n/a	NP26_EXP	HASP	Non-Spin	95	
4/8/14	19	3	SP26_EXP	RTPD	Non-Spin	15	Loss of net import required

Trade Date	Trade Hour	Trade Interval	AS Region	Market	Ancillary Service	Shortage MW	Causes
	20	3-4	CAISO_EXP	RTPD	Non-Spin	128/106	additional in-state energy procurement
4/12/14	13	3	CAISO_EXP	RTPD	Regulation Down	5	Over-generation conditions and resources could not move up to provide regulation down.
12/23/14	22	4	SP26	RTPD	Regulation Down	5.93	Generator outage
12/24/14	4	3	CAISO_EXP	RTPD	Regulation Down	3.36	Generator telemetry outage
12/24/14	12	2	SP26	RTPD	Regulation Down	5.93	Generator telemetry outage
2/15/15	1	2	SP26	RTPD	Regulation Down	3.06	Generator de-rate
4/21/15	3	1, 3	CAISO_EXP	RTPD	Regulation Up	9	Generator ramp limitation
	11	2, 3	SP26	RTPD	Regulation Down	10	
5/17/15	17	1,2	SP26	RTPD	Regulation Down	5	Generator min up time
5/24/15	9-17	n/a	SP26	IFM	Regulation Down	0.35	Interplay with PATH15_S-N congestion
5/24/15	9	3, 4	SP26	RTPD	Spin	1.65	Generator der-ate and interplay with PATH15_S-N congestion
	10	1	SP26	RTPD	Regulation Down	0.35	
	10	2	SP26	RTPD	Spin	2.72	
	11	1	SP26	RTPD	Spin	0.98	
	11	2	SP26	RTPD	Spin	5.86	
	13	1	SP26	RTPD	Regulation Down	0.35	
10/13/15	19	4	CAISO_EXP	RTPD	Non-Spin	182	Grid alert issued due to high loads and lack of resources
3/19/16	15	3,4	SP26_EXP	RTPD	Regulation Down	15.5	Generator telemetry outage
	16	1	SP26_EXP	RTPD	Regulation Down	62	

Trade Date	Trade Hour	Trade Interval	AS Region	Market	Ancillary Service	Shortage MW	Causes
4/27/16	15	n/a	SP26_EXP	IFM	Spin	0.08	Interplay with OMS 3602720_Path15 congestion
5/20/16	5	2	SP26_EXP	RTPD	Regulation Down	6	Generator ramp limitation
5/22/16	16	2, 3	SP26_EXP	RTPD	Regulation Down	4	Generator telemetry outage
	20	2	SP26_EXP	RTPD	Regulation Down	6	
	21	3	SP26_EXP	RTPD	Regulation Down	6	
	23	1, 2	SP26_EXP	RTPD	Regulation Down	15	
	24	1	SP26_EXP	RTPD	Regulation Down	14	
5/23/16	1	2,3	SP26_EXP	RTPD	Regulation Down	2.7	Generator telemetry outage
	2	1,2	SP26_EXP	RTPD	Regulation Down	15	
	3	1,3	SP26_EXP	RTPD	Regulation Down	4	
	4	1	SP26_EXP	RTPD	Regulation Down	11	
	4	4	SP26_EXP	RTPD	Regulation Down	2	
	21	3,4	SP26_EXP	RTPD	Regulation Down	18.5	
9/22/16	13	4	CAISO_EXP	RTPD	Regulation Up	1.88	Generator outage
9/28/16	21	1	CAISO_EXP	RTPD	Regulation Up	7.97	Generator ramp limitation
10/14/16	3	1	SP26_EXP	RTPD	Regulation Up	13.94	Generator telemetry outage
11/17/16	10	1	SP26_EXP	RTPD	Spin	6.15	Generator telemetry outage
11/20/16	18	2	SP26_EXP	RTPD	Spin	6.68	Generator de-rate

IV. Financial Impacts of Scarcity Events

The estimated financial impact of the scarcity events is shown in Table 3. Cost is calculated as procurement in MWs at the scarcity prices multiplied by the difference between the ancillary

service marginal price (ASMP) of current interval and the last interval that did not have ancillary service scarcity. The ASMP of the last interval without scarcity is used as a proxy price of the ASMP of the current interval in which the scarcity condition occurred.

Table 3: Financial Impact of Scarcity Events

Trade Date	Trade Hour	Trade Intervals	AS Region	Market	Ancillary Service	Procurement (MW)	Cost ($)
2/6/14	17	1-3	NP26_EXP	RTPD	Non-Spin	332.92	41,614.98[3]
2/6/14	17	1-4	NP26_EXP	RTPD	Regulation Down	0[4]	0
2/6/14	18	n/a	NP26_EXP	HASP	Non-Spin	25	14,999.75
2/6/14	18	n/a	NP26_EXP	HASP	Regulation Down	0	0
2/6/14	19	n/a	NP26_EXP	HASP	Non-Spin	25	16,186.25
4/8/14	19	3	SP26_EXP	RTPD	Non-Spin	1.75	214.42
4/8/14	20	3-4	CAISO_EXP	RTPD	Non-Spin	28.3	2,792.51
4/12/14	13	3	CAISO_EXP	RTPD	Regulation Down	0	0
12/23/14	22	4	SP26	RTPD	Regulation Down	4.07	505.69
12/24/14	4	3	CAISO_EXP	RTPD	Regulation Down	136.64	16,812.83
12/24/14	12	2	SP26	RTPD	Regulation Down	4.07	487.26
					2014 Totals	**557.75**	**93,613.69**
2/15/15	1	2	SP26	RTPD	Regulation Down	124.18	15,419.85
4/21/15	3	1,3	CAISO_EXP	RTPD	Regulation Up	108.39	5,418.05
4/21/15	11	2,3	SP26	RTPD	Regulation Down	0	0
5/17/15	17	1,2	SP26	RTPD	Regulation Down	8	604.47
5/24/15	9-17	n/a	SP26	IFM	Regulation Down	86.85	39,834.59
5/24/15	9	3,4	SP26	RTPD	Spin	133.02	3,292.25
5/24/15	10	1	SP26	RTPD	Regulation Down	0	0
5/24/15	10	2	SP26	RTPD	Spin	65.94	906.68
5/24/15	11	1,2	SP26	RTPD	Spin	105.37	1450.66
5/24/15	13	1	SP26	RTPD	Regulation Down	0	0

[3] NP26 region was not active in intervals prior to HE 17 so the CAISO region price is used as a proxy.
[4] No incremental MWs in RTPD were procured at the scarcity price.

Trade Date	Trade Hour	Trade Intervals	AS Region	Market	Ancillary Service	Procurement (MW)	Cost ($)
10/13/15	19	4	CAISO_EXP	RTPD	Non-Spin	76.14	8,207.35
					2015 Totals	**707.89**	**75,133.90**
3/19/16	15	3,4	SP26_EXP	RTPD	Regulation Down	364.10	40,714.95
3/19/16	16	1	SP26_EXP	RTPD	Regulation Down	78.85	10,788.97
4/27/16	15	n/a	SP26_EXP	IFM	Spin	146.40	11,416.78
5/20/16	5	2	SP26_EXP	RTPD	Regulation Down	35	3,874.82
5/22/16	16	2,3	SP26_EXP	RTPD	Regulation Down	299.74	34,097.38
5/22/16	20	2	SP26_EXP	RTPD	Regulation Down	62.58	7,441.90
5/22/16	21	3	SP26_EXP	RTPD	Regulation Down	62.14	7,333.27
5/22/16	23	1,2	SP26_EXP	RTPD	Regulation Down	390.39	46,423.12
5/22/16	24	1	SP26_EXP	RTPD	Regulation Down	195.44	23,684.97
5/23/16	1	2,3	SP26_EXP	RTPD	Regulation Down	396.52	47,311.48
5/23/16	2	1,2	SP26_EXP	RTPD	Regulation Down	335.30	40,264.30
5/23/16	3	1,3	SP26_EXP	RTPD	Regulation Down	379.84	44,335.90
5/23/16	4	1	SP26_EXP	RTPD	Regulation Down	190.39	22,240.10
5/23/16	4	4	SP26_EXP	RTPD	Regulation Down	199.36	23,476.56
5/23/16	21	3,4	SP26_EXP	RTPD	Regulation Down	294.43	36,007.36
9/22/16	13	4	CAISO_EXP	RTPD	Regulation Up	258.54	12,280.70
9/28/16	21	1	CAISO_EXP	RTPD	Regulation Up	13.63	677.83
10/14/16	3	1	SP26_EXP	RTPD	Regulation Up	91.06	4,165.24
11/17/16	10	1	SP26_EXP	RTPD	Spin	87.31	2,182.66
11/20/16	18	2	SP26_EXP	RTPD	Spin	0.32	8.06
					2016 Totals	**3,881.34**	**418,726.35**

V. Conclusion

From 2014 to 2016, the frequency of scarcity events has been low and the duration of the events is generally short since many events were a single or two-interval event. This indicates that the ISO experiences intermittent scarcity events and that the Ancillary Service 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 Ancillary Services in the ISO markets and the ISO does not see a need to change the Scarcity Reserve Demand Curves at this time.