

Western Energy Imbalance Market Benefits

Third Quarter 2022

October 31, 2022

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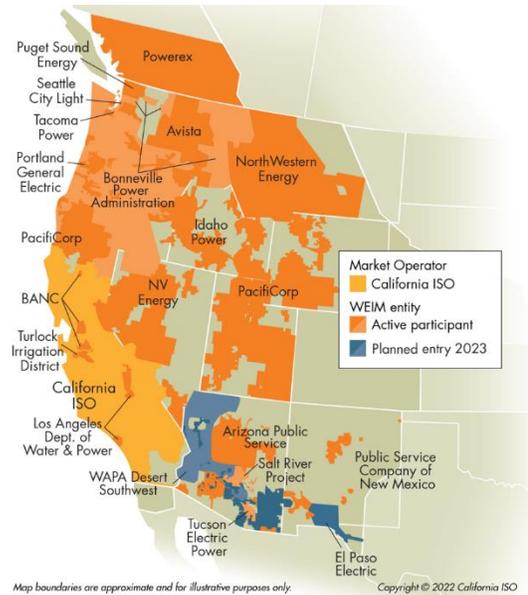
EXECUTIVE SUMMARY

Gross benefits from WEIM since November 2014
\$2.91 billion

This report presents the benefits associated with participation in the Western Energy Imbalance Market (WEIM).

The measured benefits of participation in the WEIM include cost savings, increased integration of renewable energy, and improved operational efficiencies including the reduction of the need for real-time flexible reserves.

This analysis demonstrates the benefit of economic dispatch in the real time market across a larger WEIM footprint with diverse resources and geography.



2022
Q3 BENEFITS

Q3 2022 Gross Benefits by Participant

	(millions \$)
Arizona Public Service	\$36.42
Avista	\$7.24
BANC	\$111.54
BPA	\$9.07
California ISO	\$65.99
Idaho Power	\$12.04
LADWP	\$25.79
NV Energy	\$62.38
NorthWestern Energy	\$6.84
PacifiCorp	\$84.54
Portland General Electric	\$19.64
PNM	\$16.63
Puget Sound Energy	\$7.59
Powerex	\$2.76
Seattle City Light	\$3.67
Salt River Project	\$19.28
Tacoma Power	\$3.84
TEP	\$26.88
TID	\$4.37
Total	\$526.51

ECONOMICAL

\$526.51 M

Gross benefits realized due to more efficient inter-and intra-regional dispatch in the Fifteen-Minute Market (FMM) and Real-Time Dispatch (RTD)*

ENVIRONMENTAL

18,176

Metric tons of CO₂** avoided curtailments

OPERATIONAL

61%

Average reduction in flexibility reserves across the footprint

*WEIM Quarterly Benefit Report Methodology: <https://www.westerneim.com/Documents/EIM-BenefitMethodology.pdf>.

**The GHG emission reduction reported is associated with the avoided curtailment only. The current market process and counterfactual methodology cannot differentiate the GHG emissions resulting from serving ISO load via the EIM versus dispatch that would have occurred external to the ISO without the WEIM. For more details, see <http://www.caiso.com/Documents/GreenhouseGasEmissionsTrackingReport-FrequentlyAskedQuestions.pdf>

■ BACKGROUND

The Western EIM began financially binding operation on November 1, 2014 by optimizing resources across the ISO and PacifiCorp Balancing Authority Areas (BAAs). NV Energy began participating in December 2015, Arizona Public Service and Puget Sound Energy began participating in October 2016, and Portland General Electric began participating in October 2017. Idaho Power and Powerex began participating in April 2018, and the Balancing Authority of Northern California (BANC) began participating in April 2019. Seattle City Light and Salt River Project began participating in April 2020.

In 2021, new balancing authorities began participating in the Western EIM, with the Turlock Irrigation District (TID) in March 2021, the second phase of BANC in March 2021, and the Los Angeles Department of Water and Power (LADWP) and Public Service Company of New Mexico (PNM) in April 2021, followed by NorthWestern Energy (NWMT) starting in June 2021.

Avista Utilities (AVA) and Tacoma Power (TPWR), two utilities serving a combined 600,000 electric customers in the Pacific Northwest, became the newest members of the WEIM, with both beginning their participation on March 2, 2022. On May 3, 2022, the Bonneville Power Administration (BPA) and Tucson Electric Power (TEP) both joined the WEIM.

The Western EIM footprint now includes portions of Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming, and extends to the border with Canada.

■ WEIM ECONOMIC BENEFITS IN Q3 2022

Table 1 shows the estimated WEIM gross benefits by each region per month¹. The monthly savings presented show \$141.35 million for July, \$175.44 million for August, and \$209.72 million for September with a total estimated benefit of \$526.51 million for this quarter². This level of WEIM benefits accrued from having additional WEIM areas participating in the market and economical transfers displacing more expensive generation.

¹ The WEIM benefits reported here are calculated based on available data. Intervals without complete data are excluded in the calculation. The intervals excluded due to unavailable data are normally within a few percent points of the total intervals.

² For several quarterly estimates, CAISO benefits were calculated on a variation of the counterfactual methodology. For CAISO only the logic had considered offline resources as part of the bid stack in the counterfactual. In Q4 2021, CAISO identified some questionable results that drove persistent negative benefits for CAISO when considering offline resources. Since Q4 2021, the benefit calculation for CAISO area follows the same methodology applicable to all WEIM entities in which only online resources are used.

<i>Region</i>	July	August	September	Total
<i>APS</i>	\$3.59	\$6.13	\$26.70	\$36.42
<i>AVA</i>	\$0.92	\$2.33	\$3.99	\$7.24
<i>BANC</i>	\$51.75	\$41.88	\$17.91	\$111.54
<i>BPA</i>	\$2.47	\$1.81	\$4.79	\$9.07
<i>CISO</i>	\$26.84	\$33.10	\$6.05	\$65.99
<i>IPCO</i>	\$2.41	\$3.56	\$6.07	\$12.04
<i>LADWP</i>	\$2.74	\$5.15	\$17.90	\$25.79
<i>NVE</i>	\$10.67	\$20.42	\$31.29	\$62.38
<i>NWMT</i>	\$0.94	\$2.86	\$3.04	\$6.84
<i>PAC</i>	\$19.83	\$29.33	\$35.38	\$84.54
<i>PGE</i>	\$2.84	\$6.37	\$10.43	\$19.64
<i>PNM</i>	\$2.70	\$3.80	\$10.13	\$16.63
<i>PSE</i>	\$1.36	\$2.63	\$3.60	\$7.59
<i>PWRX</i>	\$0.50	\$0.70	\$1.56	\$2.76
<i>SCL</i>	\$0.99	\$1.21	\$1.47	\$3.67
<i>SRP</i>	\$2.91	\$4.79	\$11.58	\$19.28
<i>TPWR</i>	\$1.10	\$1.48	\$1.26	\$3.84
<i>TEP</i>	\$6.19	\$6.57	\$14.12	\$26.88
<i>TID</i>	\$0.60	\$1.32	\$2.45	\$4.37
Total	\$141.35	\$175.44	\$209.72	\$526.51

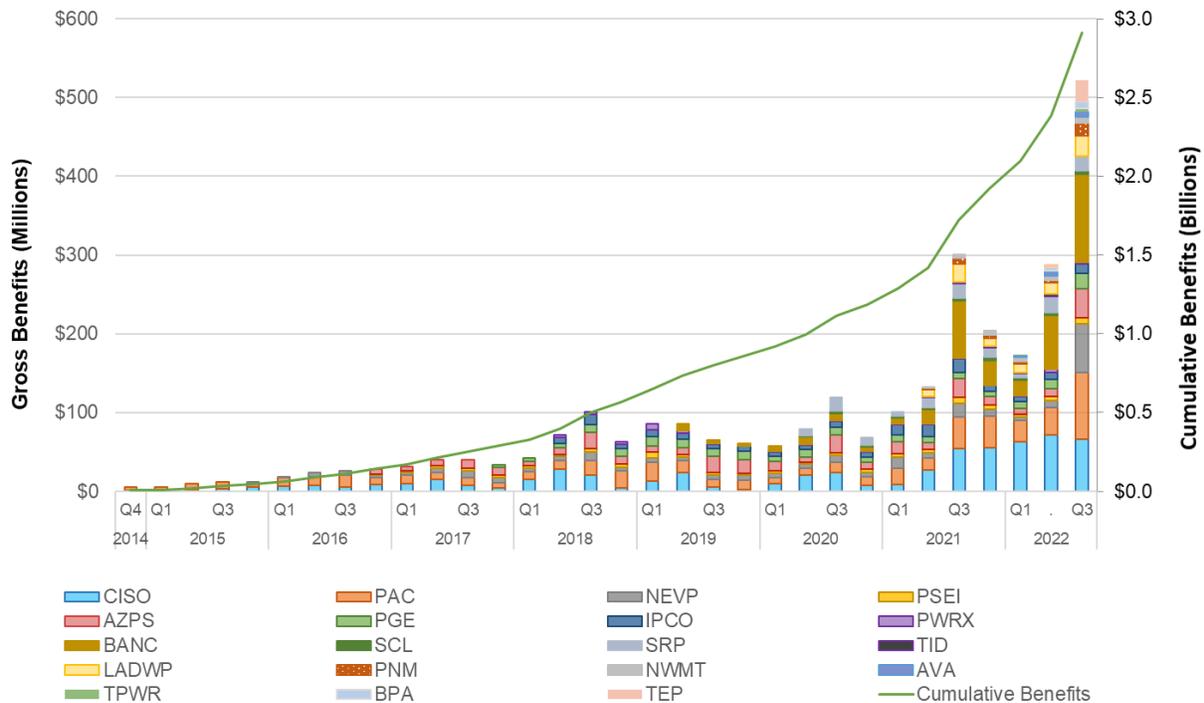
TABLE 1: Q3 2022 benefits in millions USD

■ CUMULATIVE ECONOMIC BENEFITS SINCE INCEPTION

Since the start of the WEIM in November 2014, the cumulative economic benefits of the market have totaled \$2.91 billion. The quarterly benefits have grown over time as a result of the participation of new BAAs, which results in benefits for both the individual BAA but also compounds the benefits to adjacent BAAs through additional transfers. The ISO began publishing quarterly WEIM benefit reports in April 2015.³

Graph 1 illustrates the gross economic benefits of the WEIM by quarter for each participating BAA.

³ Prior reports are available at <https://www.westerneim.com/Pages/About/QuarterlyBenefits.aspx>



GRAPH 1: Cumulative economic benefits for each quarter by BAA

INTER-REGIONAL TRANSFERS

A significant contributor to EIM benefits is transfers across balancing areas, providing access to lower cost supply, while factoring in the cost of compliance with greenhouse gas (GHG) emissions regulations when energy is transferred into the ISO. As such, the transfer volumes are a good indicator of a portion of the benefits attributed to the WEIM. Transfers can take place in both the 15-Minute Market and Real-Time Dispatch (RTD).

Generally, transfer limits are based on transmission and interchange rights that participating balancing authority areas make available to the WEIM, with the exception of the PacifiCorp West (PACW) -ISO transfer limit and the Portland General Electric (PGE) -ISO transfer limit in RTD. These RTD transfer capacities between PACW/PGE and the ISO are determined based on the allocated dynamic transfer capability driven by system operating conditions. This report does not quantify a BAA’s opportunity cost that the utility considered when using its transfer rights for the EIM.

Table 2 provides the 15-minute and 5-minute WEIM transfer volumes with base schedule transfers excluded. The WEIM entities submit inter-BAA transfers in their base schedules. The benefits quantified in this report are only attributable to the transfers that occurred through the WEIM. The benefits do not include any transfers attributed to transfers submitted in the base schedules that are scheduled prior to the start of the EIM.

The transfer from BAA_x to BAA_y and the transfer from BAA_y to BAA_x are separately reported. For example, if there is a 100 Megawatt-Hour (MWh) transfer during a 5-minute interval, in addition to a base transfer from ISO to NVE, it will be reported as 100 MWh from_BAA ISO to_BAA NEVP, and 0 MWh from_BAA NEVP to_BAA ISO in the opposite

direction. The 15-minute transfer volume is the result of optimization in the 15-minute market using all bids and base schedules submitted into the WEIM. The 5-minute transfer volume is the result of optimization using all bids and base schedules submitted into WEIM, based on unit commitments determined in the 15-minute market optimization. The maximum transfer capacities between WEIM entities are shown in Graph 2 below.

Month	From BAA	To BAA	15min WEIM transfer (15m – base)	5min WEIM transfer (5m – base)
<i>July</i>	AVA	BPAT	4,287	2,169
	AVA	CISO	0	0
	AVA	IPCO	9,467	8,216
	AVA	NWMT	7,071	6,723
	AVA	PACW	2,634	1,617
	AVA	PGE	23	0
	AVA	PSEI	0	0
	AVA	SCL	16	0
	AVA	TPWR	0	0
	<i>July</i>	AZPS	CISO	111,143
AZPS		LADWP	9,350	7,932
AZPS		NEVP	2,638	4,757
AZPS		PACE	17,424	28,600
AZPS		PNM	50,174	57,898
AZPS		SRP	41,553	33,295
AZPS		TEPC	42,246	47,294
BANC		BPAT	0	0
BANC		CISO	3,944	5,031
BANC		TIDC	139	0
BPAT		AVA	6,898	6,811
BPAT		BANC	0	0
BPAT		CISO	4,088	9,589
BPAT		IPCO	372	55

	BPAT	LADWP	0	0
	BPAT	NEVP	0	0
	BPAT	NWMT	13,563	3,313
	BPAT	PACW	5,930	4,180
	BPAT	PGE	42,908	42,969
	BPAT	PSEI	8,809	13,022
	BPAT	PWRX	4,381	0
	BPAT	SCL	1,549	1,486
	BPAT	TPWR	6,350	9,643
	CISO	AVA	0	0
	CISO	AZPS	54,583	86,952
	CISO	BANC	181,272	182,290
	CISO	BPAT	1,458	2,114
	CISO	LADWP	36,070	50,833
	CISO	NEVP	37,916	59,924
	CISO	PACW	2,559	23,995
	CISO	PGE	5,239	23,912
	CISO	PWRX	35,629	49,711
	CISO	SRP	80,498	107,934
	CISO	TEPC	1,016	1,759
	CISO	TIDC	7,072	7,916
	IPCO	AVA	10,613	9,803
	IPCO	BPAT	2,124	130
	IPCO	NEVP	28,676	13,382
	IPCO	NWMT	1,615	1,755
	IPCO	PACE	5,734	2,170
	IPCO	PACW	19,482	14,540
<i>July</i>	IPCO	PSEI	0	0

	IPCO	SCL	4,782	5,510
	LADWP	AZPS	12,019	19,249
	LADWP	BPAT	0	0
	LADWP	CISO	97,069	67,308
	LADWP	NEVP	20,123	29,621
	LADWP	PACE	12,257	12,380
	LADWP	TEPC	0	0
	NEVP	AZPS	14,928	19,814
	NEVP	BPAT	0	0
	NEVP	CISO	166,873	96,719
	NEVP	IPCO	38,578	61,322
	NEVP	LADWP	37,726	39,438
	NEVP	PACE	21,017	22,867
	NWMT	AVA	25,660	32,558
	NWMT	BPAT	6,800	1,482
	NWMT	IPCO	6,893	5,565
	NWMT	PACE	2,161	1,411
	NWMT	PACW	121	0
	NWMT	PGE	78	0
	NWMT	PSEI	67	0
	NWMT	TPWR	0	0
	PACE	AZPS	138,901	113,551
	PACE	IPCO	69,102	79,540
	PACE	LADWP	143,300	135,756
	PACE	NEVP	68,744	47,347
	PACE	NWMT	33,804	37,153
	PACE	PACW	42,886	50,124
July	PACE	SRP	0	0

	PACE	TEPC	4,531	4,251
	PACW	AVA	6,925	6,146
	PACW	BPAT	5,421	1,831
	PACW	CISO	19,835	46,193
	PACW	IPCO	17,769	11,637
	PACW	NWMT	3	0
	PACW	PGE	44,907	48,842
	PACW	PSEI	15,553	17,562
	PACW	SCL	1,022	963
	PGE	AVA	0	0
	PGE	BPAT	17,891	20,275
	PGE	CISO	24,773	18,917
	PGE	NWMT	54	0
	PGE	PACW	22,315	24,145
	PGE	PSEI	0	0
	PGE	SCL	742	772
	PGE	TPWR	1	0
	PNM	AZPS	26,937	22,200
	PNM	SRP	1,511	1,186
	PNM	TEPC	27,932	25,573
	PSEI	AVA	0	0
	PSEI	BPAT	29,993	28,698
	PSEI	IPCO	0	0
	PSEI	NWMT	25	0
	PSEI	PACW	3	0
	PSEI	PGE	0	0
	PSEI	PWRX	16,808	17,224
July	PSEI	SCL	9,600	8,216

PSEI	TPWR	11,218	12,442
PWRX	BPAT	7,222	0
PWRX	CISO	0	0
PWRX	PSEI	10,170	10,621
SCL	AVA	9	0
SCL	BPAT	408	462
SCL	IPCO	7,498	7,211
SCL	PACW	1,252	1,362
SCL	PGE	1,522	1,676
SCL	PSEI	7,166	11,096
SRP	AZPS	9,575	9,812
SRP	CISO	63,151	54,223
SRP	PACE	0	0
SRP	PNM	295	459
SRP	TEPC	49,231	56,964
TEPC	AZPS	1,431	27
TEPC	CISO	28,437	18,693
TEPC	LADWP	0	0
TEPC	PACE	654	247
TEPC	PNM	11,791	11,266
TEPC	SRP	4,234	4,914
TIDC	BANC	84	0
TIDC	CISO	14,925	13,664
TPWR	AVA	0	0
TPWR	BPAT	4,512	4,975
TPWR	NWMT	0	0
TPWR	PGE	0	0
TPWR	PSEI	2,975	5,532

<i>August</i>	AVA	BPAT	4,749	3,178
	AVA	CISO	0	0
	AVA	IPCO	16,711	16,925
	AVA	NWMT	2,408	2,078
	AVA	PACW	1,489	1,755
	AVA	PGE	0	0
	AVA	PSEI	0	0
	AVA	SCL	12	0
	AVA	TPWR	46	80
	AZPS	CISO	164,404	114,804
	AZPS	LADWP	9,973	9,821
	AZPS	NEVP	7,196	10,283
	AZPS	PACE	15,325	12,656
	AZPS	PNM	23,748	21,788
	AZPS	SRP	34,289	28,488
	AZPS	TEPC	38,082	41,405
	BANC	BPAT	0	0
	BANC	CISO	9,661	6,010
	BANC	TIDC	59	0
	BPAT	AVA	5,576	4,395
	BPAT	BANC	0	0
	BPAT	CISO	5,429	11,676
	BPAT	IPCO	393	33
	BPAT	LADWP	0	0
BPAT	NEVP	0	0	
BPAT	NWMT	9,143	1,403	
BPAT	PACW	2,864	1,809	
<i>August</i>	BPAT	PGE	25,385	23,619

	BPAT	PSEI	10,251	11,372
	BPAT	PWRX	4,757	55
	BPAT	SCL	1,838	1,335
	BPAT	TPWR	8,128	9,806
	CISO	AVA	0	0
	CISO	AZPS	8,805	17,526
	CISO	BANC	180,068	194,375
	CISO	BPAT	2,294	3,935
	CISO	LADWP	15,141	25,640
	CISO	NEVP	9,784	13,344
	CISO	PACW	2,157	17,615
	CISO	PGE	15,394	41,675
	CISO	PWRX	31,560	41,185
	CISO	SRP	28,511	46,236
	CISO	TEPC	824	813
	CISO	TIDC	5,648	6,896
	IPCO	AVA	17,111	13,070
	IPCO	BPAT	1,270	298
	IPCO	NEVP	62,095	48,046
	IPCO	NWMT	434	871
	IPCO	PACE	7,143	4,091
	IPCO	PACW	31,503	25,610
	IPCO	PSEI	0	0
	IPCO	SCL	11,840	11,144
	LADWP	AZPS	10,982	17,035
	LADWP	BPAT	0	0
	LADWP	CISO	129,042	97,849
<i>August</i>	LADWP	NEVP	20,189	26,589

	LADWP	PACE	17,333	19,364
	LADWP	TEPC	0	0
	NEVP	AZPS	12,237	16,914
	NEVP	BPAT	0	0
	NEVP	CISO	193,378	124,343
	NEVP	IPCO	31,439	31,988
	NEVP	LADWP	29,339	33,205
	NEVP	PACE	6,317	3,608
	NWMT	AVA	42,267	45,970
	NWMT	BPAT	6,399	3,154
	NWMT	IPCO	11,670	11,237
	NWMT	PACE	10,131	6,188
	NWMT	PACW	1	0
	NWMT	PGE	10	0
	NWMT	PSEI	0	0
	NWMT	TPWR	92	92
	PACE	AZPS	160,806	141,419
	PACE	IPCO	62,388	61,361
	PACE	LADWP	142,727	139,942
	PACE	NEVP	89,202	75,228
	PACE	NWMT	26,851	29,329
	PACE	PACW	83,914	83,431
	PACE	SRP	0	0
	PACE	TEPC	13,008	11,318
	PACW	AVA	4,441	4,831
	PACW	BPAT	3,556	1,130
	PACW	CISO	16,379	42,807
<i>August</i>	PACW	IPCO	15,977	9,724

	PACW	NWMT	0	0
	PACW	PGE	80,891	81,312
	PACW	PSEI	25,966	24,939
	PACW	SCL	1,914	1,712
	PGE	AVA	3	0
	PGE	BPAT	35,848	41,276
	PGE	CISO	20,442	17,829
	PGE	NWMT	79	0
	PGE	PACW	27,376	27,204
	PGE	PSEI	0	0
	PGE	SCL	1,559	1,385
	PGE	TPWR	0	0
	PNM	AZPS	37,441	33,201
	PNM	SRP	6,152	3,763
	PNM	TEPC	45,943	41,436
	PSEI	AVA	0	0
	PSEI	BPAT	30,712	33,488
	PSEI	IPCO	0	0
	PSEI	NWMT	1	0
	PSEI	PACW	73	79
	PSEI	PGE	0	0
<i>August</i>	PSEI	PWRX	6,749	8,380
	PSEI	SCL	20,398	18,122
	PSEI	TPWR	12,970	15,651
	PWRX	BPAT	7,231	583
	PWRX	CISO	0	0
	PWRX	PSEI	19,494	19,059
	SCL	AVA	3	0

	SCL	BPAT	545	782
	SCL	IPCO	5,395	5,730
	SCL	PACW	809	998
	SCL	PGE	932	1,139
	SCL	PSEI	4,629	6,210
	SRP	AZPS	20,286	20,549
	SRP	CISO	71,162	57,540
	SRP	PACE	0	0
	SRP	PNM	53	114
	SRP	TEPC	46,543	57,784
	TEPC	AZPS	387	0
	TEPC	CISO	29,147	21,185
	TEPC	LADWP	0	0
	TEPC	PACE	10	117
	TEPC	PNM	4,341	4,973
	TEPC	SRP	5,086	3,392
	TIDC	BANC	266	0
	TIDC	CISO	20,930	18,151
	TPWR	AVA	77	6
	TPWR	BPAT	5,670	6,957
	TPWR	NWMT	0	0
	TPWR	PGE	209	131
	TPWR	PSEI	4,755	5,025
<i>September</i>	AVA	BPAT	18,123	14,394
	AVA	CISO	0	0
	AVA	IPCO	14,896	13,290
	AVA	NWMT	2,030	1,354
	AVA	PACW	1,944	1,400

<i>September</i>	AVA	PGE	0	0
	AVA	PSEI	0	0
	AVA	SCL	16	0
	AVA	TPWR	0	0
	AZPS	CISO	234,246	177,401
	AZPS	LADWP	8,326	7,989
	AZPS	NEVP	2,241	4,389
	AZPS	PACE	7,104	9,205
	AZPS	PNM	9,952	7,659
	AZPS	SRP	22,526	18,355
	AZPS	TEPC	18,388	18,700
	BANC	BPAT	0	0
	BANC	CISO	11,799	7,632
	BANC	TIDC	552	0
	BPAT	AVA	4,455	2,362
	BPAT	BANC	0	0
	BPAT	CISO	12,375	21,295
	BPAT	IPCO	567	0
	BPAT	LADWP	0	0
	BPAT	NEVP	0	0
	BPAT	NWMT	7,547	304
	BPAT	PACW	2,971	2,139
	BPAT	PGE	16,957	12,621
	BPAT	PSEI	12,719	12,944
	BPAT	PWRX	4,143	81
	BPAT	SCL	2,295	1,885
	BPAT	TPWR	10,946	13,156
	CISO	AVA	0	0

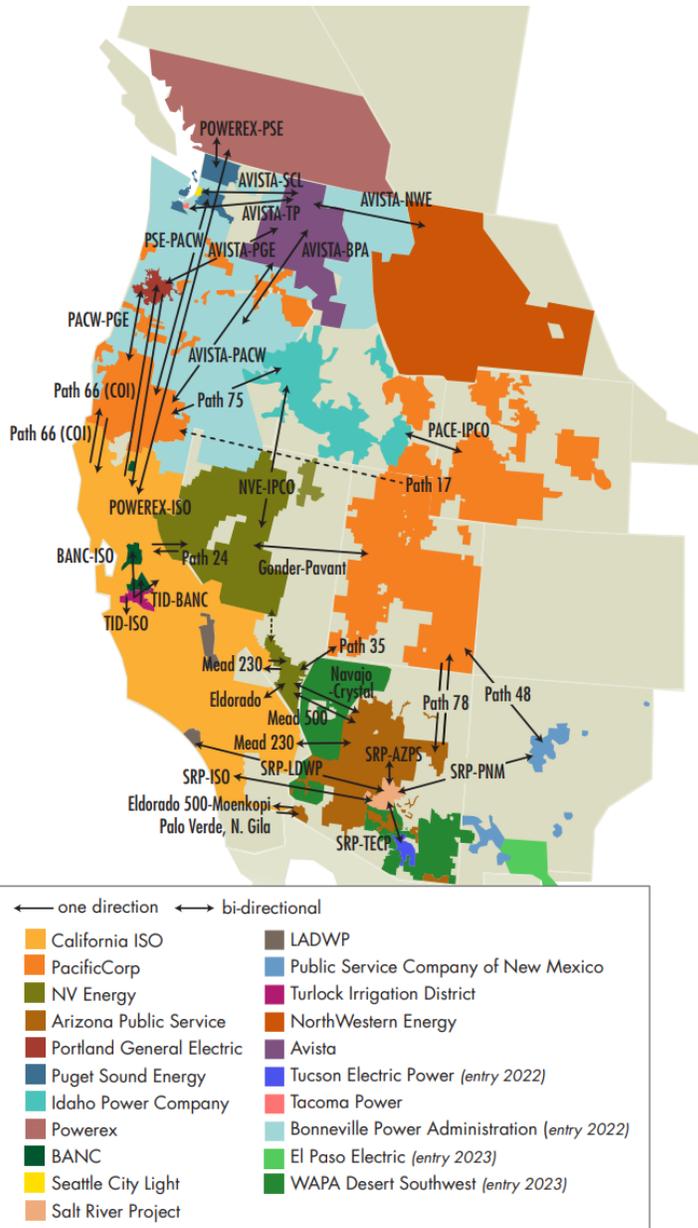
<i>September</i>	CISO	AZPS	11,956	16,177
	CISO	BANC	143,077	149,790
	CISO	BPAT	5,351	10,692
	CISO	LADWP	16,402	22,901
	CISO	NEVP	10,777	11,392
	CISO	PACW	3,230	16,696
	CISO	PGE	23,217	47,448
	CISO	PWRX	229,900	249,969
	CISO	SRP	47,912	56,189
	CISO	TEPC	416	844
	CISO	TIDC	9,065	9,707
	IPCO	AVA	31,064	26,177
	IPCO	BPAT	1,290	221
	IPCO	NEVP	70,187	52,886
	IPCO	NWMT	410	608
	IPCO	PACE	3,251	818
	IPCO	PACW	33,522	29,507
	IPCO	PSEI	0	0
	IPCO	SCL	13,054	12,379
	LADWP	AZPS	3,177	3,905
	LADWP	BPAT	0	0
	LADWP	CISO	149,927	122,421
	LADWP	NEVP	5,265	7,184
	LADWP	PACE	24,443	27,507
LADWP	TEPC	0	0	
NEVP	AZPS	6,718	7,215	
NEVP	BPAT	0	0	
<i>September</i>	NEVP	CISO	305,456	228,955

	NEVP	IPCO	26,060	24,227
	NEVP	LADWP	43,986	51,704
	NEVP	PACE	5,765	6,771
	NWMT	AVA	40,759	41,672
	NWMT	BPAT	13,608	10,591
	NWMT	IPCO	10,801	10,932
	NWMT	PACE	5,765	2,340
	NWMT	PACW	74	0
	NWMT	PGE	84	0
	NWMT	PSEI	82	0
	NWMT	TPWR	0	0
	PACE	AZPS	141,534	127,193
	PACE	IPCO	148,341	151,578
	PACE	LADWP	116,789	109,709
	PACE	NEVP	122,613	107,518
	PACE	NWMT	32,296	31,501
	PACE	PACW	82,690	96,101
	PACE	SRP	0	0
	PACE	TEPC	11,498	10,424
	PACW	AVA	1,626	2,035
	PACW	BPAT	6,384	3,608
	PACW	CISO	33,666	71,934
	PACW	IPCO	13,402	6,459
	PACW	NWMT	5	0
	PACW	PGE	84,844	87,308
	PACW	PSEI	30,665	29,379
	PACW	SCL	1,922	1,812
<i>September</i>	PGE	AVA	2	0

	PGE	BPAT	37,426	42,258
	PGE	CISO	26,559	24,204
	PGE	NWMT	64	0
	PGE	PACW	19,576	17,835
	PGE	PSEI	0	0
	PGE	SCL	1,551	1,556
	PGE	TPWR	0	0
	PNM	AZPS	52,812	53,044
	PNM	SRP	15,002	11,113
	PNM	TEPC	38,111	36,732
	PSEI	AVA	0	0
	PSEI	BPAT	31,606	33,574
	PSEI	IPCO	0	0
	PSEI	NWMT	1	0
	PSEI	PACW	2	0
	PSEI	PGE	0	0
	PSEI	PWRX	17,690	18,331
	PSEI	SCL	10,638	8,578
	PSEI	TPWR	8,836	10,706
	PWRX	BPAT	4,025	0
	PWRX	CISO	0	0
	PWRX	PSEI	7,260	7,661
	SCL	AVA	16	0
	SCL	BPAT	1,378	2,707
	SCL	IPCO	3,048	2,942
	SCL	PACW	584	673
	SCL	PGE	905	978
<i>September</i>	SCL	PSEI	10,624	14,678

SRP	AZPS	8,100	8,178
SRP	CISO	141,472	128,941
SRP	PACE	0	0
SRP	PNM	14	11
SRP	TEPC	29,538	36,782
TEPC	AZPS	595	100
TEPC	CISO	73,757	62,516
TEPC	LADWP	0	0
TEPC	PACE	23	198
TEPC	PNM	5,895	4,557
TEPC	SRP	7,907	5,482
TIDC	BANC	300	134
TIDC	CISO	14,726	12,930
TPWR	AVA	0	0
TPWR	BPAT	7,326	7,937
TPWR	NWMT	0	0
TPWR	PGE	0	0
TPWR	PSEI	8,310	9,591

TABLE 2: Energy transfers (MWh) in the FMM and RTD markets for Q3 2022



Path	Estimated Max Capacity (MW)
Path 24 (west to east)	100
Path 24 (east to west)	35-90
Eldorado	797
Path 35 (west to east)	580
Path 35 (east to west)	538
Gonder-Pavant	130
PACW to PGE	320
Path 66 (ISO to PGE)	627
Path 66 (PGE to ISO)	296
Path 66 (ISO to PACW)	331
Path 66 (PACW to ISO)	432
Path 17	0-400 ^{1 2}
PSE to PACW	300
Eldorado 500-Moenkopi	732
Palo Verde, N. Gila	3,151
Path 78 (PACE to APS)	625
Path 78 (APS to PACE)	660
Navajo-Crystal	522
Mead 500	349
Mead 230 (APS <-> ISO)	236
Mead 230 (ISO to NVE)	3,443
Mead 230 (NVE to ISO)	3,476
IPCO to PACW (Path 75)	1,500
PACW to IPCO (Path 75)	400-510
PACE to IPCO	2,557
IPCO to PACE	1,550
NVE to IPCO	262
IPCO to NVE	390-478
Powerex <-> PSE	150
Powerex <-> ISO	150
BANC <-> ISO	2,000-4,000
TID to ISO	1,400
TID to BANC	650
Path 48	2,100
SRP <-> TEPC	9,988
SRP <-> PNM	400
SRP <-> AZPS	10,021
SRP <-> ISO	14,488
SRP <-> LDWP	349
Avista <-> BPA	3,600
Avista <-> NorthWestern	764
Avista <-> PACW	500
Avista <-> SCL	500
Avista <-> TP	500
Avista <-> PGE	500

GRAPH 2: Estimated maximum transfer capacity

WHEEL-THROUGH TRANSFERS

As the footprint of the WEIM grows, wheel-through transfers may become more common. In order to derive the wheel-through transfers for each WEIM BAA, the ISO uses the following calculation for every real-time interval dispatch:

- *Total import*: summation of transfers above base transfers coming into the WEIM BAA under analysis

- *Total export*: summation of all transfers above base transfers going out of the WEIM BAA under analysis
- *Net import*: the maximum of zero or the difference between total imports and total exports
- *Net export*: the maximum of zero or the difference between total exports and total imports
- *Wheel-through*: the minimum of the WEIM transfers into (total import) or WEIM transfer out (total export) of a BAA for a given interval

All wheel-through transfers are summed over both the month and the quarter.

Currently, a WEIM entity facilitating a wheel through receives no direct financial benefit for facilitating the wheel; only the sink and source directly benefit. As part of the WEIM Consolidated Initiatives stakeholder process, the ISO committed to monitoring the wheel through volumes to assess whether, after the addition of new WEIM entities, there is a potential future need to pursue a market solution to address the equitable sharing of wheeling benefits.

The ISO will continue to track the volume of wheel-through transfers in the WEIM market in the quarterly reports.

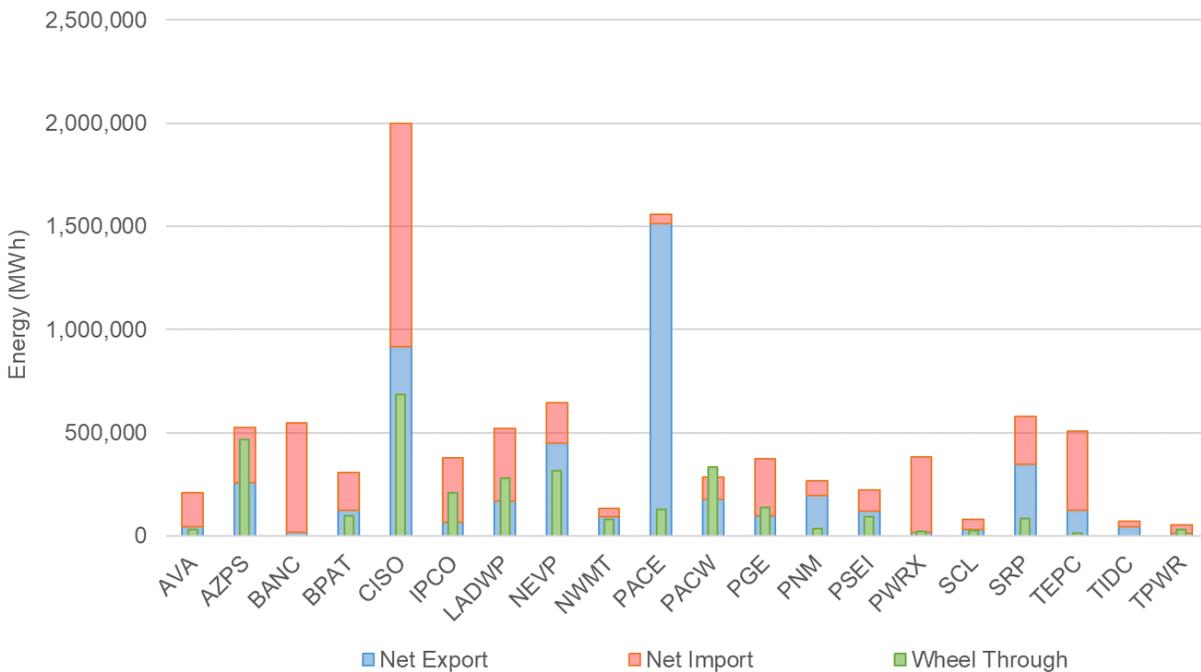
This volume reflects the total wheel-through transfers for each WEIM BAA, regardless of the potential paths used to wheel through. The net imports and exports estimated in this section reflect the overall volume of net imports and exports; in contrast, the imports and exports provided in Table 2 reflect the gross transfers between two WEIM BAAs.

The metric is measured as energy in MWh for each month and the corresponding calendar quarter, as shown in Tables 3 through 6 and Graphs 3 through 6.

BAA	Net Export	Net Import	Wheel Through
AVA	43,479	166,138	29,698
AZPS	259,011	266,659	467,402
BANC	18,674	526,589	-
BPAT	123,665	183,208	99,692
CISO	915,264	1,081,334	683,121
IPCO	65,844	312,802	207,171
LADWP	168,958	353,418	281,453
NEVP	451,416	194,216	317,674
NWMT	94,441	37,640	78,752

PACE	1,513,934	41,793	129,841
PACW	177,993	107,545	335,268
PGE	99,617	275,591	138,039
PNM	193,620	74,094	34,629
PSEI	119,444	104,643	94,047
PWRX	16,901	363,914	21,023
SCL	30,482	48,693	28,161
SRP	345,373	234,363	85,983
TEPC	125,449	379,861	12,217
TIDC	44,879	24,518	-
TPWR	11,158	42,580	28,996

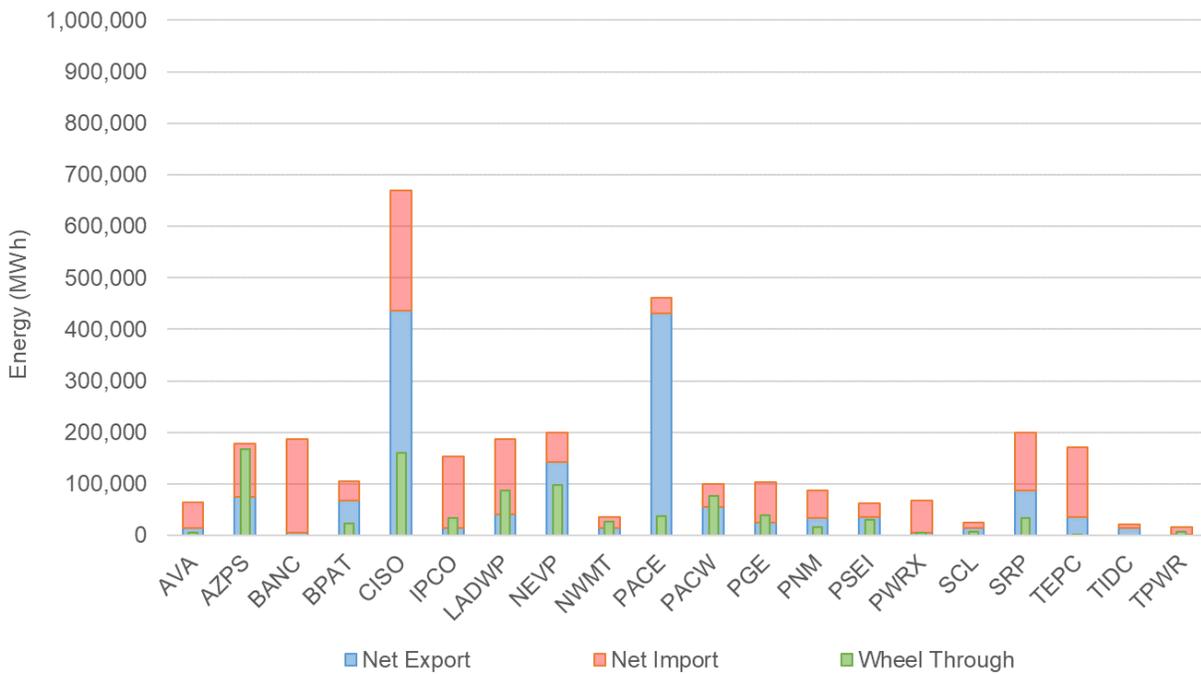
TABLE 3: Estimated wheel-through transfers in Q3 2022



GRAPH 3: Estimated wheel-through transfers in Q3 2022

BAA	Net Export	Net Import	Wheel Through
AVA	14,129	50,723	4,595
AZPS	75,394	103,532	168,074
BANC	5,031	182,290	-
BPAT	67,084	38,154	23,983
CISO	436,627	233,317	160,714
IPCO	13,671	139,927	33,619
LADWP	40,727	146,128	87,831
NEVP	142,209	57,080	97,950
NWMT	13,629	21,556	27,388
PACE	430,188	30,141	37,533
PACW	56,045	42,834	77,129
PGE	25,325	78,614	38,784
PNM	33,020	53,684	15,940
PSEI	35,966	27,218	30,615
PWRX	5,968	62,283	4,653
SCL	14,612	9,752	7,195
SRP	87,160	113,030	34,298
TEPC	34,826	135,520	320
TIDC	13,664	7,916	-
TPWR	2,601	14,179	7,906

TABLE 4: Estimated wheel-through transfers in July 2022

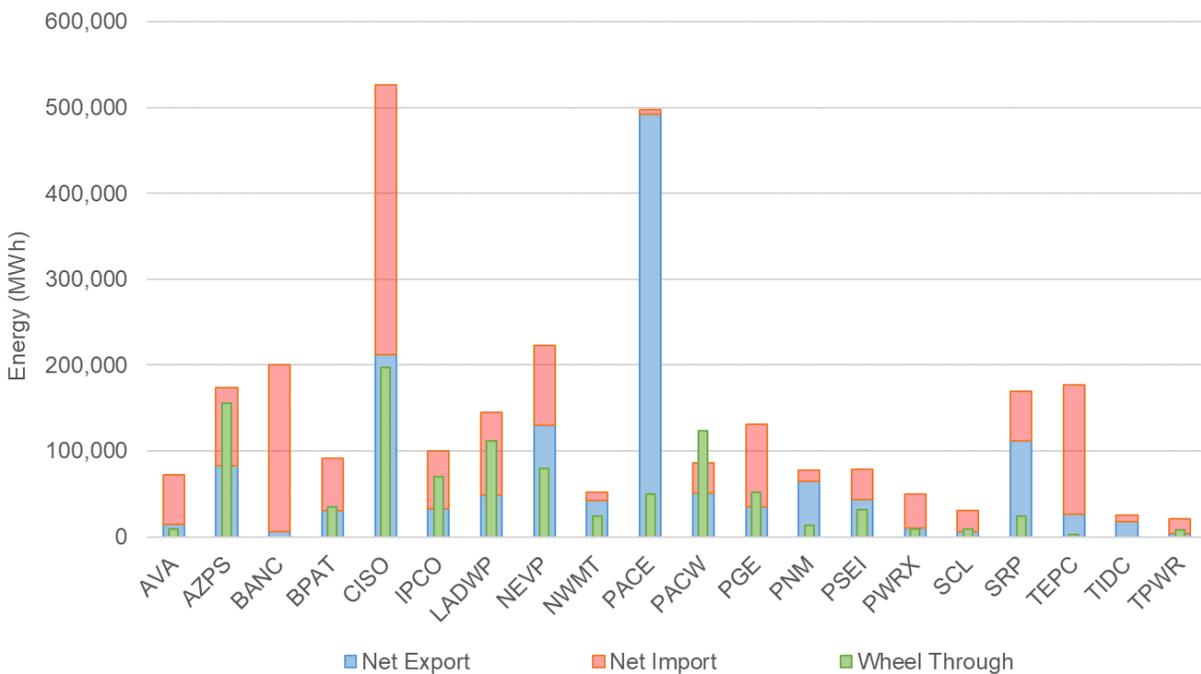


GRAPH 4: Estimated wheel-through transfers in July 2022

BAA	Net Export	Net Import	Wheel Through
AVA	14,248	58,505	9,767
AZPS	83,439	90,836	155,808
BANC	6,010	194,375	-
BPAT	30,932	60,211	34,570
CISO	211,845	314,800	197,394
IPCO	32,987	66,855	70,143
LADWP	48,708	96,479	112,129
NEVP	129,850	93,282	80,208
NWMT	42,524	9,565	24,116
PACE	492,409	4,493	49,620
PACW	51,125	35,080	123,420
PGE	35,381	95,563	52,312

PNM	64,522	12,996	13,879
PSEI	43,875	34,759	31,846
PWRX	10,145	40,123	9,497
SCL	5,851	24,690	9,008
SRP	111,866	57,760	24,120
TEPC	26,811	149,901	2,856
TIDC	18,151	6,896	-
TPWR	3,532	17,041	8,587

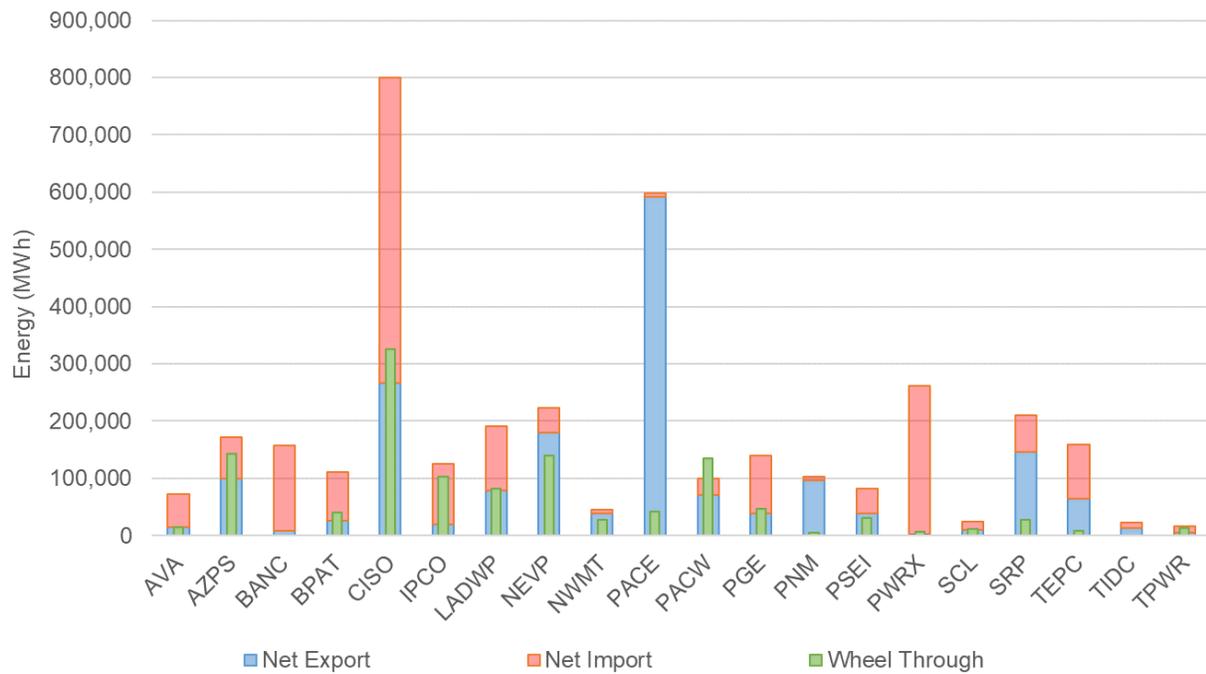
TABLE 5: Estimated wheel-through transfers in August 2022



GRAPH 5: Estimated wheel-through transfers in August 2022

BAA	Net Export	Net Import	Wheel Through
AVA	15,102	56,910	15,336
AZPS	100,178	72,291	143,520
BANC	7,632	149,924	-
BPAT	25,648	84,843	41,139
CISO	266,792	533,217	325,013
IPCO	19,186	106,019	103,409
LADWP	79,524	110,811	81,493
NEVP	179,357	43,854	139,516
NWMT	38,288	6,519	27,248
PACE	591,336	7,159	42,688
PACW	70,822	29,631	134,719
PGE	38,911	101,414	46,942
PNM	96,078	7,415	4,811
PSEI	39,603	42,666	31,587
PWRX	788	261,509	6,873
SCL	10,019	14,251	11,959
SRP	146,347	63,574	27,565
TEPC	63,811	94,440	9,041
TIDC	13,064	9,707	-
TPWR	5,025	11,359	12,503

TABLE 6: Estimated wheel-through transfers in September 2022



GRAPH 6: Estimated wheel-through transfers in September 2022

■ REDUCED RENEWABLE CURTAILMENT AND GHG REDUCTIONS

The WEIM benefit calculation includes the economic benefits that can be attributed to avoided renewable curtailment within the ISO footprint. If not for energy transfers facilitated by the WEIM, some renewable generation located within the ISO would have been curtailed via either economic or exceptional dispatch. The total avoided renewable curtailment volume in MWh for Q3 2022 was calculated to be 20,691 MWh (July) + 9,471 MWh (August) + 12,306 MWh (September) = 42,468 MWh total.

There are environmental benefits of avoided renewable curtailment as well. Under the assumption that avoided renewable curtailments displace production from other resources at a default emission rate of 0.428 metric tons CO₂/MWh, avoided curtailments displaced an estimated 18,176 metric tons of CO₂ for Q3 2022. Avoided renewable curtailments also may have contributed to an increased volume of renewable credits that would otherwise have been unavailable. This report does not quantify the additional value in dollars associated with this benefit. Total estimated reductions in the curtailment of renewable energy in the ISO footprint, along with the associated reductions in CO₂, are shown in Table 7.

Year	Quarter	MWh	Eq. Tons CO ₂
2015	1	8,860	3,792
	2	3,629	1,553
	3	828	354
	4	17,765	7,521

2016	1	112,948	48,342
	2	158,806	67,969
	3	33,094	14,164
	4	23,390	10,011
2017	1	52,651	22,535
	2	67,055	28,700
	3	23,331	9,986
	4	18,060	7,730
2018	1	65,860	28,188
	2	129,128	55,267
	3	19,032	8,146
	4	23,425	10,026
2019	1	52,254	22,365
	2	132,937	56,897
	3	33,843	14,485
	4	35,254	15,089
2020	1	86,740	37,125
	2	147,514	63,136
	3	37,548	16,071
	4	39,956	17,101
2021	1	76,147	32,591
	2	109,059	46,677
	3	23,042	9,862
	4	38,044	16,283
2022	1	94,168	40,304
	2	118,352	50,655
	3	42,468	18,176
Total		1,825,188	781,101

TABLE 7: Total reduction in curtailment of renewable energy and associated reductions in CO₂

FLEXIBLE RAMPING PROCUREMENT DIVERSITY SAVINGS

■ The WEIM facilitates procurement of flexible ramping capacity in the FMM to address variability that may occur in the RTD. Because variability across different BAAs may happen in opposite directions, the flexible ramping requirement for the entire WEIM footprint can be less than the sum of individual BAA's requirements. This difference is known as flexible ramping procurement diversity savings.

Starting in 2016, the ISO replaced the flexible ramping constraint with flexible ramping products that provide both upward and downward ramping. The minimum and maximum flexible ramping requirements for each BAA and for each direction are listed in Table 8.

Month	BAA	Direction	Minimum requirement	Maximum requirement
July	AVA	up	14	71
	AZPS	up	51	318
	BANC	up	4	147
	BPAT	up	102	460
	CISO	up	443	2,453
	IPCO	up	76	216
	LADWP	up	65	456
	NEVP	up	72	370
	NWMT	up	17	128
	PACE	up	108	592
	PACW	up	50	189
	PGE	up	56	223
	PNM	up	35	200
	PSEI	up	42	199
	PWRX	up	48	235
	SCL	up	4	34
	SRP	up	42	262
	TEPC	up	52	132
	TIDC	up	2	15
	TPWR	up	3	17
ALL EIM	up	558	2,624	
AVA	down	20	78	

<i>July</i>	<i>AZPS</i>	down	30	390
	<i>BANC</i>	down	2	154
	<i>BPAT</i>	down	138	402
	<i>CISO</i>	down	108	1,322
	<i>IPCO</i>	down	52	301
	<i>LADWP</i>	down	59	289
	<i>NEVP</i>	down	50	360
	<i>NWMT</i>	down	44	171
	<i>PACE</i>	down	111	652
	<i>PACW</i>	down	59	208
	<i>PGE</i>	down	55	286
	<i>PNM</i>	down	37	182
	<i>PSEI</i>	down	31	198
	<i>PWRX</i>	down	67	246
	<i>SCL</i>	down	1	28
	<i>SRP</i>	down	37	175
	<i>TEPC</i>	down	30	110
	<i>TIDC</i>	down	2	23
	<i>TPWR</i>	down	3	24
		ALL EIM	down	370
<i>August</i>	<i>AVA</i>	up	16	65
	<i>AZPS</i>	up	46	344
	<i>BANC</i>	up	10	82
	<i>BPAT</i>	up	109	460
	<i>CISO</i>	up	355	2,608
	<i>IPCO</i>	up	60	216
	<i>LADWP</i>	up	47	415
	<i>NEVP</i>	up	63	423
	<i>NWMT</i>	up	19	111
	<i>PACE</i>	up	132	592
	<i>PACW</i>	up	42	186

August	PGE	up	60	223
	PNM	up	40	200
	PSEI	up	28	161
	PWRX	up	61	223
	SCL	up	4	41
	SRP	up	58	262
	TEPC	up	44	129
	TIDC	up	2	15
	TPWR	up	2	15
	ALL WEIM	up	636	2,713
	AVA	down	22	71
	AZPS	down	42	390
	BANC	down	2	154
	BPAT	down	127	401
	CISO	down	167	1,003
	IPCO	down	40	214
	LADWP	down	72	289
	NEVP	down	23	360
	NWMT	down	44	171
	PACE	down	164	652
	PACW	down	52	203
	PGE	down	39	257
	PNM	down	37	182
	PSEI	down	29	198
	PWRX	down	57	246
	SCL	down	0	24
	SRP	down	34	169
	TEPC	down	40	110
	TIDC	down	2	26
	TPWR	down	3	19
	ALL EIM	down	261	1,569

September	AVA	up	18	95
	AZPS	up	54	315
	BANC	up	8	76
	BPAT	up	82	481
	CISO	up	371	2,758
	IPCO	up	47	213
	LADWP	up	61	390
	NEVP	up	54	410
	NWMT	up	17	111
	PACE	up	108	651
	PACW	up	34	130
	PGE	up	60	259
	PNM	up	40	194
	PSEI	up	28	147
	PWRX	up	62	247
	SCL	up	4	41
	SRP	up	46	296
	TEPC	up	34	221
	TIDC	up	2	19
	TPWR	up	2	15
ALL WEIM	up	636	2,510	
AVA	down	18	113	
AZPS	down	41	385	
BANC	down	9	134	
BPAT	down	120	639	
CISO	down	135	1,145	
IPCO	down	40	170	
LADWP	down	62	364	
NEVP	down	31	471	
NWMT	down	40	168	
PACE	down	111	689	

September	<i>PACW</i>	down	33	160
	<i>PGE</i>	down	38	185
	<i>PNM</i>	down	38	229
	<i>PSEI</i>	down	26	213
	<i>PWRX</i>	down	57	307
	<i>SCL</i>	down	2	26
	<i>SRP</i>	down	25	544
	<i>TEPC</i>	down	37	215
	<i>TIDC</i>	down	3	32
	<i>TPWR</i>	down	3	18
	ALL WEIM	down	226	1,645

Table 8: Flexible ramping requirements

The flexible ramping procurement diversity savings for all the intervals averaged over the month are shown in Table 9. The percentage savings is the average MW savings divided by the sum of the individual BAA requirements.

<i>Direction</i>	July		August		September	
	Up	Down	Up	Down	Up	Down
<i>Average MW saving</i>	1,909	1,912	1,886	1,917	1,708	1,928
<i>Sum of BAA requirements</i>	3,336	2,877	3,356	2,954	3,175	2,934
<i>Percentage savings</i>	57%	66%	56%	65%	54%	66%

Table 9: Flexible ramping procurement diversity savings in Q3 2022

Flexible ramping capacity may be used in RTD to handle uncertainties in the future interval. The RTD flexible ramping capacity is prorated to each BAA. Flexible ramping surplus MW is defined as the awarded flexible ramping capacity in RTD minus its share, and the flexible ramping surplus cost is defined as the flexible ramping surplus MW multiplied by the flexible ramping WEIM-wide marginal price. A positive flexible ramping surplus MW is the capacity that a BAA provided to help other BAAs, and a negative flexible ramping surplus MW is the capacity that a BAA received from other BAAs.

The EIM dispatch cost for a BAA with positive flexible ramping surplus MW is increased because some capacities are used to help other BAAs. The flexible ramping surplus cost is subtracted from the BAA's WEIM dispatch cost to reflect the true dispatch cost of a BAA. Please see the Benefit Report Methodology for more details.

■ CONCLUSION

Using state-of-the-art technology to find and deliver low-cost energy to meet real-time demand, the WEIM demonstrates that utilities can realize financial and operational benefits through increased coordination and optimization. In addition to these benefits, the WEIM provides significant environmental benefits through the reduction of renewable curtailments during periods of oversupply.

Sharing resources across a larger geographic area reduces greenhouse gas emissions by using renewable generation that otherwise would have been turned off. The quantified environmental benefits from avoided curtailments of renewable generation from 2015 to-date reached 781,101 metric tons of CO₂, roughly the equivalent of avoiding the emissions from 164,223 passenger cars driven for one year.

APPENDIX 1: GLOSSARY OF ABBREVIATIONS

Abbreviation	Description
APS	Arizona Public Service
AVA	Avista Utilities
BAA	Balancing Authority Area
BANC	Balancing Authority of Northern California
BPA	Bonneville Power Administration
CISO, ISO	California ISO
EIM	Energy Imbalance Market
FMM	Fifteen Minute Market
GHG	Greenhouse Gas
IPCO	Idaho Power
LADWP	Los Angeles Department of Water and Power
MW	Megawatt
MWh	Megawatt-Hour
NVE	NV Energy
PAC	PacifiCorp
PACE	PacifiCorp East
PACW	PacifiCorp West
PGE	Portland General Electric
PSE	Puget Sound Energy
PWRX	Powerex
RTD	Real Time Dispatch
SCL	Seattle City Light
SRP	Salt River Project
TEP	Tucson Electric Power
TID	Turlock Irrigation District
TPWR	Tacoma Power
WEIM	Western Energy Imbalance Market