

# WESTERN ENERGY IMBALANCE MARKET



July 29, 2020

The ISO is pleased to announce that as of July 3, 2020 customers of entities participating in the Western Energy Imbalance Market (Western EIM) have seen \$1 billion in gross benefits since its start in 2014. This milestone was achieved based on the benefits quantified in the Q2 2020 EIM benefits report plus additional benefits quantified in the first days of July.

When the Western EIM began in November 2014, I noted that “consumers across the West win one today as the EIM is live, performing well and working to reduce costs to consumers.”

The Western EIM has surpassed the participation and benefit savings expectations of the original studies. The access to a real-time market continues to provide value to customers across the West while preserving participating entities’ control over transmission and generation assets. It is building on the ISO’s highly successful market platform and provides a low-cost, low-risk option with proven benefits.

The ISO looks forward to the continued success of the Western EIM and building upon our strong relationship with all stakeholders following this significant milestone.

Sincerely,

A handwritten signature in black ink, appearing to read "Steve Berberich".

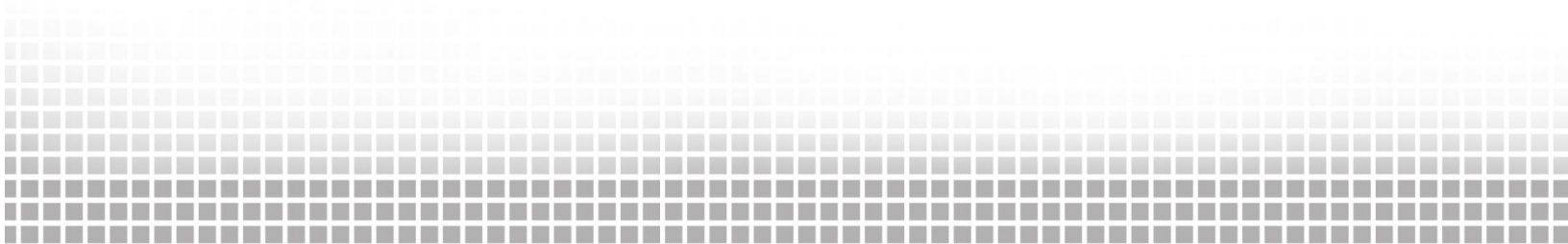

Steve Berberich  
President and CEO

# WESTERN EIM BENEFITS REPORT

**Second Quarter 2020** ■ ■ ■

Prepared by: Market Analysis and Forecasting

July 29, 2020



CONTENTS

**EXECUTIVE SUMMARY ..... 3**

**BACKGROUND..... 4**

**WESTERN EIM ECONOMIC BENEFITS IN Q2 2020..... 4**

    CUMULATIVE EIM BENEFITS SINCE INCEPTION ..... 5

    INTER-REGIONAL TRANSFERS ..... 5

    WHEEL THROUGH TRANSFERS..... 12

**REDUCED RENEWABLE CURTAILMENT AND GHG REDUCTIONS .....17**

**FLEXIBLE RAMPING PROCUREMENT DIVERSITY SAVINGS.....18**

**CONCLUSION.....21**

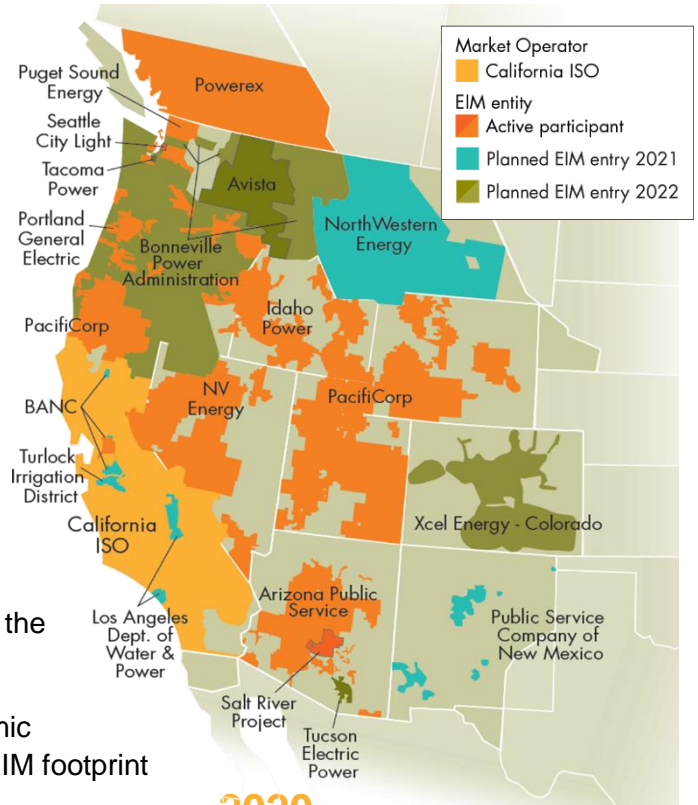
**EXECUTIVE SUMMARY**

Gross benefits from EIM since November 2014  
**\$998.69 million**

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

The measured benefits of participation in the Western EIM 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 EIM footprint with more diverse resources and geography.



**2020 Q2 BENEFITS**

**Q2 2020 Gross Benefits by Participant**

	(millions \$)
Arizona Public Service	\$6.40
BANC	\$9.17
California ISO	\$21.25
Idaho Power	\$6.08
NV Energy	\$4.73
PacifiCorp	\$8.46
Portland General Electric	\$9.15
Puget Sound Energy	\$2.84
Powerex	\$1.15
Seattle City Light	\$1.63
Salt River Project	\$8.14
<b>Total</b>	<b>\$79.00</b>

**ECONOMICAL**

**\$79.00M**

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

**ENVIRONMENTAL**

**63,136**

Metric tons of CO<sub>2</sub>\*\* avoided curtailments

**OPERATIONAL**

**49%**

Average reduction in flexibility reserves across the footprint

\*EIM Quarterly Benefit Report Methodology, [https://www.caiso.com/Documents/EIM\\_BenefitMethodology.pdf](https://www.caiso.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 EIM. 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. The Balancing Authority of Northern California (BANC)<sup>1</sup> began participating in April 2019. Most recently, Seattle City Light (SCL) and Salt River Project (SRP) began participating in April 2020. The EIM footprint now includes portions of Arizona, California, Idaho, Nevada, Oregon, Utah, Washington, Wyoming, and extends to the border with Canada.

The ISO began publishing quarterly EIM benefit reports in April 2015<sup>2</sup>.

## ■ WESTERN EIM ECONOMIC BENEFITS IN Q2 2020

Table 1 shows the estimated EIM gross benefits by each region per month<sup>3</sup>. The monthly savings presented show \$23.54 million for April, \$28.14 million for May, and \$27.32 million for June with a total estimated benefit of \$79.00 million for the quarter.

<i>Region</i>	<i>April</i>	<i>May</i>	<i>June</i>	<i>Total</i>
<i>APS</i>	\$1.83	\$2.24	\$2.33	\$6.40
<i>BANC</i>	\$3.90	\$2.36	\$2.91	\$9.17
<i>CISO</i>	\$6.01	\$7.82	\$7.42	\$21.25
<i>IPCO</i>	\$1.63	\$2.34	\$2.11	\$6.08
<i>NVE</i>	\$2.34	\$1.51	\$0.88	\$4.73
<i>PAC</i>	\$1.62	\$3.55	\$3.29	\$8.46
<i>PGE</i>	\$2.10	\$3.45	\$3.60	\$9.15
<i>PSE</i>	\$0.95	\$1.17	\$0.72	\$2.84
<i>PWRX</i>	\$0.39	\$0.39	\$0.37	\$1.15
<i>SCL</i>	\$0.48	\$0.46	\$0.69	\$1.63
<i>SRP</i>	\$2.29	\$2.85	\$3.00	\$8.14
<b><i>Total</i></b>	<b>\$23.54</b>	<b>\$28.14</b>	<b>\$27.32</b>	<b>\$79.00</b>

**TABLE 1: Second Quarter 2020 benefits in millions USD**

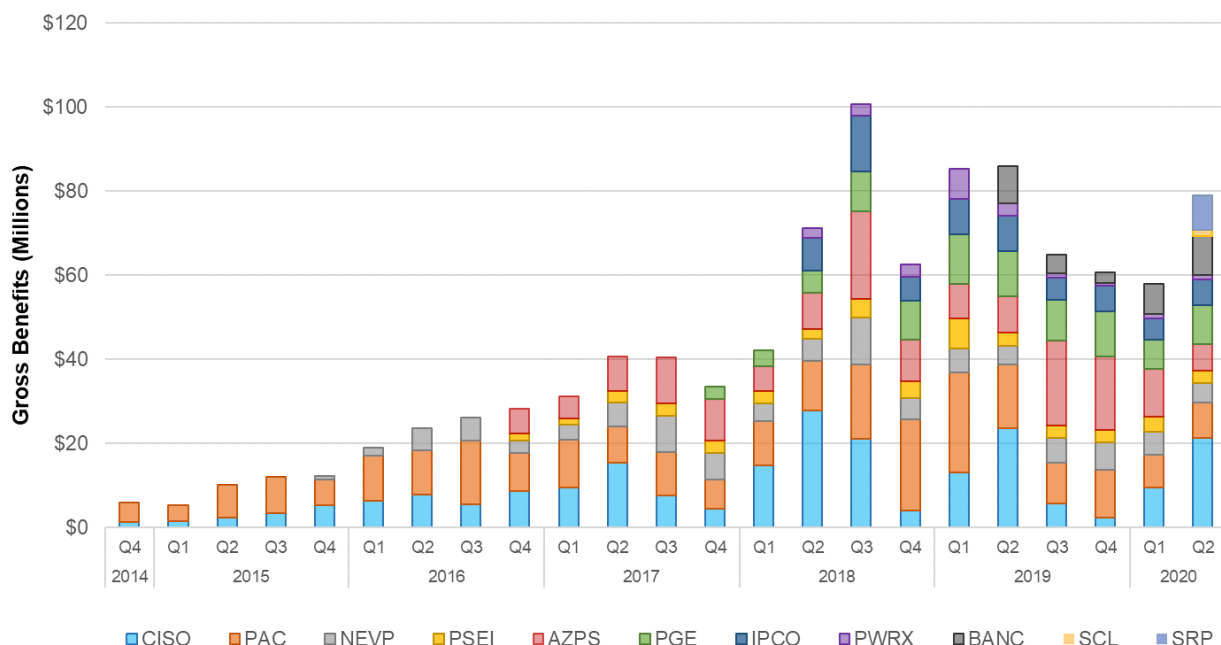
<sup>1</sup> The benefits reflect the Sacramento Municipal Utility District as the participating resource within BANC.

<sup>2</sup> Prior reports are available at <https://www.westerneim.com/Pages/About/QuarterlyBenefits.aspx>

<sup>3</sup> The EIM 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 of the total intervals.

**CUMULATIVE EIM BENEFITS SINCE INCEPTION**

Since the start of the EIM in November 2014, the cumulative economic benefits have totaled \$998.69 million. The quarterly benefits have grown over time as a result of the participation of new BAAs in the market, which results in additional benefits for both the individual BAA but also compounds the benefits to adjacent BAAs by enabling further transfers. Graph 1 illustrates the gross economic benefits of the EIM by quarter for each participating BAA.



**GRAPH 1: Cumulative gross benefits since the inception of the EIM**

**INTER-REGIONAL TRANSFERS**

A significant contributor to EIM benefits is transfers across BAAs, 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 EIM. 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 BAAs make available to the EIM, 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 EIM transfer volumes with base schedule transfers excluded. The EIM 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

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

Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
<i>April</i>	AZPS	CISO	72,483	52,848
	AZPS	NEVP	3,558	5,406
	AZPS	PACE	114,949	140,215
	AZPS	SRP	55,591	50,295
	BANC	CISO	2,677	1,799
	CISO	AZPS	143,796	172,210
	CISO	BANC	107,842	113,520
	CISO	NEVP	260,691	252,850
	CISO	PACW	21,564	41,158
	CISO	PGE	38,982	64,748
	CISO	PWRX	57,402	71,557
	CISO	SRP	99,096	97,671
	IPCO	NEVP	29,644	18,209
	IPCO	PACE	64,934	57,266
	IPCO	PACW	50,898	61,499
	IPCO	PSEI	5,859	7,575
	IPCO	SCL	4,817	6,123
	NEVP	AZPS	25,661	14,905
	NEVP	CISO	99,893	59,691
	NEVP	IPCO	70,765	70,376
NEVP	PACE	166,394	182,340	

Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)	
<i>April</i>	PACE	AZPS	25,967	15,724	
	PACE	IPCO	4,576	6,218	
	PACE	NEVP	21,797	5,646	
	PACE	PACW	27,960	38,411	
	PACE	SRP	0	0	
	PACW	CISO	44,562	49,485	
	PACW	IPCO	37,443	23,872	
	PACW	PGE	9,605	7,513	
	PACW	PSEI	7,809	10,473	
	PACW	SCL	188	423	
	PGE	CISO	8,298	7,507	
	PGE	PACW	98,689	105,787	
	PGE	PSEI	2,311	2,524	
	PGE	SCL	3,611	4,123	
	PSEI	IPCO	0	0	
	PSEI	PACW	73,082	71,234	
	PSEI	PGE	932	1,014	
	PSEI	PWRX	16,115	20,345	
	PSEI	SCL	3,753	4,456	
	PWRX	CISO	0	0	
	PWRX	PSEI	21,165	19,865	
	SCL	IPCO	7,217	6,108	
	SCL	PACW	7,770	8,349	
	SCL	PGE	4,817	5,026	
	SCL	PSEI	19,110	19,269	
	SRP	AZPS	23,600	28,032	
	SRP	CISO	65,182	67,464	
	SRP	PACE	0	0	
	<i>May</i>	AZPS	CISO	41,930	24,540
		AZPS	NEVP	4,070	6,072



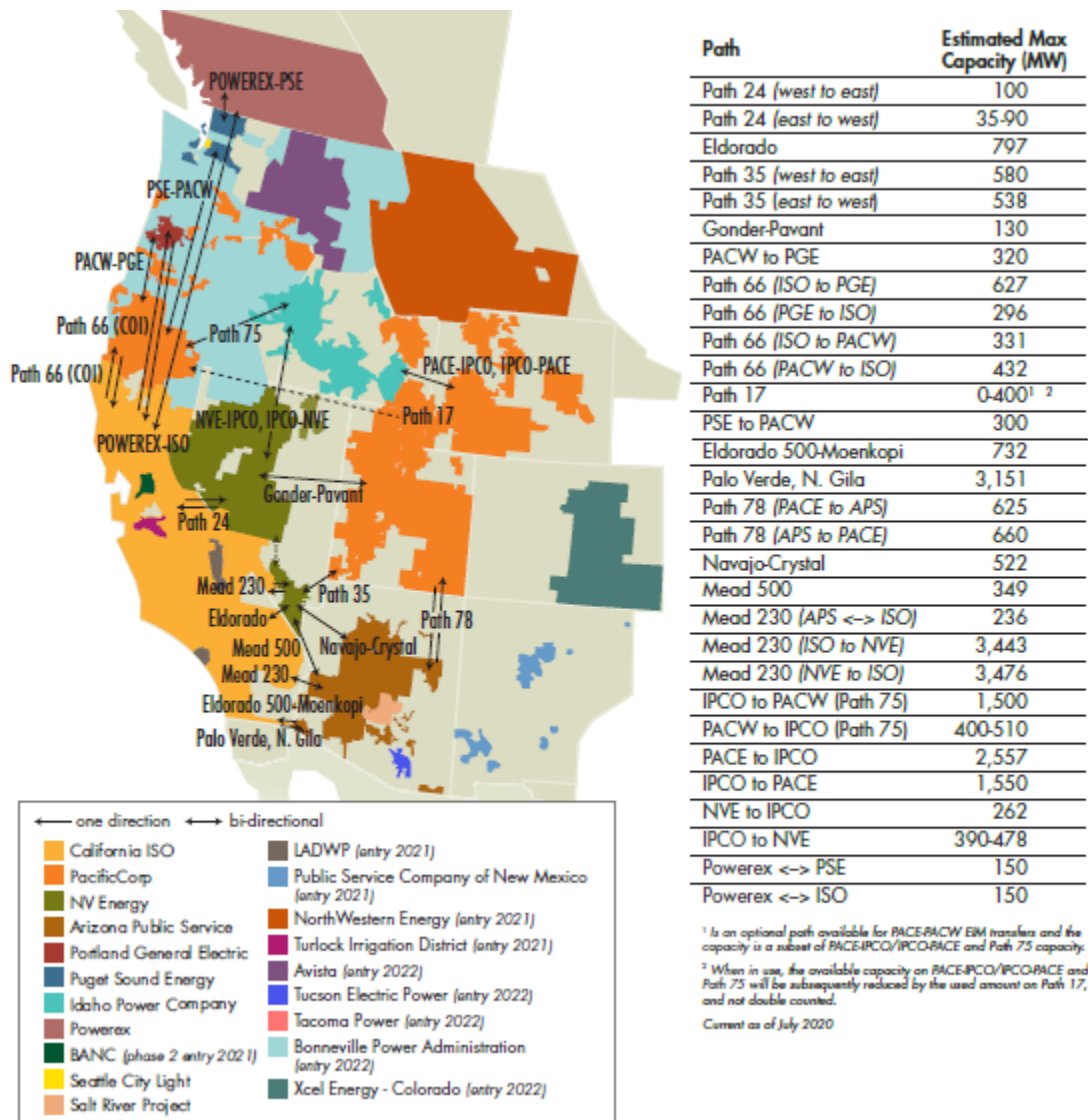
Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
May	AZPS	PACE	150,220	161,038
	AZPS	SRP	109,066	108,844
	BANC	CISO	8,673	6,146
	CISO	AZPS	256,917	268,766
	CISO	BANC	107,338	115,550
	CISO	NEVP	345,660	359,883
	CISO	PACW	27,795	45,548
	CISO	PGE	26,418	50,229
	CISO	PWRX	26,313	36,553
	CISO	SRP	138,772	135,264
	IPCO	NEVP	10,047	5,459
	IPCO	PACE	79,540	87,145
	IPCO	PACW	60,778	53,291
	IPCO	PSEI	3,092	2,830
	IPCO	SCL	2,331	2,139
	NEVP	AZPS	18,571	16,691
	NEVP	CISO	39,603	19,362
	NEVP	IPCO	83,362	75,839
	NEVP	PACE	224,444	230,665
	PACE	AZPS	26,685	17,315
	PACE	IPCO	11,926	9,738
	PACE	NEVP	15,030	6,998
	PACE	PACW	19,301	20,934
	PACE	SRP	0	0
	PACW	CISO	63,533	70,808
	PACW	IPCO	29,908	26,891
	PACW	PGE	8,307	8,612
	PACW	PSEI	3,109	5,143
	PACW	SCL	189	325
	PGE	CISO	882	838

Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
<i>May</i>	PGE	PACW	102,552	110,046
	PGE	PSEI	1,763	2,139
	PGE	SCL	3,134	3,332
	PSEI	IPCO	0	0
	PSEI	PACW	92,987	100,189
	PSEI	PGE	2,024	1,939
	PSEI	PWRX	10,995	12,838
	PSEI	SCL	5,195	6,219
	PWRX	CISO	0	0
	PWRX	PSEI	28,934	29,781
	SCL	IPCO	10,817	10,209
	SCL	PACW	6,899	7,968
	SCL	PGE	4,548	4,780
	SCL	PSEI	8,109	9,329
	SRP	AZPS	32,159	42,233
	SRP	CISO	49,921	43,272
	SRP	PACE	0	0
<i>June</i>	AZPS	CISO	81,299	59,776
	AZPS	NEVP	5,501	6,152
	AZPS	PACE	129,536	138,818
	AZPS	SRP	87,648	97,546
	BANC	CISO	16,091	13,897
	CISO	AZPS	131,269	163,389
	CISO	BANC	119,050	130,846
	CISO	NEVP	206,517	213,329
	CISO	PACW	109	10,040
	CISO	PGE	3,076	15,143
	CISO	PWRX	14,707	20,811
	CISO	SRP	172,246	166,915
	IPCO	NEVP	8,125	7,296

Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
<i>June</i>	IPCO	PACE	86,625	91,534
	IPCO	PACW	31,093	22,182
	IPCO	PSEI	2,868	2,475
	IPCO	SCL	1,350	1,356
	NEVP	AZPS	8,669	9,175
	NEVP	CISO	59,802	44,789
	NEVP	IPCO	54,540	42,688
	NEVP	PACE	177,282	181,080
	PACE	AZPS	42,370	36,569
	PACE	IPCO	3,664	2,514
	PACE	NEVP	20,528	17,037
	PACE	PACW	10,986	6,119
	PACE	SRP	0	0
	PACW	CISO	21,950	58,136
	PACW	IPCO	14,833	14,755
	PACW	PGE	12,363	9,301
	PACW	PSEI	9,476	8,436
	PACW	SCL	1,026	909
	PGE	CISO	19,811	19,189
	PGE	PACW	85,380	91,870
	PGE	PSEI	1,474	1,441
	PGE	SCL	4,244	3,898
	PSEI	IPCO	0	0
	PSEI	PACW	72,976	82,797
	PSEI	PGE	851	839
	PSEI	PWRX	20,406	20,724
	PSEI	SCL	7,252	7,010
	PWRX	CISO	0	0
	PWRX	PSEI	20,055	23,011
	SCL	IPCO	16,295	15,993

Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
June	SCL	PACW	7,161	8,678
	SCL	PGE	4,928	5,378
	SCL	PSEI	17,602	22,159
	SRP	AZPS	50,365	48,843
	SRP	CISO	59,886	52,980
	SRP	PACE	0	0

TABLE 2: Energy transfers (MWh) in the FMM and RTD markets for Q2 2020



GRAPH 2: Estimated maximum transfer capacity (EIM entities operating in Q2 2020)

## ■ WHEEL THROUGH TRANSFERS

As the footprint of the Western EIM grows and continues to change, wheel-through transfers may become more common. Currently, an EIM 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 Western EIM Consolidated Initiatives stakeholder process, the ISO committed to monitoring the wheel through volumes to assess whether, after the addition of new EIM 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 EIM market in the quarterly reports. In order to derive the wheel-through transfers for each EIM BAA, the ISO uses the following calculation for every real-time interval dispatch:

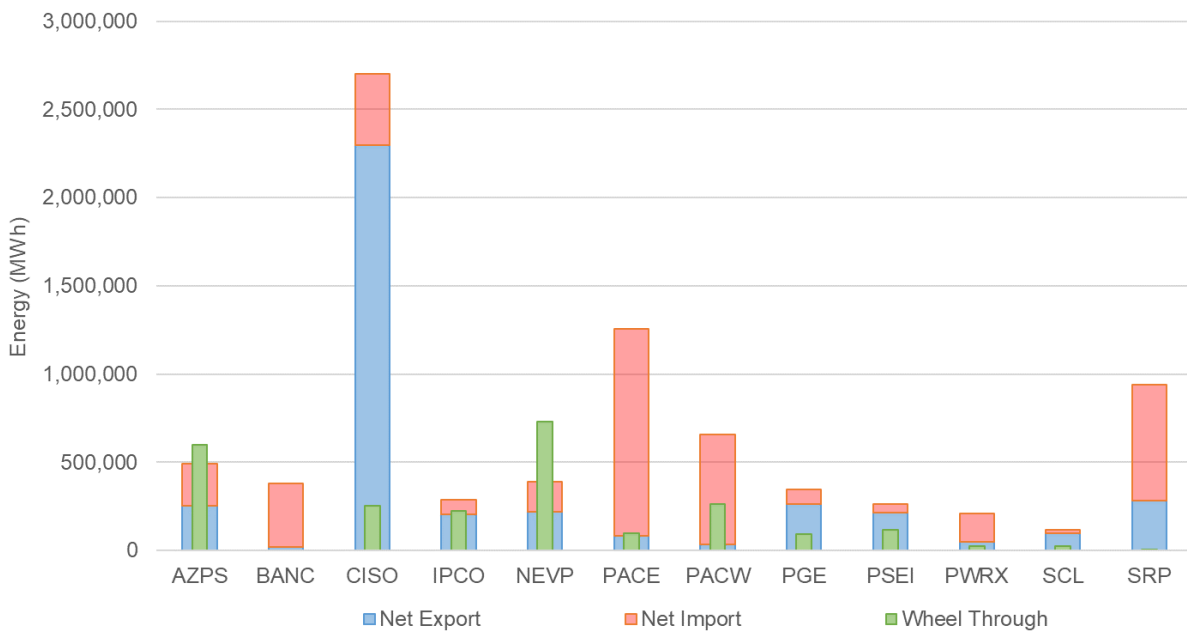
- *Total import*: summation of transfers above base transfers coming into the EIM BAA under analysis
- *Total export*: summation of all transfers above base transfers going out of the EIM BAA under analysis
- *Net import*: the maximum of zero or the difference between total imports and total exports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

All wheel-through transfers are summed over both the month and the quarter. This volume reflects the total wheel-through transfers for each EIM 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 EIM 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.

<i>BAA</i>	<i>Net Export</i>	<i>Net Import</i>	<i>Wheel Through</i>
AZPS	255,206	237,692	597,722
BANC	21,847	360,376	-
CISO	2,299,397	401,569	251,350
IPCO	203,687	82,387	223,218
NEVP	217,227	174,083	731,598
PACE	84,619	1,172,909	98,853
PACW	32,695	624,505	262,645
PGE	261,656	83,525	91,351
PSEI	212,424	49,272	117,363
PWRX	49,345	159,683	23,397
SCL	99,139	16,125	24,221
SRP	281,171	656,289	1,760

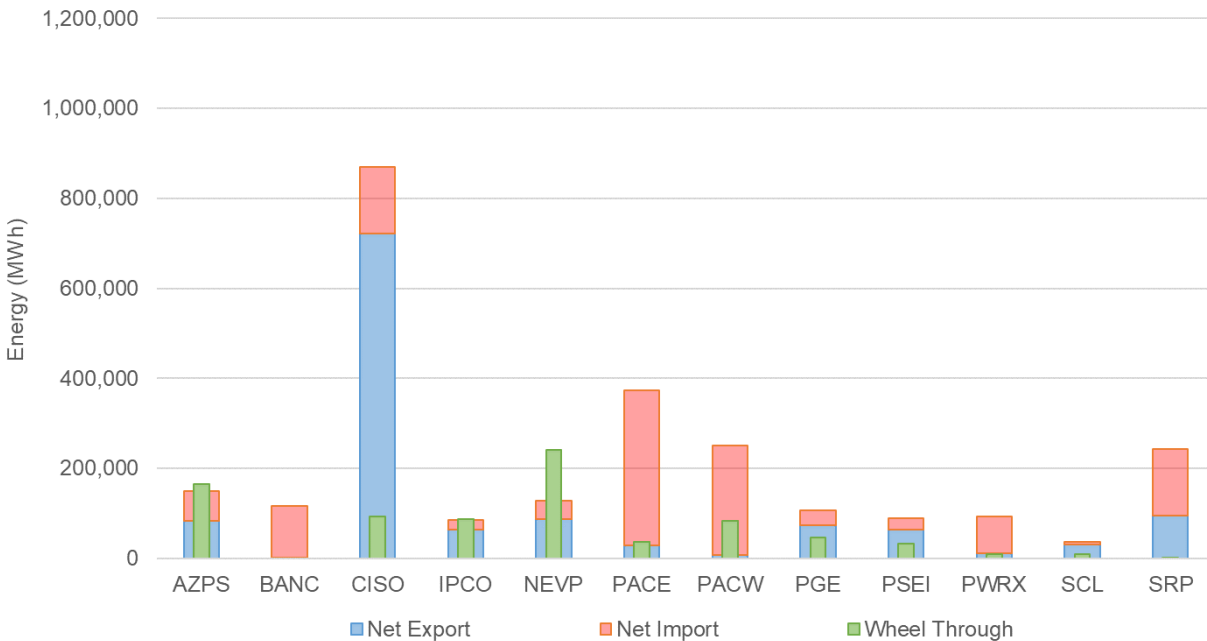
TABLE 3: Estimated wheel-through transfers in Q2 2020



GRAPH 3: Estimated wheel-through transfers in Q2 2020

<i>BAA</i>	Net Export	Net Import	Wheel-Through
<i>AZPS</i>	83,596	65,732	165,511
<i>BANC</i>	1,799	113,707	-
<i>CISO</i>	722,429	146,736	92,414
<i>IPCO</i>	64,639	20,412	86,336
<i>NEVP</i>	86,773	41,601	240,921
<i>PACE</i>	29,647	343,727	36,513
<i>PACW</i>	8,275	243,243	83,680
<i>PGE</i>	74,107	32,446	46,015
<i>PSEI</i>	63,577	26,263	33,529
<i>PWRX</i>	10,485	82,602	9,406
<i>SCL</i>	29,791	6,100	9,033
<i>SRP</i>	95,319	147,870	284

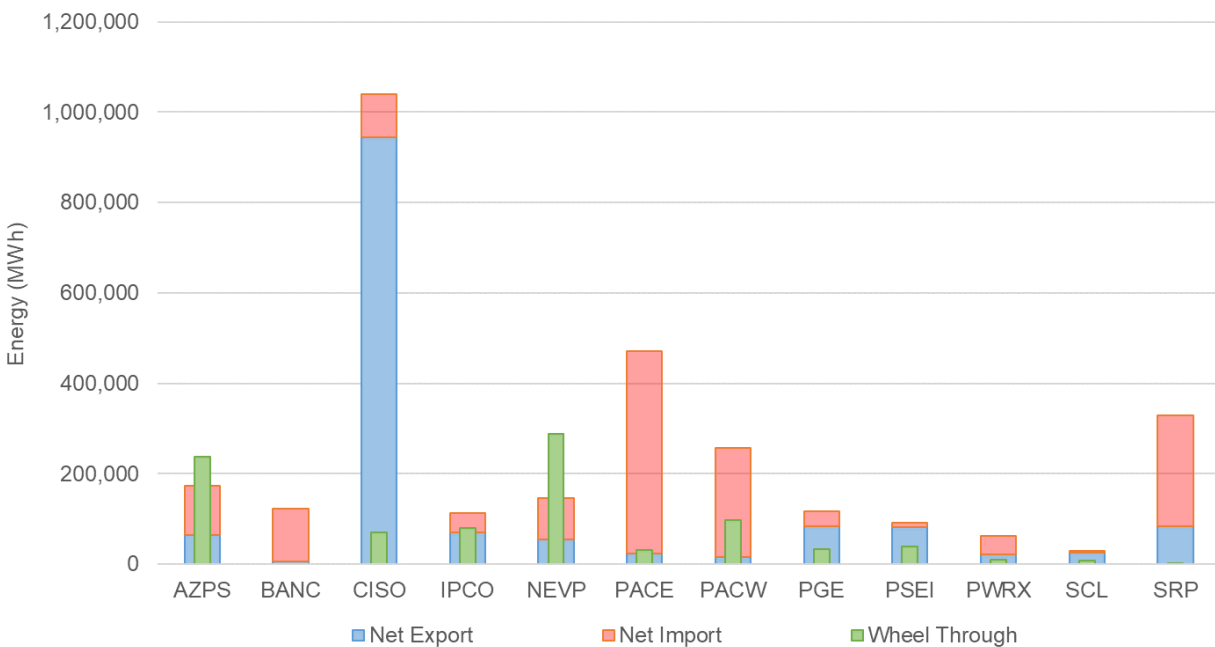
TABLE 4: Estimated wheel-through transfers in April 2020



GRAPH 4: Estimated wheel-through transfers in April 2020

<i>BAA</i>	Net Export	Net Import	Wheel- Through
<i>AZPS</i>	64,425	109,042	236,758
<i>BANC</i>	6,150	115,698	-
<i>CISO</i>	944,955	95,613	69,358
<i>IPCO</i>	70,463	42,336	80,547
<i>NEVP</i>	54,775	90,764	288,375
<i>PACE</i>	23,583	448,096	31,491
<i>PACW</i>	15,308	241,995	96,491
<i>PGE</i>	83,732	32,994	32,752
<i>PSEI</i>	81,645	9,678	39,620
<i>PWRX</i>	20,980	40,672	8,839
<i>SCL</i>	24,483	4,199	7,833
<i>SRP</i>	84,606	244,017	899

TABLE 5: Estimated wheel-through transfers in May 2020

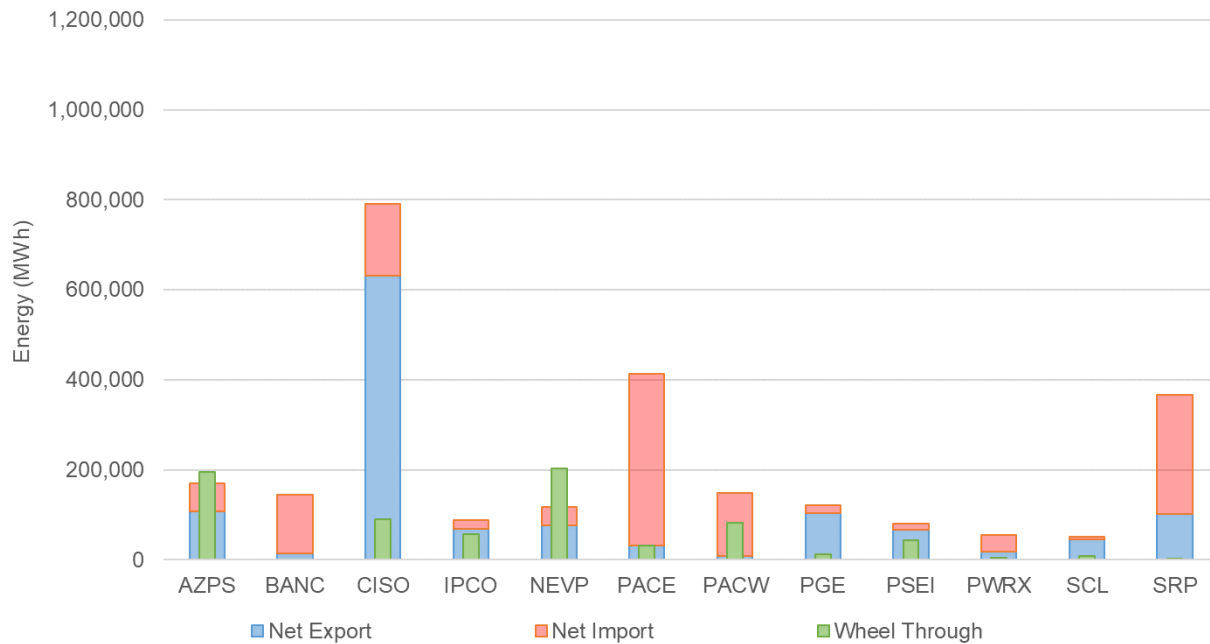


GRAPH 5: Estimated wheel-through transfers in May 2020



<i>BAA</i>	Net Export	Net Import	Wheel Through
<i>AZPS</i>	107,185	62,918	195,454
<i>BANC</i>	13,897	130,970	-
<i>CISO</i>	632,012	159,220	89,578
<i>IPCO</i>	68,585	19,639	56,336
<i>NEVP</i>	75,679	41,719	202,302
<i>PACE</i>	31,390	381,086	30,849
<i>PACW</i>	9,111	139,267	82,474
<i>PGE</i>	103,817	18,084	12,584
<i>PSEI</i>	67,202	13,330	44,215
<i>PWRX</i>	17,881	36,409	5,153
<i>SCL</i>	44,865	5,825	7,355
<i>SRP</i>	101,245	264,401	577

TABLE 6: Estimated wheel-through transfers in June 2020



GRAPH 6: Estimated wheel-through transfers in June 2020

## ■ REDUCED RENEWABLE CURTAILMENT AND GHG REDUCTIONS

The Western EIM 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 EIM, 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 Q2 2020 was calculated to be 51,654 MWh (April) + 60,398 MWh (May) + 35,462 MWh (June) = 147,514 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 CO<sub>2</sub>/MWh, avoided curtailments displaced an estimated 63,136 metric tons of CO<sub>2</sub> for Q2 2020. 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 along with the associated reductions in CO<sub>2</sub> are shown in Table 7.

<b>Year</b>	<b>Quarter</b>	<b>MWh</b>	<b>Eq. Tons CO2</b>
<b>2015</b>	1	8,860	3,792
	2	3,629	1,553
	3	828	354
	4	17,765	7,521
<b>2016</b>	1	112,948	48,342
	2	158,806	67,969
	3	33,094	14,164
	4	23,390	10,011
<b>2017</b>	1	52,651	22,535
	2	67,055	28,700
	3	23,331	9,986
	4	18,060	7,730
<b>2018</b>	1	65,860	28,188
	2	129,128	55,267
	3	19,032	8,146
	4	23,425	10,026
<b>2019</b>	1	52,254	22,365
	2	132,937	56,897

<i>Year</i>	<i>Quarter</i>	<i>MWh</i>	<i>Eq. Tons CO2</i>
<b>2019</b>	3	33,843	14,485
	4	35,254	15,089
<b>2020</b>	1	86,740	37,125
	2	147,514	63,136
<b>Total</b>		1,246,404	533,381

**TABLE 7: Total reduction in curtailment of renewable energy and associated reductions in CO<sub>2</sub>**

### ■ FLEXIBLE RAMPING PROCUREMENT DIVERSITY SAVINGS

The Western EIM 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 EIM 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.

<i>Month</i>	<i>BAA</i>	<i>Direction</i>	<i>Minimum requirement</i>	<i>Maximum requirement</i>
<i>April</i>	<i>AZPS</i>	up	25	235
	<i>BANC</i>	up	3	53
	<i>CISO</i>	up	201	1652
	<i>IPCO</i>	up	19	152
	<i>NEVP</i>	up	23	271
	<i>PACE</i>	up	86	291
	<i>PACW</i>	up	53	197
	<i>PGE</i>	up	49	206
	<i>PSEI</i>	up	20	157
	<i>PWRX</i>	up	56	228
	<i>SCL</i>	up	3	46
	<i>SRP</i>	up	33	198
	<b>ALL EIM</b>	<b>up</b>	<b>332</b>	<b>1,935</b>
	<i>AZPS</i>	down	31	272
<i>BANC</i>	down	7	81	

<i>Month</i>	<b>BAA</b>	<b>Direction</b>	<b>Minimum requirement</b>	<b>Maximum requirement</b>
<i>April</i>	<i>CISO</i>	down	101	1,616
	<i>IPCO</i>	down	81	210
	<i>NEVP</i>	down	22	284
	<i>PACE</i>	down	105	320
	<i>PACW</i>	down	37	140
	<i>PGE</i>	down	63	238
	<i>PSEI</i>	down	30	178
	<i>PWRX</i>	down	79	286
	<i>SCL</i>	down	6	54
	<i>SRP</i>	down	34	156
	<b>ALL EIM</b>	<b>down</b>	<b>293</b>	<b>1,816</b>
<i>May</i>	<i>AZPS</i>	up	3	308
	<i>BANC</i>	up	2	78
	<i>CISO</i>	up	319	1,695
	<i>IPCO</i>	up	14	216
	<i>NEVP</i>	up	18	295
	<i>PACE</i>	up	65	315
	<i>PACW</i>	up	37	197
	<i>PGE</i>	up	37	215
	<i>PSEI</i>	up	5	157
	<i>PWRX</i>	up	73	228
	<i>SCL</i>	up	3	46
	<i>SRP</i>	up	19	188
	<b>ALL EIM</b>	<b>up</b>	<b>353</b>	<b>1,936</b>
	<i>AZPS</i>	down	39	207
	<i>BANC</i>	down	4	75
	<i>CISO</i>	down	142	1,641
	<i>IPCO</i>	down	75	278
	<i>NEVP</i>	down	27	314
	<i>PACE</i>	down	77	345
<i>PACW</i>	down	32	148	

<i>Month</i>	<b>BAA</b>	<b>Direction</b>	<b>Minimum requirement</b>	<b>Maximum requirement</b>
<i>May</i>	<i>PGE</i>	down	47	277
	<i>PSEI</i>	down	30	244
	<i>PWRX</i>	down	58	297
	<i>SCL</i>	down	3	63
	<i>SRP</i>	down	38	146
	<b>ALL EIM</b>	<b>down</b>	<b>194</b>	<b>1,772</b>
<i>June</i>	<i>AZPS</i>	up	14	308
	<i>BANC</i>	up	3	78
	<i>CISO</i>	up	438	1,772
	<i>IPCO</i>	up	33	217
	<i>NEVP</i>	up	20	295
	<i>PACE</i>	up	74	318
	<i>PACW</i>	up	60	171
	<i>PGE</i>	up	57	215
	<i>PSEI</i>	up	18	157
	<i>PWRX</i>	up	41	212
	<i>SCL</i>	up	3	31
	<i>SRP</i>	up	25	151
	<b>ALL EIM</b>	<b>up</b>	<b>465</b>	<b>1,940</b>
	<i>AZPS</i>	down	26	272
	<i>BANC</i>	down	1	67
	<i>CISO</i>	down	261	1,299
	<i>IPCO</i>	down	75	278
	<i>NEVP</i>	down	19	306
	<i>PACE</i>	down	107	345
	<i>PACW</i>	down	42	148
	<i>PGE</i>	down	48	277
	<i>PSEI</i>	down	30	244
	<i>PWRX</i>	down	49	297
	<i>SCL</i>	down	3	63
	<i>SRP</i>	down	29	132
	<b>ALL EIM</b>	<b>down</b>	<b>306</b>	<b>1,453</b>

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 four individual BAA requirements.

<i>Direction</i>	<b>April</b>		<b>May</b>		<b>June</b>	
	Up	Down	Up	Down	Up	Down
<i>Average MW saving</i>	961	945	966	999	953	988
<i>Sum of BAA requirements</i>	1,983	1,998	1,957	1,990	2,050	1,840
<i>Percentage savings</i>	48%	47%	49%	50%	47%	54%

**Table 9: Flexible ramping procurement diversity savings in Q2 2020**

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 EIM-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 EIM 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 across eight western states and extending to the border with Canada, the Western EIM has proven extensive financial and operational benefits for participants. Since its inception in November 2014, the cumulative gross economic benefits have reached \$998.69 million.

The Western EIM 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 533,381 metric tons of CO<sub>2</sub>, roughly the equivalent of avoiding the emissions from 112,141 passenger cars driven for one year.

The Western EIM demonstrates that utilities can realize cost benefits and reduce carbon emissions through increased coordination and optimization in the West.