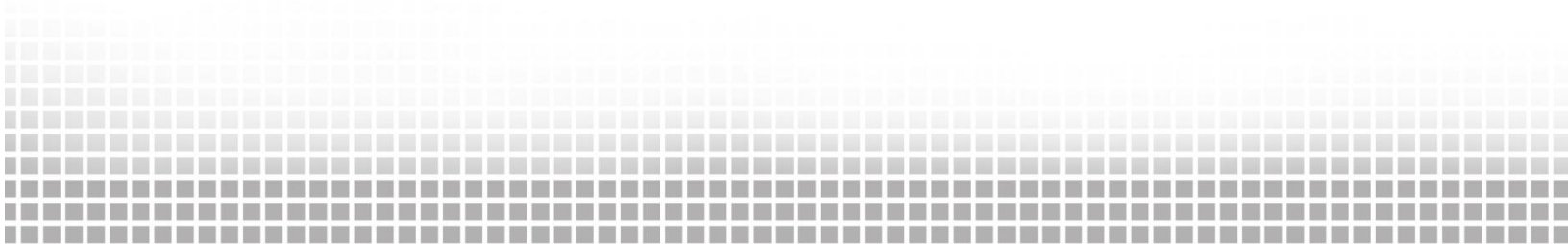


# WESTERN EIM BENEFITS REPORT

**Fourth Quarter 2020** ■ ■ ■

Prepared by: Market Analysis and Forecasting

January 29, 2021



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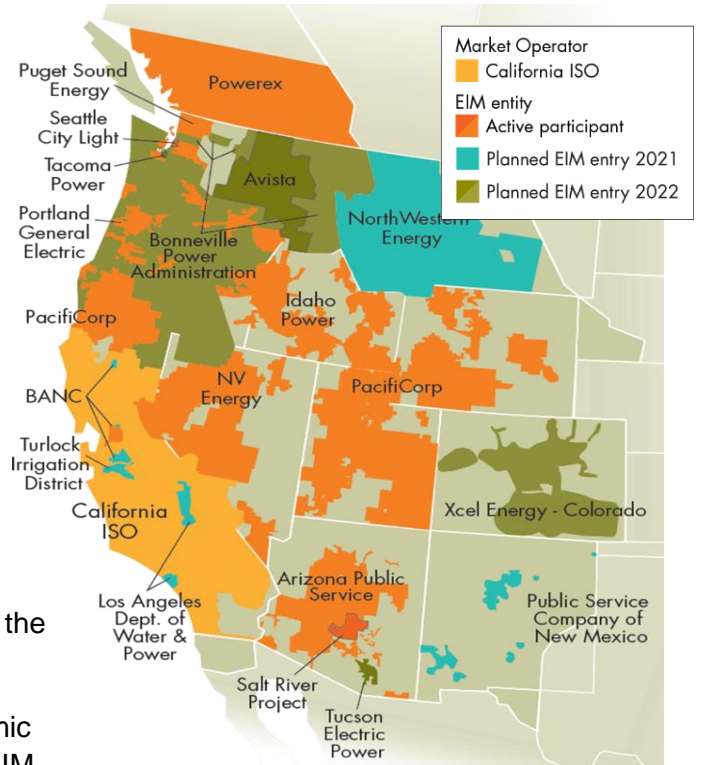
**EXECUTIVE SUMMARY**

Gross benefits from EIM since November 2014  
**\$1.18 billion**

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 Q4 BENEFITS**

**Q4 2020 Gross Benefits by Participant**

	(millions \$)
Arizona Public Service	\$8.70
BANC	\$5.42
California ISO	\$7.54
Idaho Power	\$6.56
NV Energy	\$5.72
PacifiCorp	\$10.90
Portland General Electric	\$6.73
Puget Sound Energy	\$3.73
Powerex	\$0.91
Seattle City Light	\$2.14
Salt River Project	\$10.51
<b>Total</b>	<b>\$68.86</b>

**ECONOMICAL**

**\$68.86 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**

**17,101**

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

**OPERATIONAL**

**48%**

Average reduction in flexibility reserves across the footprint

\*EIM 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 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, and 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 Q4 2020

Table 1 shows the estimated EIM gross benefits by each region per month<sup>3</sup>. The monthly savings presented show \$29.78 million for October, \$22.50 million for November, and \$16.58 million for December with a total estimated benefit of \$68.86 million for the quarter.

<i>Region</i>	October	November	December	Total
<i>APS</i>	\$4.22	\$2.64	\$1.84	\$8.70
<i>BANC</i>	\$2.00	\$2.10	\$1.32	\$5.42
<i>CISO</i>	\$2.41	\$3.79	\$1.34	\$7.54
<i>IPCO</i>	\$2.39	\$2.03	\$2.14	\$6.56
<i>NVE</i>	\$3.73	\$1.60	\$0.39	\$5.72
<i>PAC</i>	\$4.26	\$3.40	\$3.24	\$10.90
<i>PGE</i>	\$2.94	\$1.94	\$1.85	\$6.73
<i>PSE</i>	\$1.34	\$1.24	\$1.15	\$3.73
<i>PWRX</i>	\$0.16	\$0.24	\$0.51	\$0.91
<i>SCL</i>	\$0.79	\$0.73	\$0.62	\$2.14
<i>SRP</i>	\$5.54	\$2.79	\$2.18	\$10.51
<b><i>Total</i></b>	\$29.78	\$22.50	\$16.58	\$68.86

**TABLE 1: Q4 2020 benefits in millions USD**

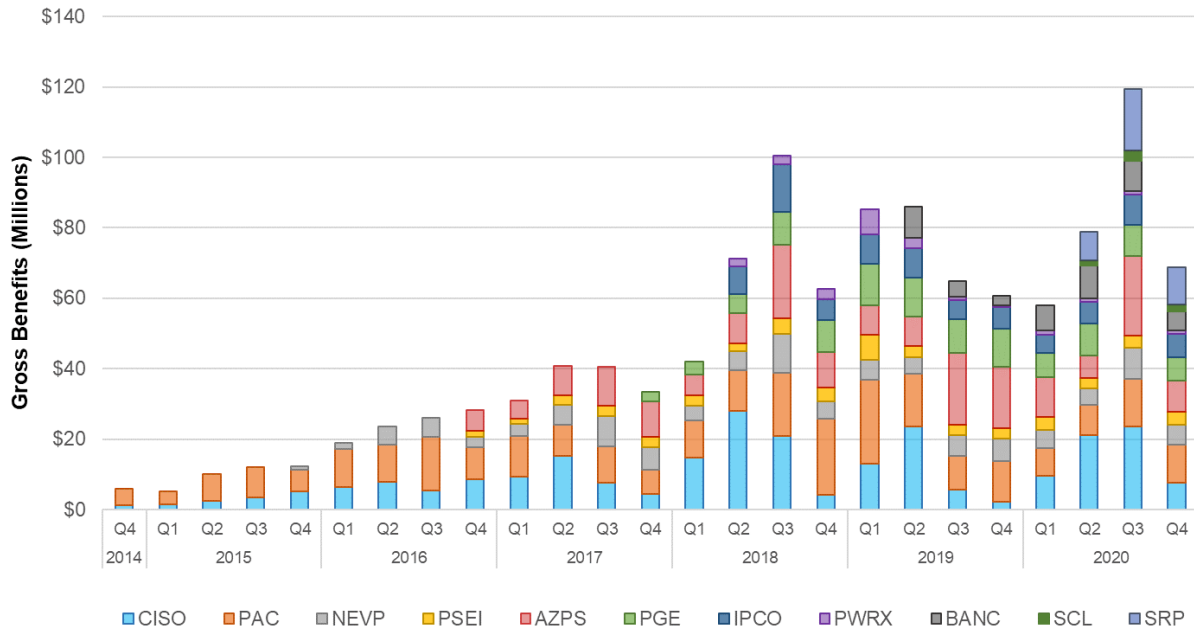
<sup>1</sup> The benefits reflect the Sacramento Municipal Utility District as the participating resource within BANC.

<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 \$1.18 billion. The quarterly benefits have grown over time as a result of the participation of new Balancing Authority Areas (BAA) in the market, which results in additional benefits for both the individual BAAs 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: Gross 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 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 balancing authority areas 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	5min EIM transfer
			(15m – base)	(5m – base)
October	AZPS	CISO	168,332	148,958
	AZPS	NEVP	9,820	7,667
	AZPS	PACE	28,712	27,426
	AZPS	SRP	39,242	36,802
	BANC	CISO	29,932	18,715
	CISO	AZPS	9,220	13,070
	CISO	BANC	80,425	96,438
	CISO	NEVP	11,030	7,784
	CISO	PACW	428	7,658
	CISO	PGE	2,947	12,556
	CISO	PWRX	18,020	34,027
	CISO	SRP	53,386	65,826
	IPCO	NEVP	75,571	52,666
	IPCO	PACE	10,122	8,523
	IPCO	PACW	68,454	76,450
	IPCO	PSEI	13,046	9,811
	IPCO	SCL	6,433	5,915
	NEVP	AZPS	13,935	13,538
	NEVP	CISO	247,959	185,367

Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
October	NEVP	PACE	4,886	4,796
	PACE	AZPS	87,413	79,407
	PACE	IPCO	82,126	78,712
	PACE	NEVP	133,700	113,512
	PACE	PACW	24,586	28,856
	PACE	SRP	0	0
	PACW	CISO	20,226	71,163
	PACW	IPCO	29,901	15,139
	PACW	PGE	61,211	59,163
	PACW	PSEI	31,556	20,937
	PACW	SCL	2,068	1,385
	PGE	CISO	15,976	10,891
	PGE	PACW	27,002	34,285
	PGE	PSEI	1,696	1,018
	PGE	SCL	9,747	8,124
	PSEI	IPCO	0	0
	PSEI	PACW	25,956	35,202
	PSEI	PGE	4,108	4,961
	PSEI	PWRX	44,046	45,273
	PSEI	SCL	5,449	6,458
	PWRX	CISO	5,825	0
	PWRX	PSEI	11,852	15,422
	SCL	IPCO	7,870	7,203
	SCL	PACW	2,782	4,034
	SCL	PGE	3,271	3,858
	SCL	PSEI	21,666	21,728
SRP	AZPS	39,688	38,102	

Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
<i>October</i>	SRP	CISO	163,634	159,393
	SRP	PACE	0	0
<i>November</i>	AZPS	CISO	158,259	100,240
	AZPS	NEVP	3,643	7,089
	AZPS	PACE	47,575	61,239
	AZPS	SRP	18,052	13,893
	BANC	CISO	15,150	7,852
	CISO	AZPS	66,025	81,412
	CISO	BANC	101,828	120,790
	CISO	NEVP	80,359	108,659
	CISO	PACW	1,212	24,362
	CISO	PGE	9,724	23,107
	CISO	PWRX	5,489	9,292
	CISO	SRP	57,592	63,623
	IPCO	NEVP	84,329	46,557
	IPCO	PACE	26,499	25,763
	IPCO	PACW	37,111	45,517
	IPCO	PSEI	672	1,023
	IPCO	SCL	3,344	4,569
	NEVP	AZPS	11,614	5,655
	NEVP	CISO	142,705	81,708
	NEVP	IPCO	24,953	27,665
	NEVP	PACE	35,707	54,272
	PACE	AZPS	125,083	89,299
	PACE	IPCO	32,015	36,995
PACE	NEVP	79,769	54,681	
PACE	PACW	8,258	12,263	

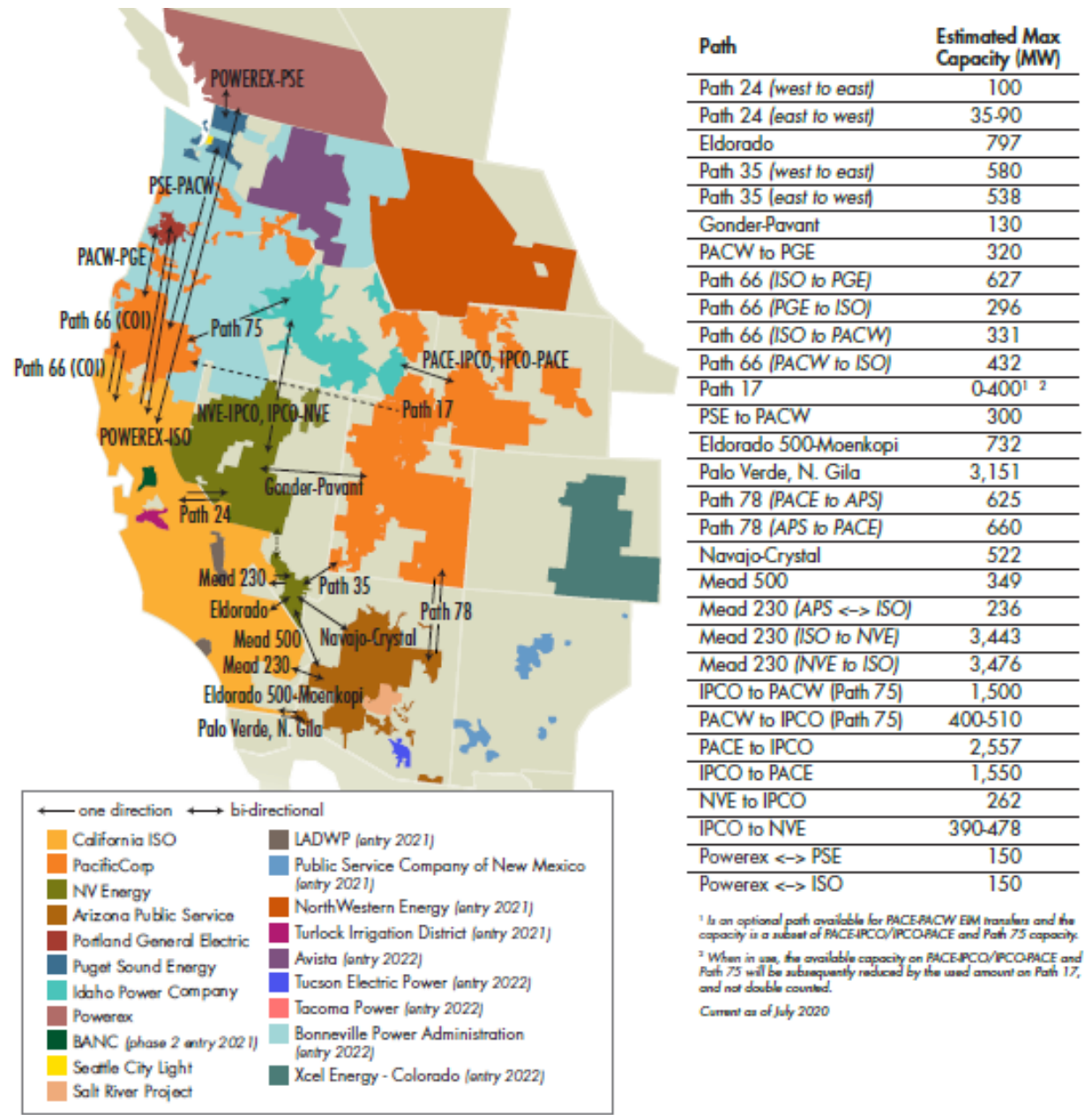


Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
<i>November</i>	PACE	SRP	0	0
	PACW	CISO	19,387	52,849
	PACW	IPCO	48,511	31,783
	PACW	PGE	55,679	62,325
	PACW	PSEI	17,223	18,039
	PACW	SCL	1,412	1,210
	PGE	CISO	9,367	3
	PGE	PACW	27,468	28,338
	PGE	PSEI	1,055	1,349
	PGE	SCL	2,430	2,151
	PSEI	IPCO	0	0
	PSEI	PACW	50,963	55,951
	PSEI	PGE	5,992	6,526
	PSEI	PWRX	28,714	31,561
	PSEI	SCL	16,689	15,383
	PWRX	CISO	10,455	0
	PWRX	PSEI	20,104	21,603
	SCL	IPCO	13,694	11,009
	SCL	PACW	7,020	8,132
	SCL	PGE	3,462	3,845
	SCL	PSEI	12,437	13,811
	SRP	AZPS	8,139	16,586
	SRP	CISO	109,179	96,097
SRP	PACE	0	0	
<i>December</i>	AZPS	CISO	112,088	75,488
	AZPS	NEVP	3,714	5,995
	AZPS	PACE	26,146	42,092

Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
<i>December</i>	AZPS	SRP	18,259	14,938
	BANC	CISO	9,808	5,082
	CISO	AZPS	43,348	58,925
	CISO	BANC	78,369	87,407
	CISO	NEVP	61,284	87,223
	CISO	PACW	6,336	22,159
	CISO	PGE	4,956	17,120
	CISO	PWRX	4,436	7,650
	CISO	SRP	32,764	35,364
	IPCO	NEVP	92,320	69,182
	IPCO	PACE	18,422	19,567
	IPCO	PACW	41,455	43,284
	IPCO	PSEI	0	0
	IPCO	SCL	4,836	5,235
	NEVP	AZPS	5,226	3,975
	NEVP	CISO	138,938	91,807
	NEVP	IPCO	19,879	19,961
	NEVP	PACE	22,032	32,348
	PACE	AZPS	129,450	107,902
	PACE	IPCO	18,927	20,011
	PACE	NEVP	83,600	67,692
	PACE	PACW	12,926	13,360
	PACE	SRP	0	0
	PACW	CISO	39,132	43,663
	PACW	IPCO	46,573	36,213
	PACW	PGE	38,422	39,498
PACW	PSEI	14,002	15,053	

Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
<i>December</i>	PACW	SCL	1,226	1,181
	PGE	CISO	28,138	639
	PGE	PACW	42,675	48,129
	PGE	PSEI	5,081	5,941
	PGE	SCL	2,846	2,598
	PSEI	IPCO	0	0
	PSEI	PACW	49,864	57,705
	PSEI	PGE	13,813	16,425
	PSEI	PWRX	16,824	15,814
	PSEI	SCL	20,944	24,423
	PWRX	CISO	12,418	7
	PWRX	PSEI	41,409	52,430
	SCL	IPCO	11,498	10,508
	SCL	PACW	5,535	6,928
	SCL	PGE	2,814	3,375
	SCL	PSEI	6,450	6,048
	SRP	AZPS	23,923	38,541
	SRP	CISO	147,514	124,690
	SRP	PACE	0	0

**TABLE 2: Energy transfers (MWh) in the FMM and RTD markets for Q4 2020**



GRAPH 2: Estimated maximum transfer capacity (EIM entities operating in Q4 2020)

### WHEEL THROUGH TRANSFERS

As the footprint of the Western EIM grows, 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	225,934	230,161	317,201
BANC	31,843	305,031	-
CISO	708,025	996,082	279,848
IPCO	172,343	65,485	242,591
NEVP	126,569	219,947	407,915
PACE	656,033	232,266	44,737
PACW	141,170	223,592	329,061
PGE	118,042	227,612	25,787
PSEI	193,005	82,606	121,938
PWRX	80,960	134,960	8,671
SCL	64,397	43,296	35,548
SRP	473,285	230,570	550

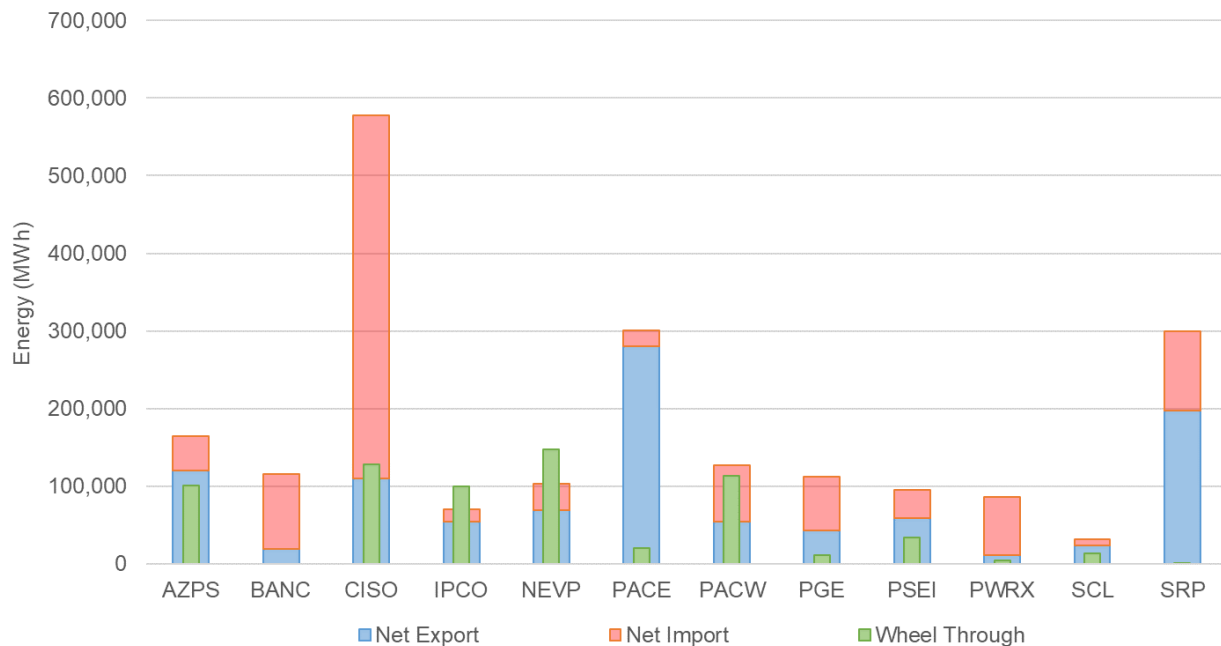
TABLE 3: Estimated wheel-through transfers in Q4 2020



GRAPH 3: Estimated wheel-through transfers in Q4 2020

<i>BAA</i>	Net Export	Net Import	Wheel-Through
<i>AZPS</i>	120,571	43,721	100,465
<i>BANC</i>	18,715	96,592	-
<i>CISO</i>	109,990	467,261	127,732
<i>IPCO</i>	54,583	15,116	99,092
<i>NEVP</i>	68,963	33,930	147,858
<i>PACE</i>	280,543	20,459	20,286
<i>PACW</i>	54,091	72,852	113,816
<i>PGE</i>	42,843	69,132	11,482
<i>PSEI</i>	58,738	35,838	33,235
<i>PWRX</i>	11,214	75,144	4,250
<i>SCL</i>	23,003	8,098	13,840
<i>SRP</i>	197,438	102,548	135

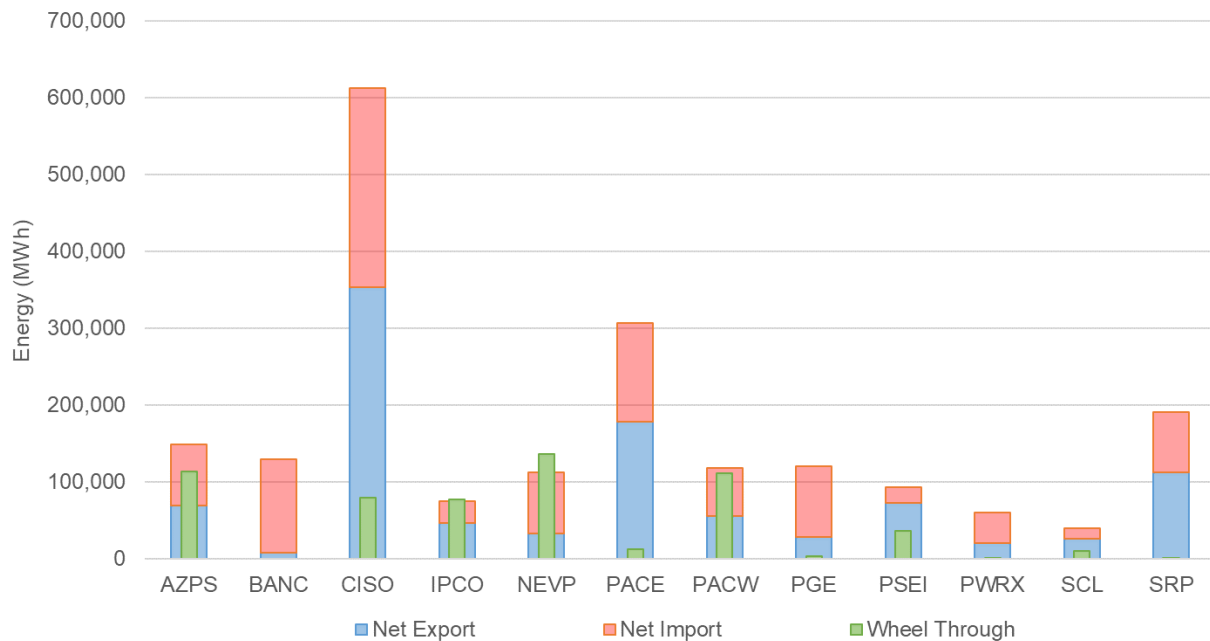
TABLE 4: Estimated wheel-through transfers in October 2020



GRAPH 4: Estimated wheel-through transfers in October 2020

<i>BAA</i>	Net Export	Net Import	Wheel- Through
<i>AZPS</i>	69,475	79,600	113,931
<i>BANC</i>	8,046	120,911	-
<i>CISO</i>	353,075	259,283	80,026
<i>IPCO</i>	46,029	29,234	77,783
<i>NEVP</i>	32,892	79,183	136,099
<i>PACE</i>	177,864	128,832	12,879
<i>PACW</i>	55,339	62,974	111,228
<i>PGE</i>	28,277	92,353	3,873
<i>PSEI</i>	72,616	19,982	35,911
<i>PWRX</i>	20,316	39,356	1,383
<i>SCL</i>	26,091	13,248	10,141
<i>SRP</i>	112,875	77,939	106

TABLE 5: Estimated wheel-through transfers in November 2020

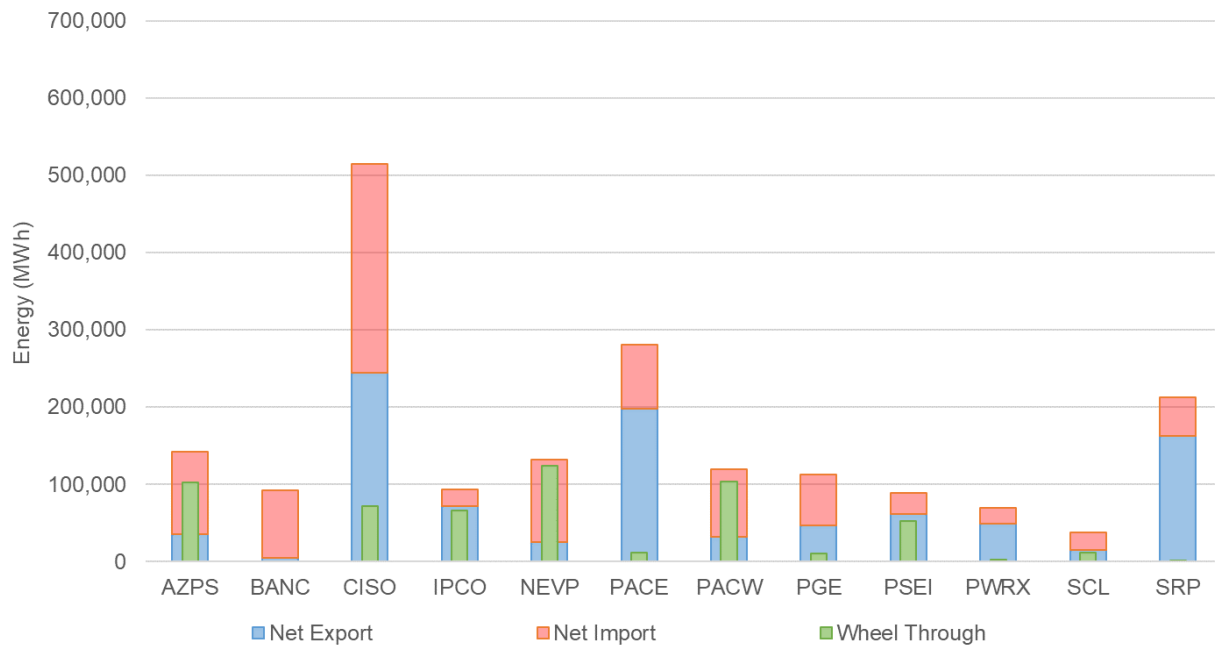


GRAPH 5: Estimated wheel-through transfers in November 2020



<i>BAA</i>	Net Export	Net Import	Wheel Through
<i>AZPS</i>	35,888	106,840	102,805
<i>BANC</i>	5,082	87,529	-
<i>CISO</i>	244,961	269,538	72,089
<i>IPCO</i>	71,731	21,135	65,716
<i>NEVP</i>	24,714	106,833	123,958
<i>PACE</i>	197,627	82,974	11,571
<i>PACW</i>	31,740	87,766	104,017
<i>PGE</i>	46,922	66,127	10,432
<i>PSEI</i>	61,651	26,786	52,792
<i>PWRX</i>	49,430	20,459	3,039
<i>SCL</i>	15,303	21,951	11,568
<i>SRP</i>	162,972	50,083	309

TABLE 6: Estimated wheel-through transfers in December 2020



GRAPH 6: Estimated wheel-through transfers in December 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 Q4 2020 was calculated to be 4,678 MWh (October) + 20,908 MWh (November) + 14,370 MWh (December) = 39,956 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 17,101 metric tons of CO<sub>2</sub> for Q4 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 CO<sub>2</sub></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 CO<sub>2</sub></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
	3	37,548	16,071
	4	39,956	17,101
	<b>Total</b>	1,323,908	586,553

**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.

<b>Month</b>	<b>BAA</b>	<b>Direction</b>	<b>Minimum requirement</b>	<b>Maximum requirement</b>
<i>October</i>	<i>AZPS</i>	up	31	289
	<i>BANC</i>	up	6	80
	<i>CISO</i>	up	369	1776
	<i>IPCO</i>	up	20	217
	<i>NEVP</i>	up	29	280
	<i>PACE</i>	up	77	311
	<i>PACW</i>	up	48	171
	<i>PGE</i>	up	50	215
	<i>PSEI</i>	up	25	157
	<i>PWRX</i>	up	56	216
	<i>SCL</i>	up	4	40
	<i>SRP</i>	up	2	151

Month	BAA	Direction	Minimum requirement	Maximum requirement
October	<b>ALL EIM</b>	<b>up</b>	<b>484</b>	<b>2,080</b>
	AZPS	down	21	272
	BANC	down	6	101
	CISO	down	130	1,295
	IPCO	down	47	224
	NEVP	down	24	256
	PACE	down	71	345
	PACW	down	35	148
	PGE	down	27	216
	PSEI	down	35	167
	PWRX	down	77	242
	SCL	down	2	36
	SRP	down	18	132
	<b>ALL EIM</b>	<b>down</b>	<b>189</b>	<b>1,761</b>
November	AZPS	up	0	259
	BANC	up	0	54
	CISO	up	0	1,776
	IPCO	up	0	217
	NEVP	up	0	280
	PACE	up	0	318
	PACW	up	0	171
	PGE	up	0	215
	PSEI	up	0	157
	PWRX	up	0	250
	SCL	up	0	40
	SRP	up	0	151
	<b>ALL EIM</b>	<b>up</b>	<b>0</b>	<b>2,080</b>
	AZPS	down	0	272
BANC	down	0	76	

Month	BAA	Direction	Minimum requirement	Maximum requirement
<i>November</i>	<i>CISO</i>	down	0	1,295
	<i>IPCO</i>	down	0	211
	<i>NEVP</i>	down	0	315
	<i>PACE</i>	down	0	345
	<i>PACW</i>	down	0	148
	<i>PGE</i>	down	0	206
	<i>PSEI</i>	down	0	190
	<i>PWRX</i>	down	0	246
	<i>SCL</i>	down	0	42
	<i>SRP</i>	down	0	132
	<b>ALL EIM</b>	<b>down</b>	<b>0</b>	<b>1,851</b>
<i>December</i>	<i>AZPS</i>	up	83	276
	<i>BANC</i>	up	6	59
	<i>CISO</i>	up	280	2,392
	<i>IPCO</i>	up	25	219
	<i>NEVP</i>	up	24	261
	<i>PACE</i>	up	85	328
	<i>PACW</i>	up	62	181
	<i>PGE</i>	up	46	263
	<i>PSEI</i>	up	44	196
	<i>PWRX</i>	up	56	253
	<i>SCL</i>	up	4	52
	<i>SRP</i>	up	33	180
	<b>ALL EIM</b>	<b>up</b>	<b>407</b>	<b>2,666</b>
	<i>AZPS</i>	down	12	243
	<i>BANC</i>	down	3	70
	<i>CISO</i>	down	147	1,303
	<i>IPCO</i>	down	46	224
<i>NEVP</i>	down	20	339	

<b>BAA</b>	<b>Direction</b>	<b>Minimum requirement</b>	<b>Maximum Requirement</b>
<i>PACE</i>	down	112	391
<i>PACW</i>	down	25	173
<i>PGE</i>	down	43	206
<i>PSEI</i>	down	40	165
<i>PWRX</i>	down	64	251
<i>SCL</i>	down	1	43
<i>SRP</i>	down	14	218
<b>ALL EIM</b>	<b>down</b>	<b>216</b>	<b>1,807</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.

	<b>October</b>		<b>November</b>		<b>December</b>	
<i>Direction</i>	Up	Down	Up	Down	Up	Down
<i>Average MW saving</i>	831	882	828	872	962	914
<i>Sum of BAA requirements</i>	2,116	1,698	1,871	1,711	1,947	1,772
<i>Percentage savings</i>	39%	52%	44%	51%	49%	52%

**Table 9: Flexible ramping procurement diversity savings in Q4 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, the Western EIM demonstrates that utilities can realize financial and operational benefits through increased coordination and optimization. In addition to these benefits, 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 566,553 metric tons of CO<sub>2</sub>, roughly the equivalent of avoiding the emissions from 119,115 passenger cars driven for one year.

## Appendix 1: Glossary of Abbreviations

<b>Abbreviation</b>	<b>Description</b>
APS	Arizona Public Service
BAA	Balancing Authority Area
BANC	Balancing Authority of Northern California
CISO, ISO	California ISO
EIM	Energy Imbalance Market
FMM	Fifteen Minute Market
GHG	Greenhouse Gas
IPCO	Idaho 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