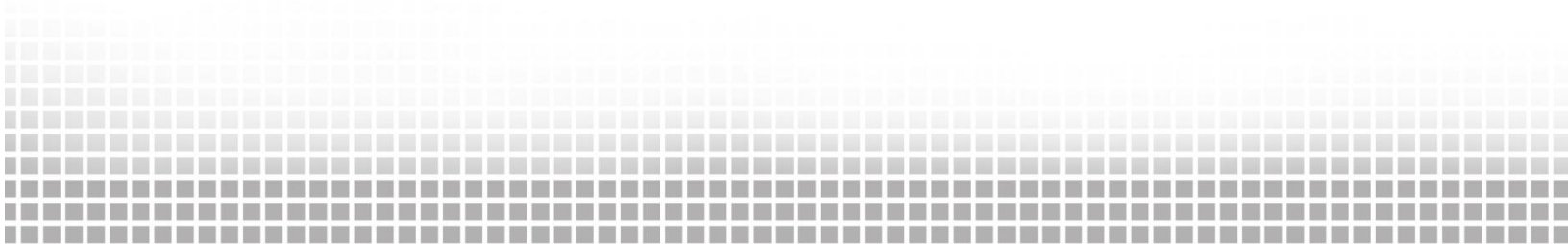


WESTERN EIM BENEFITS REPORT

First Quarter 2021 ■ ■ ■

Prepared by: Market Analysis and Forecasting

April 29, 2021



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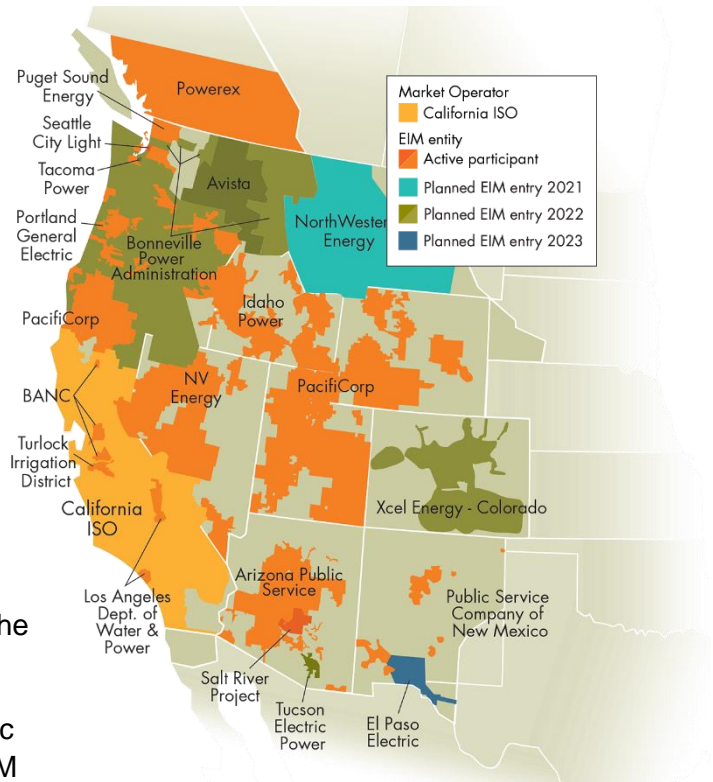
EXECUTIVE SUMMARY

Gross benefits from EIM since November 2014
\$1.28 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.



2021 Q1 BENEFITS

Q1 2021 Gross Benefits by Participant

	(millions \$)
Arizona Public Service	\$15.01
BANC	\$7.53
California ISO	\$8.91
Idaho Power	\$12.54
NV Energy	\$14.14
PacifiCorp	\$20.48
Portland General Electric	\$8.80
Puget Sound Energy	\$4.31
Powerex	\$1.17
Seattle City Light	\$2.60
Salt River Project	\$5.52
Total	\$101.01

ECONOMICAL

\$101.01 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

32,591

Metric tons of CO₂** avoided curtailments

OPERATIONAL

50%

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)¹ began participating in April 2019. Seattle City Light and Salt River Project began participating in April 2020.

Most recently, three new balancing authorities began participating in the Western EIM, with the Turlock Irrigation District in March 2021² and the Los Angeles Department of Water and Power and Public Service Company of New Mexico in April 2021. The second phase of BANC also began participating in March 2021 as well.

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

■ WESTERN EIM ECONOMIC BENEFITS IN Q1 2021

Table 1 shows the estimated EIM gross benefits by each region per month³. The monthly savings presented show \$15.77 million for January, \$61.70 million for February, and \$23.54 million for March with a total estimated benefit of \$101.01 million for this quarter.

The increased benefits observed on February 2021 was largely driven by the extreme gas prices in mid-February that resulted in high electric energy prices.

<i>Region</i>	January	February	March	Total
<i>APS</i>	\$1.73	\$11.16	\$2.12	\$15.01
<i>BANC</i>	\$1.96	\$3.41	\$2.16	\$7.53
<i>CISO</i>	\$0.79	\$4.80	\$3.32	\$8.91
<i>IPCO</i>	\$1.93	\$8.12	\$2.49	\$12.54
<i>NVE</i>	\$1.36	\$10.99	\$1.79	\$14.14
<i>PAC</i>	\$2.53	\$14.41	\$3.54	\$20.48
<i>PGE</i>	\$1.64	\$3.62	\$3.54	\$8.80

¹ The benefits for BANC reflects only the Sacramento Municipal Utility District through March 24 since Modesto Irrigation District, the City of Redding, the City of Roseville, and the Western Area Power Administration – Sierra Nevada Region became part of the overall BANC EIM on March 25. Benefits for BANC for March 25 through March 31 will be included in Q2-2021 benefits.

² Benefits for TID for March 25 through March 31 will be incorporated in Q2-2021 benefits report along with the other new EIM Entities.

³ 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.

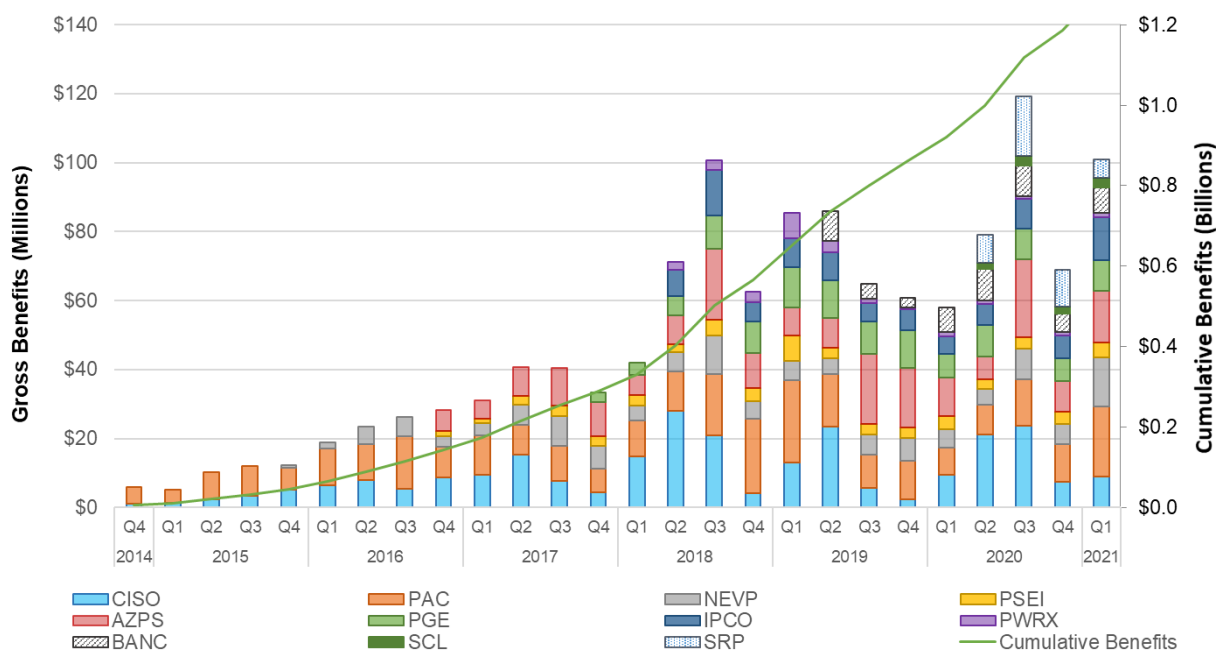
Region	January	February	March	Total
PSE	\$1.37	\$1.62	\$1.32	\$4.31
PWRX	\$0.20	\$0.62	\$0.35	\$1.17
SCL	\$0.80	\$1.08	\$0.72	\$2.60
SRP	\$1.46	\$1.87	\$2.19	\$5.52
Total	\$15.77	\$61.70	\$23.54	\$101.01

TABLE 1: Q1 2021 benefits in millions USD

CUMULATIVE ECONOMIC BENEFITS SINCE INCEPTION

Since the start of the EIM in November 2014, the cumulative economic benefits of the market have totaled \$1.28 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 EIM benefit reports in April 2015.⁴

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



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)

⁴ Prior reports are available at <https://www.westerneim.com/Pages/About/QuarterlyBenefits.aspx>

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 (15m – base)	5min EIM transfer (5m – base)
<i>January</i>	AZPS	CISO	123,307	91,442
	AZPS	NEVP	4,263	7,005
	AZPS	PACE	42,398	53,563
	AZPS	SRP	34,890	33,216
	BANC	CISO	2,852	1,921
	CISO	AZPS	55,596	59,668
	CISO	BANC	119,443	128,444
	CISO	NEVP	98,976	107,887
	CISO	PACW	2,888	17,963
	CISO	PGE	5,573	12,875

Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
<i>January</i>	CISO	PWRX	3,584	8,892
	CISO	SRP	41,890	45,350
	IPCO	NEVP	88,016	62,003
	IPCO	PACE	36,933	41,660
	IPCO	PACW	19,214	17,252
	IPCO	PSEI	0	0
	IPCO	SCL	2,331	2,635
	NEVP	AZPS	4,426	4,336
	NEVP	CISO	178,543	113,343
	NEVP	IPCO	29,694	33,329
	NEVP	PACE	56,540	65,786
	PACE	AZPS	94,245	81,719
	PACE	IPCO	13,585	14,684
	PACE	NEVP	59,325	25,073
	PACE	PACW	5,329	5,129
	PACE	SRP	0	0
	PACW	CISO	64,774	64,174
	PACW	IPCO	72,571	56,883
	PACW	PGE	19,346	15,434
	PACW	PSEI	12,406	13,029
	PACW	SCL	1,264	978
	PGE	CISO	19,675	3
	PGE	PACW	60,823	75,932
	PGE	PSEI	8,101	9,050
	PGE	SCL	2,500	2,215
	PSEI	IPCO	0	0
PSEI	PACW	20,398	23,438	

Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
<i>January</i>	PSEI	PGE	33,678	43,859
	PSEI	PWRX	42,632	44,477
	PSEI	SCL	19,683	19,780
	PWRX	CISO	12,885	2
	PWRX	PSEI	12,824	16,396
	SCL	IPCO	16,567	15,924
	SCL	PACW	10,235	12,100
	SCL	PGE	3,131	3,814
	SCL	PSEI	14,477	14,754
	SRP	AZPS	10,637	17,262
	SRP	CISO	84,613	71,852
	SRP	PACE	0	0
<i>February</i>	AZPS	CISO	81,909	57,656
	AZPS	NEVP	3,770	5,098
	AZPS	PACE	37,495	40,657
	AZPS	SRP	25,238	23,872
	BANC	CISO	9,261	6,524
	CISO	AZPS	75,348	82,605
	CISO	BANC	110,899	124,011
	CISO	NEVP	152,889	173,994
	CISO	PACW	5,631	28,793
	CISO	PGE	11,743	25,631
	CISO	PWRX	4,861	11,562
	CISO	SRP	50,244	54,720
	IPCO	NEVP	63,707	49,025
	IPCO	PACE	29,343	28,603
	IPCO	PACW	36,588	47,000

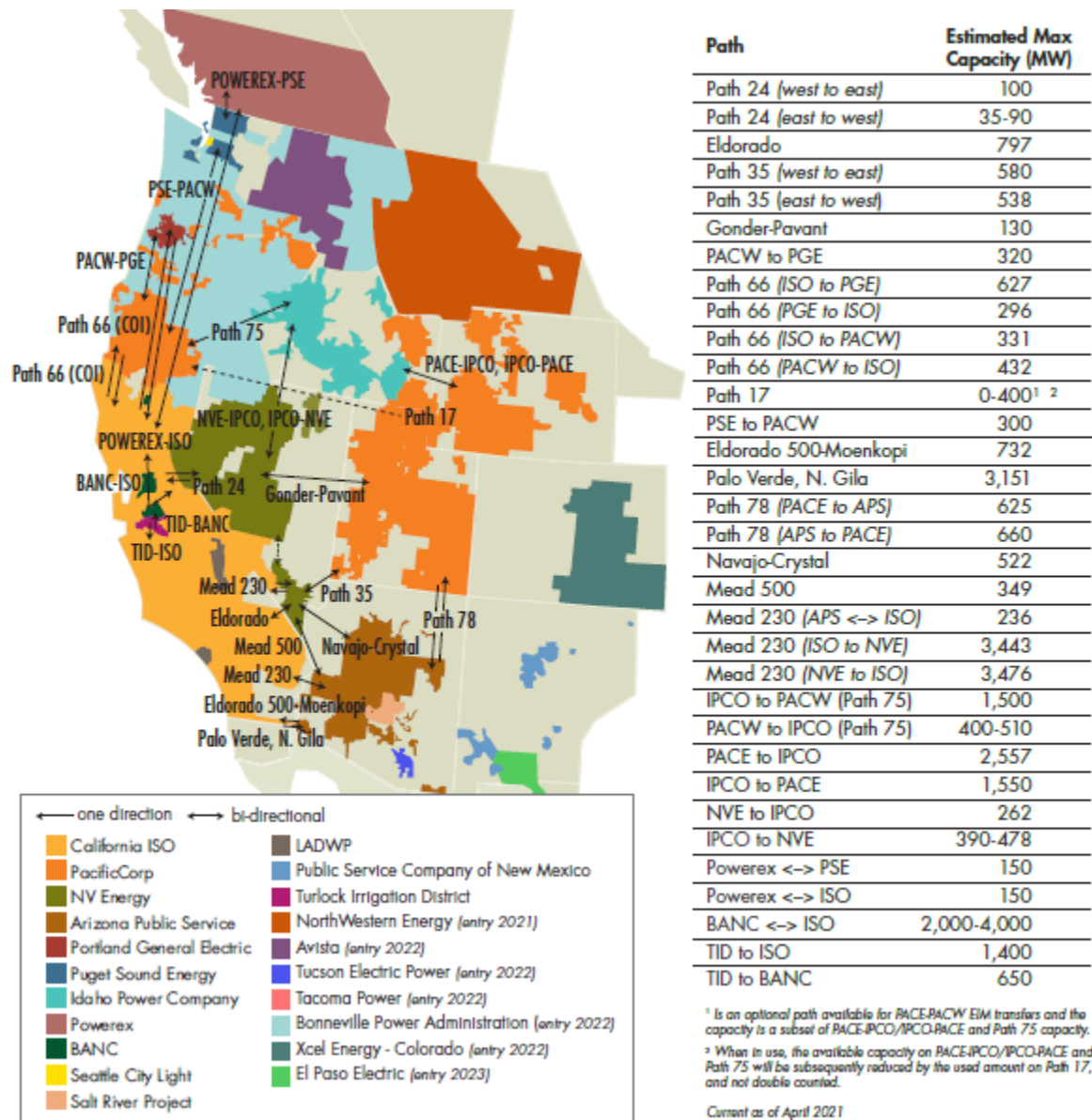
Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
<i>February</i>	IPCO	PSEI	0	0
	IPCO	SCL	4,796	6,057
	NEVP	AZPS	6,270	4,840
	NEVP	CISO	152,169	97,741
	NEVP	IPCO	65,572	73,717
	NEVP	PACE	68,599	80,796
	PACE	AZPS	83,639	71,813
	PACE	IPCO	44,639	47,745
	PACE	NEVP	70,667	45,781
	PACE	PACW	13,291	15,175
	PACE	SRP	0	0
	PACW	CISO	28,947	50,228
	PACW	IPCO	35,301	24,711
	PACW	PGE	36,628	37,463
	PACW	PSEI	25,586	30,321
	PACW	SCL	2,150	2,079
	PGE	CISO	21,851	54
	PGE	PACW	38,512	52,492
	PGE	PSEI	16,452	20,807
	PGE	SCL	3,557	3,737
	PSEI	IPCO	0	0
	PSEI	PACW	12,772	13,531
	PSEI	PGE	23,610	25,400
	PSEI	PWRX	28,280	30,595
	PSEI	SCL	24,885	25,776
	PWRX	CISO	9,526	25
	PWRX	PSEI	28,255	30,363

Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
<i>February</i>	SCL	IPCO	10,925	9,107
	SCL	PACW	5,942	7,022
	SCL	PGE	2,204	2,533
	SCL	PSEI	9,282	11,579
	SRP	AZPS	6,649	8,091
	SRP	CISO	51,362	45,876
	SRP	PACE	0	0
<i>March</i>	AZPS	CISO	110,552	87,281
	AZPS	NEVP	2,783	5,862
	AZPS	PACE	44,300	55,231
	AZPS	SRP	19,605	17,228
	BANC	CISO	1,614	1,899
	CISO	AZPS	71,716	81,618
	CISO	BANC	102,863	108,930
	CISO	NEVP	124,067	130,005
	CISO	PACW	4,348	34,860
	CISO	PGE	14,628	29,398
	CISO	PWRX	7,210	13,196
	CISO	SRP	55,021	60,404
	IPCO	NEVP	46,498	34,112
	IPCO	PACE	11,741	16,794
	IPCO	PACW	21,652	24,637
	IPCO	PSEI	0	0
	IPCO	SCL	5,829	6,649
	NEVP	AZPS	4,927	4,038
	NEVP	CISO	150,523	104,732
	NEVP	IPCO	43,683	50,962

Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
<i>March</i>	NEVP	PACE	60,510	66,649
	PACE	AZPS	82,949	66,239
	PACE	IPCO	47,046	52,702
	PACE	NEVP	64,953	46,310
	PACE	PACW	22,062	27,985
	PACE	SRP	0	0
	PACW	CISO	34,999	43,842
	PACW	IPCO	49,229	40,992
	PACW	PGE	30,789	31,285
	PACW	PSEI	30,326	36,356
	PACW	SCL	2,272	2,370
	PGE	CISO	18,323	6
	PGE	PACW	45,534	57,130
	PGE	PSEI	17,484	24,725
	PGE	SCL	4,262	4,506
	PSEI	IPCO	10,415	8,610
	PSEI	PACW	29,647	37,194
	PSEI	PGE	10,311	11,685
	PSEI	PWRX	27,339	28,700
	PSEI	SCL	23,707	26,513
	PWRX	CISO	12,557	1
	PWRX	PSEI	41,837	44,567
	SCL	IPCO	10,430	9,349
	SCL	PACW	3,832	4,644
	SCL	PGE	2,012	2,278
	SCL	PSEI	15,919	17,968
	SRP	AZPS	8,206	12,479

Month	From BAA	To BAA	15min EIM transfer (15m – base)	5min EIM transfer (5m – base)
March	SRP	CISO	84,532	74,529
	SRP	PACE	0	0

TABLE 2: Energy transfers (MWh) in the FMM and RTD markets for Q1 2021



GRAPH 2: Estimated maximum transfer capacity (EIM entities operating in Q1 2021)

■ 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:

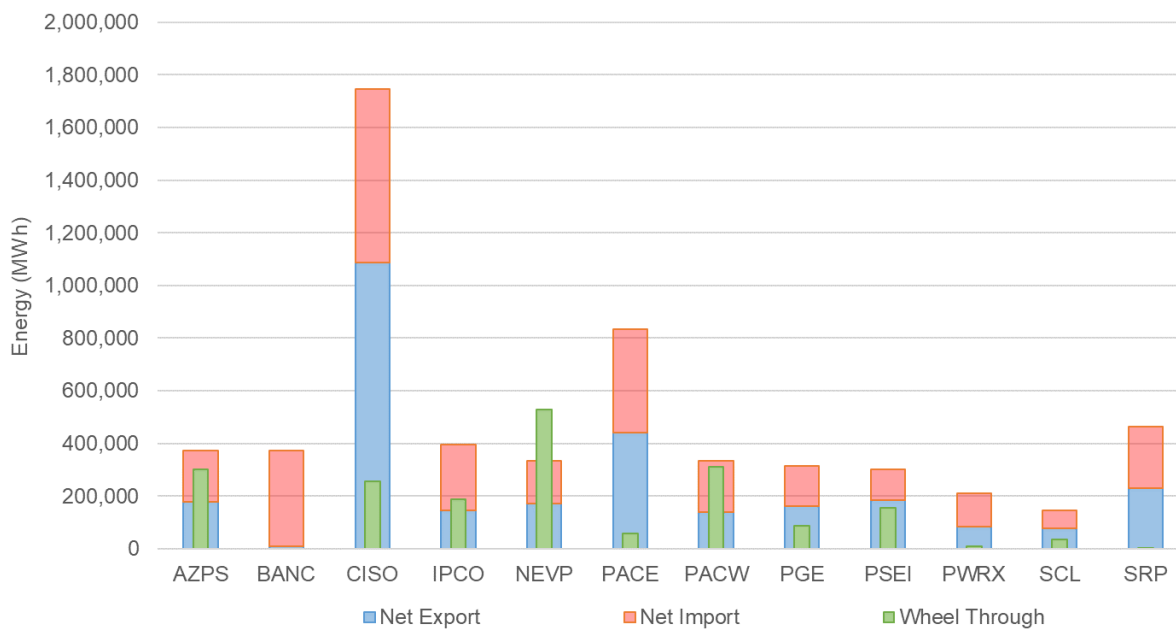
- *Total import*: summation of transfers above base transfers coming into the EIM BAA under analysis
- *Total export*: summation of all transfers above base transfers going out of the EIM BAA under analysis
- *Net import*: the maximum of zero or the difference between total imports and total exports
- *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>
<i>AZPS</i>	178,433	194,757	300,603
<i>BANC</i>	10,355	361,995	-
<i>CISO</i>	1,086,844	658,486	255,781
<i>IPCO</i>	147,446	249,709	189,501
<i>NEVP</i>	171,558	163,641	529,312
<i>PACE</i>	442,496	391,878	58,424
<i>PACW</i>	140,739	192,488	310,315
<i>PGE</i>	161,808	153,004	89,097
<i>PSEI</i>	185,510	115,661	154,594
<i>PWRX</i>	83,126	129,381	8,290
<i>SCL</i>	76,763	68,935	34,523
<i>SRP</i>	229,829	234,973	321

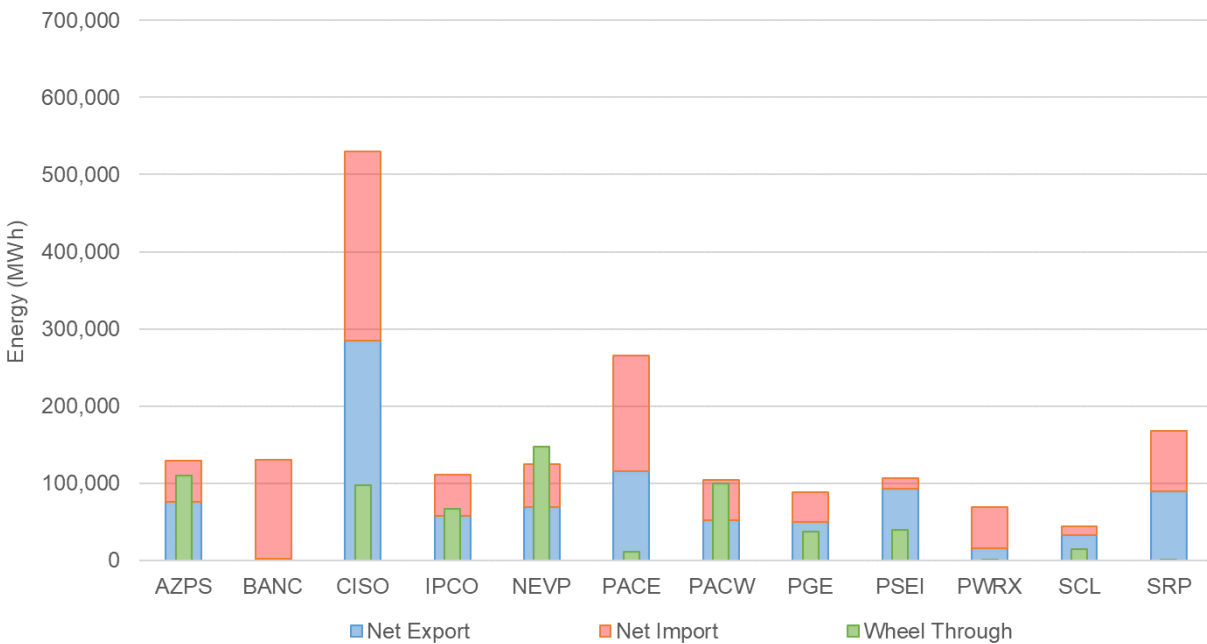
TABLE 3: Estimated wheel-through transfers in Q1 2021



GRAPH 3: Estimated wheel-through transfers in Q1 2021

<i>BAA</i>	Net Export	Net Import	Wheel-Through
<i>AZPS</i>	75,953	53,520	109,753
<i>BANC</i>	1,921	128,840	-
<i>CISO</i>	284,297	245,282	97,927
<i>IPCO</i>	57,113	54,217	66,802
<i>NEVP</i>	69,470	54,807	147,621
<i>PACE</i>	115,200	149,956	11,512
<i>PACW</i>	51,773	52,856	99,187
<i>PGE</i>	49,912	38,782	37,397
<i>PSEI</i>	92,630	14,073	39,226
<i>PWRX</i>	15,838	52,890	597
<i>SCL</i>	32,271	11,290	14,402
<i>SRP</i>	88,893	78,757	221

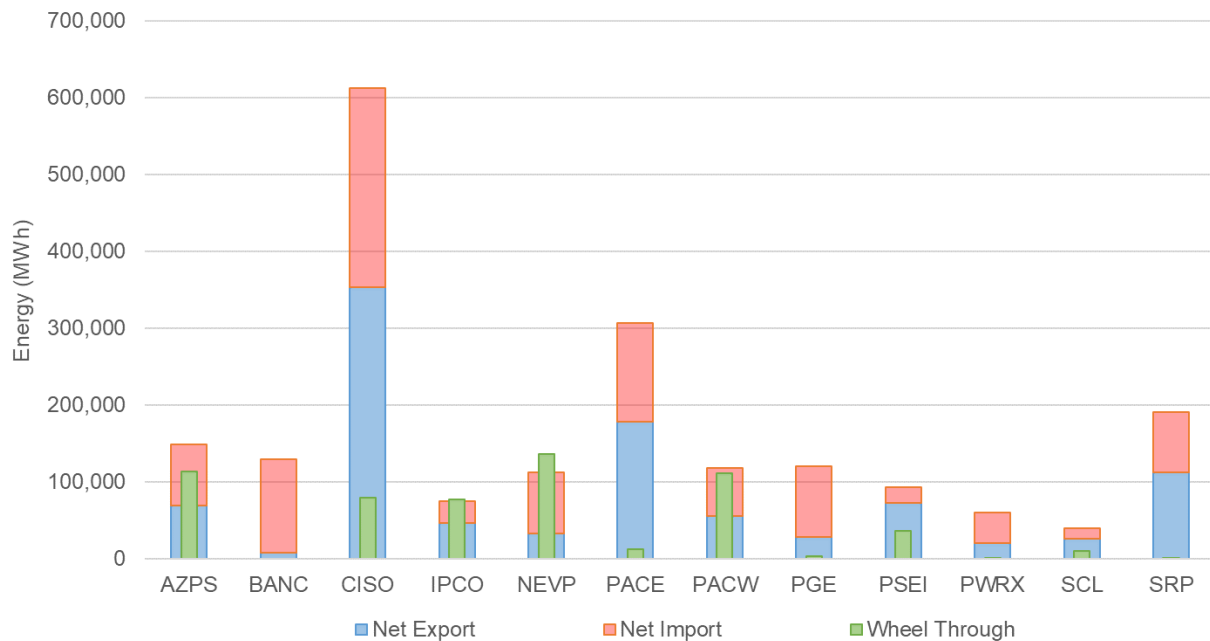
TABLE 4: Estimated wheel-through transfers in January 2021



GRAPH 4: Estimated wheel-through transfers in January 2021

<i>BAA</i>	Net Export	Net Import	Wheel- Through
<i>AZPS</i>	40,619	80,722	86,824
<i>BANC</i>	6,524	124,138	-
<i>CISO</i>	420,420	176,860	81,386
<i>IPCO</i>	63,761	88,418	66,974
<i>NEVP</i>	42,591	59,503	214,638
<i>PACE</i>	154,294	123,655	26,498
<i>PACW</i>	43,488	62,717	101,435
<i>PGE</i>	47,369	61,405	29,766
<i>PSEI</i>	46,397	44,163	49,010
<i>PWRX</i>	26,889	38,693	3,508
<i>SCL</i>	17,964	25,370	12,313
<i>SRP</i>	53,952	78,623	15

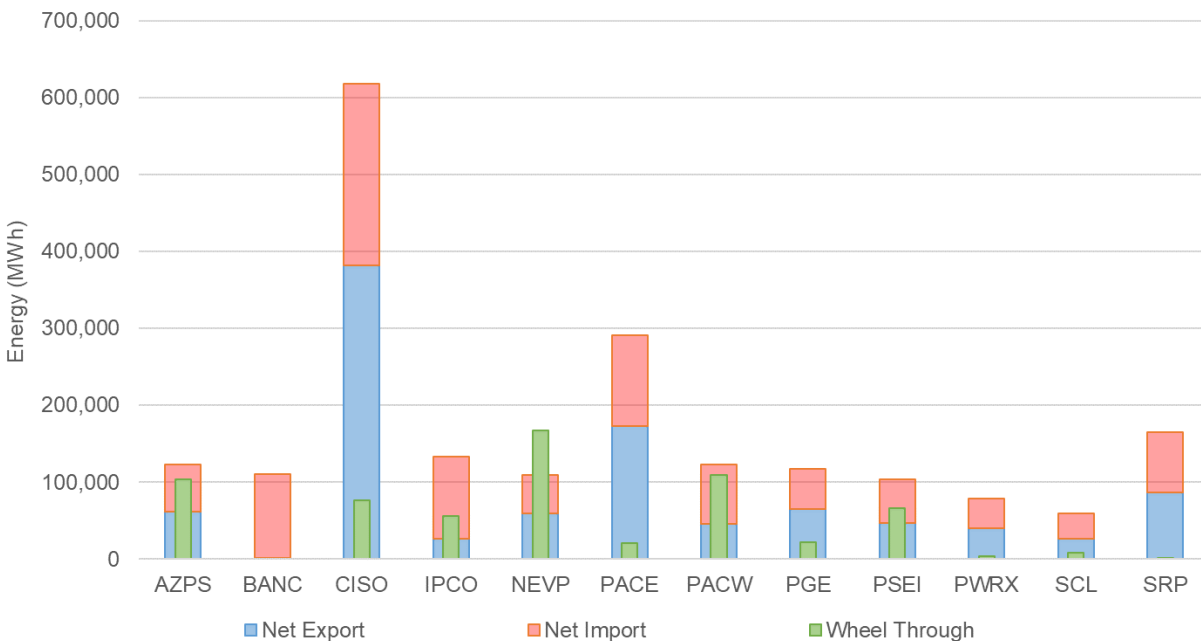
TABLE 5: Estimated wheel-through transfers in February 2021



GRAPH 5: Estimated wheel-through transfers in February 2021

<i>BAA</i>	Net Export	Net Import	Wheel Through
<i>AZPS</i>	61,861	60,516	104,026
<i>BANC</i>	1,910	109,016	-
<i>CISO</i>	382,127	236,344	76,467
<i>IPCO</i>	26,573	107,074	55,725
<i>NEVP</i>	59,497	49,331	167,054
<i>PACE</i>	173,002	118,266	20,414
<i>PACW</i>	45,478	76,915	109,693
<i>PGE</i>	64,527	52,817	21,934
<i>PSEI</i>	46,483	57,426	66,359
<i>PWRX</i>	40,400	37,797	4,184
<i>SCL</i>	26,528	32,275	7,808
<i>SRP</i>	86,984	77,593	85

TABLE 6: Estimated wheel-through transfers in March 2021



GRAPH 6: Estimated wheel-through transfers in March 2021

■ 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 Q1 2021 was calculated to be 19,089 MWh (January) + 28,216 MWh (February) + 28,842 MWh (March) = 76,147 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 32,591 metric tons of CO₂ for Q1 2021. 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 CO₂
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

Year	Quarter	MWh	Eq. Tons CO₂
2019	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
Total		1,400,055	599,144

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

■ 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.

Month	BAA	Direction	Minimum requirement	Maximum requirement
<i>January</i>	<i>AZPS</i>	up	0	286
	<i>BANC</i>	up	0	59
	<i>CISO</i>	up	0	2392
	<i>IPCO</i>	up	0	165
	<i>NEVP</i>	up	0	261
	<i>PACE</i>	up	0	328
	<i>PACW</i>	up	0	181
	<i>PGE</i>	up	0	253
	<i>PSEI</i>	up	0	170
	<i>PWRX</i>	up	0	291
	<i>SCL</i>	up	0	45

Month	BAA	Direction	Minimum requirement	Maximum requirement
January	SRP	up	0	180
	ALL EIM	up	0	2,666
	AZPS	down	0	230
	BANC	down	0	70
	CISO	down	0	1,361
	IPCO	down	0	224
	NEVP	down	0	339
	PACE	down	0	391
	PACW	down	0	183
	PGE	down	0	234
	PSEI	down	0	158
	PWRX	down	0	237
	SCL	down	0	49
	SRP	down	0	164
	ALL EIM	down	0	1,807
February	AZPS	up	23	292
	BANC	up	4	59
	CISO	up	269	2,119
	IPCO	up	24	165
	NEVP	up	16	275
	PACE	up	96	328
	PACW	up	54	181
	PGE	up	46	310
	PSEI	up	40	162
	PWRX	up	78	291
	SCL	up	4	47
	SRP	up	27	180
	ALL EIM	up	410	2,748
	AZPS	down	14	229

Month	BAA	Direction	Minimum requirement	Maximum requirement
February	BANC	down	4	70
	CISO	down	179	1,361
	IPCO	down	46	224
	NEVP	down	25	270
	PACE	down	95	363
	PACW	down	42	183
	PGE	down	42	234
	PSEI	down	36	158
	PWRX	down	77	237
	SCL	down	9	49
	SRP	down	26	164
ALL EIM	down	217	1,807	
March	AZPS	up	28	292
	BANC	up	5	59
	CISO	up	342	2,119
	IPCO	up	36	212
	NEVP	up	19	275
	PACE	up	100	328
	PACW	up	66	181
	PGE	up	69	310
	PSEI	up	32	167
	PWRX	up	77	282
	SCL	up	4	52
	SRP	up	31	151
	ALL EIM	up	421	2,748
	AZPS	down	28	292
	BANC	down	4	70
CISO	down	203	1,361	
IPCO	down	66	224	

BAA	Direction	Minimum requirement	Maximum requirement
<i>NEVP</i>	down	23	274
<i>PACE</i>	down	98	407
<i>PACW</i>	down	42	183
<i>PGE</i>	down	53	234
<i>PSEI</i>	down	33	151
<i>PWRX</i>	down	77	268
<i>SCL</i>	down	4	49
<i>SRP</i>	down	26	161
ALL EIM	down	251	1,807

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.

	January		February		March	
<i>Direction</i>	Up	Down	Up	Down	Up	Down
<i>Average MW saving</i>	983	918	998	970	1,022	993
<i>Sum of BAA requirements</i>	1,956	1,804	2,011	1,943	2,188	1,978
<i>Percentage savings</i>	50%	51%	50%	50%	47%	50%

Table 9: Flexible ramping procurement diversity savings in Q1 2021

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 599,144 metric tons of CO₂, roughly the equivalent of avoiding the emissions from 125,967 passenger cars driven for one year.

APPENDIX 1: GLOSSARY OF ABBREVIATIONS

Abbreviation	Description
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
TID	Turlock Irrigation District