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IDAHO PUBLIC
UTILITIES COMMISSION

May 18, 2023

Jan Noriyuki, Secretary
Idaho Public Utilities Commission
11331 W. Chinden Blvd.
Bldg. 8, Suite 201-A
Boise, Idaho 83714

Re: Case No. AVU-E-20-01 - Avista Corporation Energy Imbalance Market Report per Order No. 34606

Dear Ms. Noriyuki:

Avista Corporation, dba Avista Utilities (Avista or the Company) provides this report on the Company's operation in the Energy Imbalance Market (EIM) after one year of operation, detailing expenditures and informing the Commission of ongoing costs and benefits, as required by Order No. 34606 in Case No. AVU-E-20-01.

I. Background

On January 10, 2020, Avista Corporation applied to the Commission for an order allowing the Company to defer its Idaho jurisdictional incremental operation and maintenance ("O&M") costs associated with joining the California Independent System Operator's ("CAISO") Western Energy Imbalance Market ("EIM"). The Company sought to defer those costs until they could be included in base rates through a general rate case proceeding. The Company expected to "go-live" with the EIM by April 1, 2022.

The Commission approved the request for deferred accounting treatment, authorizing Avista to track its Idaho jurisdictional incremental O&M expenses associated with joining the EIM in a deferral account, with no carrying charge. The Company was also directed to cease booking

costs to the deferral account at the go-live date.[1] In addition, as noted at page 5 of Order No. 34606 the Commission ordered:

> [A]fter the Company has participated in the EIM for one-year, it will file a report with the Commission describing the costs and benefits of participation as of the date, in addition to any other relevant information. The Company is directed to include in this report any available benefit and cost information, including but not limited to the CAISO's quarterly Western EIM Benefits Report.

In addition to the deferred accounting treatment approved in Docket AVU-E-20-01, the Commission also approved, per AVU-E-21-01 (Avista's 2021 General Rate Case), Order No. 35169, that effective with the expected "go live" March 1, 2022 date, the Company will begin to reflect Idaho's share of incremental EIM O&M expenses through the PCA up to Idaho's share of EIM benefits that also will flow through the PCA. Any incremental EIM O&M expenses exceeding EIM benefits would continue to be deferred for review and determination of recovery in a future proceeding.

Finally, through Commission review of the Company's Annual Power Cost Adjustment (PCA) Application, Case No. AVU-E-22-11, Order No. 35543, the Commission continued to find it just and reasonable to authorize the Company to continue to recover EIM incremental expenses in the PCA, up to the benefits realized from the EIM, and to continue the current method of addressing EIM incremental expenses in the PCA process. During the 2022 PCA review, Staff verified the Company's calculations of the EIM expenses, however the Commission directed the Company to explain its methodology for measuring EIM benefits, and how that method differs from CAISO's method. Pursuant to Order No. 35543, the Company filed with the Commission on October 11, 2022 its report on its method for measuring EIM benefits and how that method differs from CAISO's method ("EIM benefit report"). In Order No. 35606, the Commission acknowledged Avista's EIM benefit report was in compliance with Order No. 35543.

[1] Order No. 34606 at page 5.

II. EIM REPORT DOCUMENTATION

In compliance with Order No. 34606, although certain information has been previously reviewed or provided to the Commission, the following information is provided in support of Avista's operation in the Energy Imbalance Market (EIM), after one year of operation, detailing expenditures and informing the Commission of ongoing costs and benefits:

- **Attachment A - Energy Imbalance Market Program Summary Report** – this report summarizes the implementation of the EIM program, with total system (Washington/Idaho) incremental integration costs of $27.4 million, with $24.2 million in capital and $3.2 million in incremental expense. Annual O&M expense associated with incremental EIM employees and software maintenance costs are estimated at $3.1 million, with an annual capital estimate of $0.5 million to support software enhancements and upgrades.
- **Attachment B – Life to date (3/1/2023) EIM Capital Investment**
- **Attachment C – Life to date (3/1/2023) EIM Expenses, Preliminary Benefit Calculation and Net Revenues and Sales**
- **Attachment D – Avista's October 11, 2022 EIM Benefit Compliance Report** - Per Case No. AVU-E-22-11, explaining Avista's methodology for measuring EIM benefits, and how that method differs from CAISO's method.
- **Attachment E - CAISO's quarterly Western EIM Benefits Reports**

Additionally, listed below are incremental benefits Avista receives from participation in the EIM that are not quantifiable:

- Enhanced grid reliability through sharing information on electricity delivery conditions between balancing authorities across the EIM region.
- Congestion management functions in the market are more economically efficient than non-market curtailments and bilateral redispatch capabilities.
- Balancing and regulation of renewable resources, allowing Avista to leverage available footprint wide market resources, instead of relying on only Company resources to provide regulation and meet flexible ramping requirements.
- Hourly bilateral market liquidity has decreased substantially as most Pacific Northwest utilities are in the EIM. Since joining EIM Avista now accesses the 15-minute interval commitment and redispatches footprint wide on the 5-minute interval.
- Better utilization of transmission for transfers between Avista and other EIM Entities.

Finally, as discussed in Attachment D, Avista's October 11, 2022 EIM Benefit Compliance Report, a process for determining Avista's EIM benefits is defined and will be further developed through practice over time. Avista will continue refining its EIM Benefit methodology, identifying opportunities to further improve the accuracy of its EIM benefit calculation, and will provide an update on the EIM benefit calculation and results with the Company's next annual PCA filing.

For questions about this report please contact me at 509-495-8601 or liz.andrews@avistacorp.com.

Sincerely,

/s/ Elizabeth Andrews

Elizabeth Andrews
Sr. Manager, Revenue Requirements
Enclosure

ATTACHMENT A

ENERGY IMBALANCE MARKET
PROGRAM SUMMARY REPORT 11.29.2022

Program Approval to Close

Program Name: Energy Imbalance Market
Program Manager: Kelly Dengel
Business Case Name: Energy Imbalance Market
Expenditure Request: 7141 – Energy Imbalance Market
Submit Date: November 29, 2022

1 Key Roles & Program Information

Program Sponsor(s):	Scott Kinney/ Mike Magruder	**Business Case Owner(s):**	Kelly Dengel
Business Program Manager:	Kelly Dengel	**Executive Steering Committee Members:**	Jason Thackston, Heather Rosentrater, Jim Kensok, Ryan Krasselt, Kevin Christie, Scott Kinney
Director Steering Committee Members:	Kevin Holland, Alexis Alexander, Mike Magruder, Jim Corder, Hossein Nikdel, Adam Munson, John Wilcox, Pat Ehrbar, Todd Colton, Clay Storey	**Other Stakeholders:**	James Dykes, Robert Follini, Annette Brandon, Jacob Reidt, Kit Parker, Bob Weisbeck, Tom Dempsey, Alexis Alexander, Glen Farmer, Brad Calbick, Craig Figart, Kenny Dillon, Mike Andrea, Glenn Madden, Lamont Miles, Brian Hoerner, Xin Shane, Jason Pegg

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3 Executive Summary

On April 25, 2019, Avista signed the Western Energy Imbalance Market (WEIM) Implementation Agreement with the California Independent System Operator (CAISO) to join the market in April 2022. After a three-year implementation program, Avista successfully entered the WEIM ahead of schedule on March 2, 2022, under the allocated budget and delivered the required scope for market operations – all while navigating the challenges of the COVID-19 Pandemic. To support the integration effort, Avista contracted Utilicast as a market integration consultant to assist with market and software expertise. In preparation for the first of four CAISO integrated testing phases, Avista completed the required metering, controls and network upgrades by June 2021 and started connectivity/integration testing in early June 2021. Avista also purchased and configured eight EIM software applications, supplemented with internal system upgrades and integrations and began formal integration testing July 15, 2021. To support software integration testing and market operations, Avista established 17 new EIM positions (EIM Human Resource Plan) and began hiring in the summer of 2020 through market entry. Avista entered the three-month parallel operations testing phase with CAISO on December 1, 2021, and entered the market just after midnight at 00:00:01 on March 2, 2022.

The EIM Implementation Program closed with total incremental integration costs at $27.4 million with $24.2 million in capital and $3.2 million in incremental expense. Annual O&M expense associated with incremental EIM employees and software maintenance costs are estimated at $3.1 million, with an annual capital estimate of $0.5 million to support software enhancements and upgrades.

Table 1 – Incremental Implementation Program Actuals as of September 2022

EIM Program Closed Actuals (as of 09/2022)	Implementation	Contingency	Totals	Annual O&M Expenses	Annual Capital
Capital	$24.1	$0.1	$24.2	$0.0	$0.5
Incremental Expense	$3.1	$0.1	$3.2	$3.1	$0.0
Total Costs	**$27.2**	**$0.2**	**$27.4**	**$3.1**	**$0.5**

4 Program Implementation Cost Comparisons

The EIM Program implementation undertook two cost estimation phases. The first cost estimation results were reflected in the EIM Program Charter, finalized in May of 2019. The second cost estimation results were reflected in the EIM Scope Document, finalized in October 2020. The actual implementation costs as of accounting period September 2022 are reflected in this EIM Close Document. To provide a cost comparison, the financial charts will display information in terms of Charter vs. Scope vs. Close financials where applicable.

The implementation effort required both capital and expense investments. Avista began charging EIM expense projects across six business units July 1, 2019, for both existing and incremental labor and non-labor costs. However, Avista did not create an individual expense project for each expense deliverable, as expense reporting is not tracked by deliverable within the Company financial records. When comparing expense estimates, some costs have been re-assigned from one cost area to another, and a direct comparison is not possible. Where possible, this document will represent expense costs in terms of existing and incremental labor. For metering projects, an estimated expense threshold of $10k was established to track costs associated with an individual expense project. The EIM Program documentation expressed costs in these terms:

- **Implementation Capital** – includes all known project costs for EIM software integration and testing, network infrastucture and metering and controls upgrades.

- **Implementation Expense** – includes all known expense costs associated with market integration prior to market entry, including existing Avista labor, new incremental Avista labor associated with the EIM HR Plan and non-labor expense items such as the CAISO milestone payments and Utilicast support. Where possible, a distinction of existing vs. incremental expense is noted.

- **Contingency** – includes an estimate for capital and expense funds to cover unknown costs or increased costs above expected spend. This is consisent with Avista project estimating practices.

- **Annual O&M Expenses** – this includes all known updated costs associated with market operations post go-live, including the incremental Avista labor to support EIM operations (EIM HR Plan), CAISO grid management fees, and software maintenance and liscencing fees.

- **Annual Capital** – this represents anticipated capital costs for software enhancements and upgrades. Avista will have a better estimate after gaining operational experience and understanding the impact CAISO annual updates have on system integration. These annual capital costs were not included in the cost benefit anaylsis.

The EIM Program closed with all financial activity complete as of the September 2022 accounting period. Costs in the "Closed Actuals" columns reflect final actual costs.

5 CAISO & Avista Program Scope

The CAISO developed an implementation structure for market participants with six program tracks. A description with requirements, along with an Avista scope has been provided.

CAISO EIM Track	Avista Scope	Complete – Yes/No/In Progress
Track 0 Avista EIM Program Preparation		
	Avista program structure, leadership, documentation, change management plan, internal project schedule, software procurement and contracting	Yes
	Select System Integrator	Yes
Track 1 Planning & Project Management		
	Joint Avista-CAISO project plan and schedule	Yes
	Joint impact assessment document	Yes
	Avista go-live support plan document	Yes
	Joint checkpoint, progress evaluation meetings, etc.	Yes
	Joint monthly project leadership meetings	Yes
	Joint quarterly executive meetings	Yes
Track 2 Policy, Legal, Support		
	EIM Entity Implementation Agreement	Yes
	EIM Entity Agreement	Yes
	EIM Entity Scheduling Coordinator (EESC) Agreement	Yes
	EIM Participating Resource Scheduling Coordinator (PRSC) Agreement	Yes
	EIM Participating Resource Agreement	Yes
	Department of Market Monitor Filings	Yes
	Market Base Rate Study	Yes
	CAISO Implementation Milestone Payments	Yes
	CAISO Grid Management Charge	Yes
	Open Access Transmission Tariff (OATT) Filing	Yes
Track 3 Transmission & Generation Modeling		
	Transmission Full Network Model (FNM) creation & maintenance	Yes
	Integrate Energy Management System (EMS) to CAISO Automated Dispatch System	Yes
	Master File / Generation Participation & Cost Modeling	Yes

	Major Maintenance Adders & Default Energy Bid logic	Yes
	Energy Transfer System Resource (ETSRs)	Yes
Track 4 System Integration & Testing		
	Acquire & configure Generation Outage Management software	Yes
	Acquire & configure Transmission Outage Management software	Yes
	Acquire & configure Participating Resource Scheduling Coordinator (PRSC) bidding & scheduling software (merchant)	Yes
	Acquire & configure EIM Entity Scheduling Coordinator (EESC) scheduling software (transmission)	Yes
	Acquire & configure PRSC settlement software (merchant)	Yes
	Acquire & configure EESC settlement software (transmission)	Yes
	Acquire & configure reporting & analytics software	Yes
	Enhance & integrate Avista Decision Support System (ADSS)	Yes
	Acquire & configure Energy Accounting software	Yes
	Acquire & configure a E-Tagging solution	Yes
	Enhance Nucleus functionality	N/A
	Install new instance of Itron MV90 xi for meter data collection	Yes
	Integrate EIM software systems	Yes
	Integrate EIM software with CAISO systems	Yes
	Pre-production testing with CAISO – Day in the Life phase	Yes
	Pre-production testing with CAISO – Market Simulation phase	Yes
	Pre-production testing with CAISO – Parallel Operations phase	Yes
Track 5 Metering & Settlements		
	Low-Side Metering (LSM) installation at generation plants	Yes
	High-Side Metering (HSM) installation at generation plants	Yes
	Current Transformer (CT)/Potential Transformer (PT) testing/upgrades	Yes
	Interconnection meter upgrades/reconfiguration at substations	Yes
	Network and communications installations/upgrades	Yes
	Generation plant Programmable Logic Control (PLC) upgrades	Yes
	Creation, submission & approval of Settlement Quality Meter Data (SQMD) plans and metering portfolio to CAISO	Yes
Track 6 Operations Readiness & Training		
	Create internal EIM training plan	Yes
	Complete CAISO EIM computer-based training modules	Yes
	CAISO conducts hands-on training for Avista	Yes
	Develop internal operational EIM procedures	Yes
	File internal operational EIM procedures with CAISO	Yes
	Complete CAISO market readiness criteria worksheet	Yes
	CAISO provides planned go-live operations procedure documents	Yes
	CAISO files market readiness certificate with FERC prior to go-live	Yes
	Develop & implement EIM operations & support model	Yes
	EIM Human Resource Plan	Yes
	EIM Transmission System Operations desk & remodel at Backup Control Center (BuCC)	Yes
	EIM Transmission System Operations desk & remodel at Mission	Yes
	Noxon 230kV Switchyard CIP Compliance	Yes

6 Avista Scope Delivery by CAISO EIM Track

6.1 Track 0/1 –EIM Program Planning & Project Management Delivery

6.1.1 Utilicast – System Integrator Delivery Summary

Avista engaged with Utilicast in three phases, with the intent to evaluate performance and value before signing additional EIM integration support agreements. Phase one in 2018 focused on the technology, metering, and network model assessment, helping Avista understand the CAISO requirements and processes, and identifying the gaps to be filled. After soliciting responses for a System Integrator via a Request for Information (RFI) proposal, Avista agreed to a sole sourcing engagement with Utilicast. This led to a second agreement in 2019 that focused on metering and generation control requirements and design, generation bidding strategies, development of technology application requirements and RFPs and the evaluation/selection of EIM software vendors. The third engagement was signed in December 2019 and focused on the program implementation efforts through go-live of 2022. When the 2020-22 Implementation agreement with Utilicast was signed, each deliverable was assigned an expense or capital indicator, which allowed for an estimate of annual expense and capital charges by year. The primary Utilicast expense drivers were associated with market training, business process design and generation/interchange modeling.

6.1.2 Utilicast Actuals

During the two-year EIM implementation agreement, Utilicast supported Avista with subject matter experts in the areas of metering, resource modeling, bidding strategies, software implementation, market rules expertise, and training. The Utilicast implementation agreement concluded in June 2022. Utilicast capital costs closed at $3.2 million, approximately $0.5 million under the Scope budget, with savings attributed to limited travel (Covid-19 pandemic) and effective management of deliverables between Avista and Utilicast. Utilicast expense costs closed at $1.2 million, approximately $0.45 million under the Scope estimates, with savings also attributed to limited travel and effective joint management of program deliverables.

Table 2 – Utilicast Agreements Financial Comparison as of September 2022

Utilicast Agreements		Charter Estimates (as of 05/2019)		Scope Estimates (as of 08/2020)		Closed Actuals (as of 09/2022)	
Agreement	**Year**	**Capital**	**Expense**	**Capital**	**Expense**	**Capital**	**Expense**
Technology RFP	2019	$ -	$ 500,000	$ -	$ 508,435	$ -	$ 508,435
Implementation	2020-2022	$ 3,200,000	$ -	$ 3,700,000	$ 1,150,000	$ 3,238,235	$ 708,052
	Totals	**$ 3,200,000**	**$ 500,000**	**$ 3,700,000**	**$ 1,658,435**	**$ 3,238,235**	**$ 1,216,486**
Actuals							

Table 3 – Utilicast 2020-2022 Implementation Agreement
Actuals by Business Unit Financial Comparison as of September 2022

Utilicast Implementation Agreement (signed 10/2019)		Implementation Agreement (as of 10/2019)		Scope Estimates (as of 08/2020)		Closed Actuals (as of 09/2022)	
Business Units	**CAISO Track**	**Capital**	**Expense**	**Capital**	**Expense**	**Capital**	**Expense**
ET Applications	Track 4	$ 2,986,181		$ 2,986,181		$ 2,676,885	
ET Network	Track 4 & 5	$ 67,060		$ 67,060		$ 42,364	
GPSS	Track 5	$ 67,060		$ 67,060		$ 32,639	
Substation & Third Party Generation	Track 5	$ 67,060		$ 67,060		$ 35,539	
Transmission	Track 4	$ 40,000		$ 40,000		$ 25,841	
Facilities	Track 6	$ -		$ -		$ -	
ADSS	Track 4	$ 472,639		$ 472,639		$ 424,967	
EIM Program	All	$ -	$ 1,600,000	$ -	$ 1,150,000	$ -	$ 708,052
	Utilicast Totals	**$ 3,700,000**	**$ 1,600,000**	**$ 3,700,000**	**$ 1,150,000**	**$ 3,238,235**	**$ 708,052**

6.2 Track 2 – Policy, Legal & Support Delivery

6.2.1 Policy, Legal & Support Delivery Summary

Apart from professional services to support the EIM Market Base Rate Study, most costs represented in this section are implementation expense (existing and incremental). Although an estimate was provided by deliverable, actual expense costs were not tracked by individual deliverable, but by business unit. See Table 24 – Total Incremental & Non-Incremental Labor Actuals for expense costs by business unit, which includes delivery of these items.

Table 4 – Policy, Legal, Support Financial Comparison as of September 2022

Track 2 - Policy & Legal	Charter Estimates (as of 05/2019)			Scope Estimates (as of 08/2020)			Closed Actuals (as of 09/2022)		
	Capital	*Implementation Expense*	*Ongoing Expense*	*Capital*	*Implementation Expense*	*Ongoing Expense*	*Capital*	*Implementation Expense*	*Ongoing Expense*
EIM Agreements	$ -	$ 130,000	$ -	$ -	$ 130,000	$ -	$ -	$ -	$ -
OATT	$ -		$ -	$ -		$ -	$ -	$ -	$ -
Market Base Rate Study	$ -		$ -	$ -		$ -	$ -	$ -	$ -
DMM Filings	$ -	$ -	$ -	$ -		$ -	$ -	$ -	$ -
Professional Services	$ -	$ 105,000	$ -	$ -	$ 105,000	$ -	$ -	$ 50,216	$ -
CAISO Payments	$ -	$ 300,000	$ -	$ -	$ 300,000	$ -	$ 250,000	$ 50,000	$ -
CAISO Grid Management Fee	$ -	$ -	$ 120,000	$ -	$ -	$ 120,000	$ -	$ -	$ 216,281
Totals	**$ -**	**$ 535,000**	**$ 120,000**	**$ -**	**$ 535,000**	**$ 120,000**	$ -	$ -	$ -
Utilicast	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Grand Totals	**$ -**	**$ 535,000**	**$ 120,000**	**$ -**	**$ 535,000**	**$ 120,000**	**$ 250,000**	**$ 100,216**	**$ 216,281**

6.2.1.1 *EIM Agreements*

Avista signed various CAISO agreements to conduct operations as a Merchant Scheduling Coordinator and Entity Scheduling Coordinator to transact in the market. This also included items such as financial forms, certifications, risk policies, and user and contact lists. All EIM agreements were executed by March 2021.

6.2.1.2 *Open Access Transmission Tariff (OATT)*

Avista made changes to its OATT to accommodate transmission utilization in the EIM, change ancillary service charges and incorporate EIM financial settlement obligations. The updated OATT was filed with FERC on October 27, 2021, and approved January 28, 2022.

6.2.1.3 *Market Base Rate Study*

Market Based Rate (MBR) authority represents permission granted by FERC to allow power to be sold at market rates, as opposed to a traditional cost of service rate (also known as cost-plus). An EIM MBR study was required to ensure Avista didn't have the ability to set the market price within the market. The EIM MBR was filed with FERC on June 30, 2021 and approved on February 28, 2022.

6.2.1.4 *Professional Services*

In addition to Utilicast support, Avista contracted Llyod Reed Consulting to conduct the EIM MBR study at a cost of $0.05 million.

6.2.1.5 *Department of Market Monitoring Filings*

Avista submitted and negotiated Major Maintenance Adders (MMAs) and Default Energy Bids (DEB) by generation resource with the ISO's Department of Market Monitoring. These had multiple internal reviews before submission and approval by the CAISO on February 7, 2022.

6.2.1.6 *CAISO Milestone Payments*

As part of the EIM Implementation Agreement with the CAISO, six milestone payments were required. Each milestone payment was $50k, for a total implementation fee of $300k, and were planned as expense. Apart from the first expense milestone payment, the remaining payments were reclassified to capital in support of EIM software and system integration testing efforts and are captured in the software actuals costs in Table 8.

Table 5 – CAISO EIM Implementation Agreement Milestone Payments

CAISO Milestone	Dates for March 2, 2022 Entry	Amount Due
Milestone 1 – Sign EIM Implementation Agreement	April 2020	$50,000
Milestone 2 – Deploy Avista's FNM in a non-production CAISO environment	June 30, 2021	$50,000
Milestone 3 – Promote Avista's FNM to Market Simulation environment	July 15, 2021	$50,000
Milestone 4 – Begin Market Simulation Testing	October 1, 2021	$50,000
Milestone 5 – Begin Parallel Operations Testing	December 1, 2021	$50,000
Milestone 5 – Begin EIM Operations in Production	March 2, 2022	$50,000
	Total	**$300,000**

6.2.1.7 *CAISO Grid Management Charge*

The CAISO charges EIM participants a grid management fee based on the amount of MWhs transacted in the market and is assessed through the CAISO settlement process. The Scope estimate for this on-going variable expense charge was $0.1 million, while actuals as of September 2022 are $0.2 million.

6.3 Track 3 – Transmission & Generation Modeling Delivery

6.3.1 Transmission & Generation Modeling Delivery Summary

Apart from CAISO Dispatch Integration project, most of the costs represented in this section are implementation expense (existing and incremental). Although an estimate was provided, actual expense costs were not tracked by individual deliverable, but by business unit. See Table 24 – Total Incremental & Non-Incremental Labor Actuals for expense costs by business unit, which includes delivery of the Master File/Generation Participation and Cost Modeling, and Energy Transfer System Resource work.

Table 6 – Transmission & Generation Modeling Financial Comparison as of September 2022

Track 3 - Transmission & Generation Modeling	Charter Estimates (as of 05/2019)			Scope Estimates (as of 08/2020)			Closed Actuals (as of 09/2022)		
	Capital	*Implementation Expense*	*Ongoing Expense*	*Capital*	*Implementation Expense*	*Ongoing Expense*	*Capital*	*Implementation Expense*	*Ongoing Expense*
FNM Creation*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
FNM EIM Support	$ 80,000	$ -	$ 50,000	$ 80,000	$ -	$ 50,000	$ -	$ -	$ -
EIM Dispatch Module	$ 156,000	$ -	$ -	$ 160,000	$ -	$ -	$ 499,742	$ -	$ -
Master File / Gen Cost Modeling	$ 200,000	$ -	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -
Totals	**$ 436,000**	**$ -**	**$ 50,000**	**$ 240,000**	**$ 200,000**	**$ 50,000**		$ -	$ -
Utilicast	$ 40,000	$ -	$ -	$ 40,000	$ -	$ -	$ 25,841	$ -	$ -
Grand Totals	**$ 476,000**	**$ -**	**$ 50,000**	**$ 280,000**	**$ 200,000**	**$ 50,000**	**$ 525,583**	$ -	$ -

* Funded by SCADA Business Case

6.3.1.1 *Transmission Full Network Model (FNM) Creation*

The creation of the transmission Full Network Model (FNM), real-time state estimation, and real-time contingency analysis was not funded under the EIM implementation; however, it was critical for market operations. Avista delivered the first version of the FNM in June 2021, in accordance with Milestone 2, and updated the model as Avista progressed through the market testing phases. The model will be updated in accordance with CAISO's planned FNM database release schedule.

6.3.1.2 *FNM EIM Support*

The capital funds planned in the Charter and the Scope documents were allocated to support implementation of the CAISO Dispatch Integration project, while the on-going expense labor was included in the EIM Human Resource Plan costs (see Section 6.6.1.2).

6.3.1.3 *EIM Dispatch Module / Integration with CAISO Automated Dispatch System*

Avista integrated its Supervisory Control and Data Acquisition (SCADA) system with the CAISO Automated Dispatch System (ADS) to receive market Dispatch Operating Targets (DOTs) and send them to the generation plants control systems for targeted energy output. At the time of the Scope Document, it was unknown how much scope would be completed within the GPSS control upgrade projects vs. the integration effort with SCADA. After the GPSS control projects were complete, $336k was transferred from GPSS to this project, along with $50k of the FNM EIM capital line listed above and a contingency request to fund the project. The CAISO Dispatch Integration (EIM Dispatch Module listed in Table 4) project began in May 2021 to support Parallel Operations testing in December 2021, transferred to plant in March 2022 and completed at $0.53 million, inclusive of Utilicast costs.

6.3.1.4 *Master File / Generation Participation & Cost Modeling*

Avista began the data collection process for the Generation Resource Data Template (GRDT) and the Interconnection Resource Data Template (IRDT) in December 2019 to support market operations and submit to the CAISO Master File application. The GRDTs described the physical and operational properties of each generation resource, while the IRDTs represented Energy Transfer System Resource (ETSR) physical locations and market dispatch transmission limits between Balancing Authorities Areas (BAAs). The GRDT and IRDT data files were configured with CAISO and in the EIM software to support market testing and will continue to be evaluated/updated for operational efficiency and performance.

6.4 Track 4 – System Integration & Testing Delivery

6.4.1 EIM Software Summary

In June of 2019, Avista engaged with Utilicast to define the system requirements for various EIM software applications. Avista issued two technology-based RFPs – the Generation and Transmission Outage Management System in August 2019 and the Bid to Bill EIM suite, including the PRSC and EESC for scheduling, the PRSC and EESC for settlements, Energy Accounting and an Analytics/Reporting application in October 2019. A recommendation to purchase Power Cost, Inc.'s (PCI) products for OMS, EESC, PRSC and Energy Accounting was made, along with Power Settlements (PS) products for settlements and analytics, to the EIM Director Steering Committee in November 2019 and to the Executive Steering Committee in December 2019. After the Executive Steering Committee approval, Avista engaged with PCI and Power Settlements to negotiate the terms and conditions of the agreements, as well as the implementation costs (capital) and on-going operating expense (expense). In March 2020, Avista concluded the negotiations with PCI, and in May 2020 concluded the negotiations with Power Settlements for the systems in Table 7.

Table 7 – EIM Bid to Bill Software Suite

Vendor	Application Name	Function
Power Costs, Inc	Asset Operations	Generation Outage Management
		Transmission Outage Management
	GenManager Front Office	PRSC Bidding & Scheduling
		EESC Scheduling
	Energy Accounting	Energy Accounting
Power Settlements	Settle Core	PRSC Settlements
		EESC Settlements
	Visual Analytics	Performance & Analytics

Beyond the EIM Bid to Bill software provided by PCI and PS, Avista also implemented software to support meter data collection and a Variable Energy Resource (VER) forecast submission. When Avista conducted the RFP, the Avista Decision Support System (ADSS) was planned to perform EIM bid calculation and base schedule creation.

At the time of the Charter estimates, Utilicast estimates were provided as a total amount and were not separated by program area. As such, the Charter Estimates in Table 8 below does not have Utilicast costs included for software

implementation. The Scope Estimate section of Table 8 below represents the EIM software implementation capital estimates of $18.4 million, with vendor labor, software licensing, hardware and existing labor combined in the individual project costs, while the Utilicast costs and labor associated with EIM Human Resources Plan are separate. The Close Actuals section represents individual project costs with the inclusion of the EIM Human Resource Plan incremental labor, existing Avista labor and vendor costs, while separating the Utilicast charges for the EIM software suite and ADSS from the project totals. Most of the software projects transferred to plant in March 2022, had warranty charges through the end of May and trailing charges through September 2022. The software warranty period completed May 31, 2022, and Utilicast support completed by June 30, 2022.

The capital software implementation completed at $14.7 million, $3.7 million under the Scope Document budget with savings attributed to reduced incremental and existing employee labor and avoided Utilicast and vendor travel costs. Software implementation expense actuals were as planned, while on-going O&M EIM software expense is forecasted at $0.55 million, $0.08 million over the Scope budget due to additional software purchased during the implementation.

Table 8 – EIM Software Financial Comparison as of September 2022

Vendor	Track 4 - EIM Software Projects	Charter Estimates (as of 05/2019)			Scope Estimates (as of 08/2020)			Closed Actuals (as of 09/2022)		
		Capital	*Implementation Expense*	*Ongoing Expense*	*Capital*	*Implementation Expense*	*Ongoing Expense*	*Capital*	*Implementation Expense*	*Ongoing Expense*
	EIM Software Vendors	$ 2,380,000	$ -	$ 500,000	$ -	$ -	$ -	$ -	$ -	$ -
	EIM Software Internal Labor	$ 2,964,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PCI	EESC Scheduling	$ -	$ -	$ -	$ 1,599,004	$ 10,152	$ 100,395	$ 1,326,475	$ 10,152	$ 129,945
PCI	PRSC Bidding & Scheduling	$ -	$ -	$ -	$ 1,731,003	$ 10,152	$ 100,395	$ 1,531,629	$ 10,152	$ 100,395
PCI	OMS (Gen / Trans) Phase 1	$ -	$ -	$ -	$ 1,421,499	$ 13,699	$ 84,961	$ 1,048,885	$ 13,699	$ 84,961
PCI	OMS (Gen / Trans) Phase 2				$ 459,591			$ 294,550		
PCI	Energy Accounting	$ -	$ -	$ -	$ 1,586,342	$ 8,122	$ 100,395	$ 1,156,219	$ 8,122	$ 100,395
PS	PRSC & EESC Settlement	$ -	$ -	$ -	$ 2,256,541	$ 22,500	$ 64,637	$ 1,843,191	$ 22,500	$ 93,790
	ADSS Phase 1	$ -	$ -	$ -	$ 2,987,491	$ -	$ -	$ 2,258,109	$ -	$ -
	ADSS Phase 2	$ -	$ -	$ -		$ -	$ -	$ 1,285,466	$ -	$ -
	ADSS Disaster Recovery	$ -	$ -	$ -	$ -	$ -	$ -	$ 96,561	$ -	$ -
Itron	MV90xi	$ -	$ -	$ -	$ 438,166	$ -	$ -	$ 438,168	$ -	$ 21,816
Itron	MV90xi Additional Licenses	$ -	$ -	$ -	$ -	$ -	$ -	$ 23,143	$ -	$ -
	CT/PT Accuracy Testing	$ -	$ -	$ -	$ 11,004	$ -	$ -	$ 11,004	$ -	$ -
	VER Forecast	$ -	$ -	$ -	$ 200,000	$ -	$ 15,000	$ 323,905	$ -	$ 15,000
	Totals	**$ 5,344,000**	**$ -**	**$ 500,000**	**$ 12,690,641**	**$ 64,625**	**$ 465,783**	**$ 11,637,305**	**$ 64,625**	**$ 546,302**
	Utilicast (Technology RFP)	$ -	$ 500,000	$ -	$ -	$ 508,435	$ -		$ 508,435	$ -
	Utilicast (EIM Suite)	$ -	$ -	$ -	$ 2,986,181	$ -	$ -	$ 2,676,885	$ -	$ -
	Utilicast (ADSS)	$ -	$ -	$ -	$ 472,639	$ -	$ -	$ 424,967	$ -	$ -
	EIM HR Plan (Incremental Labor)	$ -	$ -	$ -	$ 2,255,219	$ -	$ -	$ -	$ -	$ -
	Grand Totals	**$ 5,344,000**	**$ 500,000**	**$ 500,000**	**$ 18,404,680**	**$ 573,060**	**$ 465,783**	**$ 14,739,157**	**$ 573,060**	**$ 546,302**

6.4.1.1 *EIM Software Projects – Capital Actuals Summary*

Table 9 below represents EIM software capital projects Transferred to Plant (TTP) between January 2020 and March 2022, with total project costs associated with internal Avista labor (existing and incremental), Utilicast, software vendors, and software hardware/licensing.

Table 9 – EIM Software Projects Capital Actuals as of September 2022

Vendor	Track 4 - EIM Software Projects	Closed Actuals (as of 09/2022)					
		TTP Date	Labor	Vendor	Hardware / Licenses	Utilicast	Total
PCI	EESC Scheduling	Mar-22	$ 819,262	$ 291,345	$ 215,868	$ 559,684	$ 1,886,159
PCI	PRSC Bidding & Scheduling	Mar-22	$ 1,074,586	$ 251,967	$ 205,076	$ 524,449	$ 2,056,078
PCI	OMS (Gen / Trans) Phase 1	Jun-21	$ 641,845	$ 149,726	$ 257,314	$ 623,000	$ 1,671,885
PCI	OMS (Gen / Trans) Phase 2	Mar-22	$ 145,514	$ 124,246	$ 24,790	$ 198,082	$ 492,632
PCI	Energy Accounting	Mar-22	$ 698,360	$ 253,857	$ 204,002	$ 377,210	$ 1,533,429
PS	PRSC & EESC Settlement	Mar-22	$ 848,727	$ 540,263	$ 454,201	$ 339,720	$ 2,182,911
	EIM Software Suite Totals		**$ 4,228,294**	**$ 1,611,404**	**$ 1,361,251**	**$ 2,622,145**	$ 9,823,094
	ADSS Phase 1	Jun-21	$ 2,084,641	$ 151,416	$ 22,052	$ 62,360	$ 2,320,469
	ADSS Phase 2	Mar-22	$ 1,133,914	$ 72,800	$ 78,752	$ 362,607	$ 1,648,073
	ADSS Disaster Recovery	May-22	$ 28,521	$ -	$ 68,040	$ -	$ 96,561
Itron	MV90xi	Jan-20	$ 228,262	$ 13,247	$ 196,659	$ -	$ 438,168
Itron	MV90xi Additional Licenses	Nov-21	$ 2,413	$ -	$ 20,730	$ -	$ 23,143
	CT/PT Accuracy Testing	Apr-20	$ 550	$ -	$ 10,454	$ -	$ 11,004
	VER Forecast	Mar-22	$ 323,905	$ -	$ -	$ 54,740	$ 378,645
	Grand Totals		**$ 8,030,500**	**$ 1,848,867**	**$ 1,757,938**	**$ 3,101,852**	$ 14,739,157

6.4.1.1.1 EIM Software Suite

The EIM software suite consisted of the applications purchased from PCI and Power Settlements. After contract negotiations were complete in March 2020 (PCI) and May 2020 (PS), capital projects began in March 2020 (PCI) and in July 2020 (PS) in preparation for the first CAISO software testing milestone on July 15, 2021.

In the design phase for the EESC project, additional tagging software was needed to support EESC settlements, which resulted in the purchase of Open Access Technology, Inc.'s (OATI) Tag Forwarding service and PCI's E-Tag Forwarding service. The OMS application was delivered into two phases: OMS Phase 1 to support CAISO Reliability Coordination (RC) functionality, while OMS Phase 2 focused on functionality to support market entry. Apart from OMS Phase 1, the EIM software suite applications transferred to plant in March 2022 and completed at a total cost of $9.8 million.

6.4.1.1.2 Avista Decision Support System

Avista estimated $1 million in internal labor to perform the ADSS enhancements but did not include estimates for professional services to develop the business logic functionality or data integration with other EIM applications. The estimate was increased to $3.46 million in August 2020 to include updated labor estimates, professional services, Utilicast costs and full integration costs. The ADSS delivery was separated into two phases: ADSS Phase 1 supported the OMS Phase 1 project for CAISO Reliability Coordinator) functionality, while ADSS Phase 2 focused on functionality required for market entry. ADSS Phase 1 and 2 is completed at $4.0 million, $0.55 million over the Scope budget, with increased costs associated with professional services for calculation logic and contracted non-labor.

In the event of a disaster rendering ADSS software unavailable from Mission Campus servers, Avista installed a parallel version of the ADSS software and associated hardware in the San Jose Disaster Recovery environment. This project was not planned in the Charter or the Scope Document and completed at $0.1 million.

6.4.1.1.3 EIM MV90xi

Avista installed Itron's MV90xi meter head-end system to collect interval meter data from generation and substation interconnection sites for market submission. The project with Itron began in Q2 2019, transferred to plant in January 2020 and completed at $0.44 million.

6.4.1.1.4 Current Transformer/Potential Transformer (CT/PT) Accuracy Testing

To support the transformer accuracy testing efforts at substation and generation locations, Avista purchased software called "CT Analyzer" offered by Omicron. These costs were not planned in the Charter and the actual software cost was $11k. This software supported metering research expense efforts shown in Table 10 and Table 12.

6.4.1.1.5 Variable Energy Resource (VER) Forecast

To forecast Variable Energy Resources (VER) generation output, Avista required a solution capable of a five-minute generation forecast based on weather conditions for all VER generators in Avista's Balancing Authority Area (BAA). To satisfy this requirement, Avista expanded its existing forecasting agreement with Vaisala for wind resources and contracted with CAISO to provide a solar generation forecast. The project began in Q1 2021, transferred to plant in March 2022, and completed at $0.38 million.

6.4.1.2 *EIM Software – Implementation Expense Actuals Summary*

The software implementation expense covered cost associated with vendor-provided software training. This non-labor incremental expense was planned at $0.57 million in the Scope Document and completed at $0.57 million.

6.4.1.3 *EIM Software – On-Going Expense Estimate Summary*

The on-going O&M expense associated with EIM software maintenance and service agreements was planned at $0.47 million in the Scope Document, while close actuals are planned at $0.55 million, with increases attributed to the EESC tag forwarded services, MV90xi and the settlements software.

6.4.1.4 *EIM Software – Annual Upgrades & Enhancements*

The CAISO releases annual market enhancements which affect EIM software and may cause subsequent internal integration changes. Avista has forecasted costs for annual upgrades and enhancements to expand capabilities and increase efficiencies under the Energy Markets Modernization and Operational Efficiency Business Case at $500k annually. These estimates are preliminary and will be refined as Avista gains operational market experience.

6.5 Track 5 – Metering & Settlements Delivery

6.5.1 Generation Production & Substation Support Delivery Summary

In 2018, Utilicast and Avista partnered to conduct a site-specific metering assessment to document Avista's generation metering and controls infrastructure, highlighting existing assets that were insufficient for EIM entry. Sites were divided into two categories: market dispatch and non-dispatch, and very high-level cost estimates assigned.

Early in the first quarter of 2019, Generation Production & Substation Support (GPSS) refined these estimates based on known participation decisions and market strategy information, however detailed site-specific scope was not yet defined. In March 2019, GPSS completed their estimate updates, bringing the capital metering and controls costs to approximately $5.07 million, as reflected in the EIM Program Charter document, and projects began in the summer of 2019. Throughout 2020, GPSS conducted Resource Participation Strategy Workshops by plant to finalize detailed project scope at each generation site. As a result, some changes to project scope and cost estimates occurred. In August 2020, GPSS updated its forecasted scope, schedule, and budget with an approved capital budget of $4.4 million, including Utilicast support costs of $.06 million, and $0.28 million in implementation expense, as reflected in the October 2020 EIM Program Scope document.

By June of 2021, GPSS had transferred to plant nine capital metering and controls projects, and by December 2021 the projects officially closed with a total capital investment of $4.22 million – approximately $0.24 million under the EIM Program Scope Document approval. The Utilicast contribution to GPSS projects closed at $0.03 million, approximately $0.04 million under Scope Document approvals. The total implementation expense charges closed at $0.24 million, approximately $0.05 million under the Scope Document approvals.

Table 10 – GPSS Financial Comparison as of September 2022

GPSS	Charter Estimates (as of 05/2019)			Scope Estimates (as of 08/2020)			Closed Actuals (as of 09/2022)		
Project Type	*Capital*	*Implementation Expense*	*Ongoing Expense*	*Capital*	*Implementation Expense*	*Ongoing Expense*	*Capital*	*Implementation Expense*	*Ongoing Expense*
HSM	$ 2,336,696	$ -	$ -	$ 2,137,536	$ -	$ -	$ 1,699,561	$ -	$ -
PLC	$ 2,131,353	$ -	$ -	$ 1,594,331	$ -	$ -	$ 1,286,691	$ -	$ -
LSM	$ 607,615	$ -	$ -	$ 663,490	$ -	$ -	$ 1,199,237	$ -	$ -
LSM Reconfiguration	$ -	$ -	$ -	$ -	$ 222,326	$ -	$ -	$ 173,362	$ -
Metering Research	$ -	$ -	$ -	$ -	$ 62,250	$ -	$ -	$ 62,250	$ -
Totals	**$ 5,075,664**	**$ -**	**$ -**	**$ 4,395,356**	**$ 284,576**	**$ -**	**$ 4,185,489**	**$ 235,612**	**$ -**
Utilicast	$ -	$ -	$ -	$ 67,060	$ -	$ -	$ 32,639	$ -	$ -
Grand Totals	**$ 5,075,664**	**$ -**	**$ -**	**$ 4,462,416**	**$ 284,576**	**$ -**	**$ 4,218,128**	**$ 235,612**	**$ -**

6.5.1.1 *GPSS Projects – Capital Actuals Summary*

The below table represents GPSS EIM capital projects completed between summer 2019 and June 2021, with combined Avista and Utilicast costs per location and project type.

Table 11 – GPSS Capital Actuals as of September 2022

GPSS Capital - Final Closed Actuals		
Location	**Project Type**	**Actual Capital Cost**
Noxon	HSM	$ 443,614
Cabinet Gorge	HSM	$ 572,724
Rathdrum CT	HSM	$ 698,522
	Subtotal	**$ 1,714,860**
Boulder Park	LSM	$ 261,349
Long Lake	LSM	$ 403,553
Nine Mile	LSM	$ 205,713
Post Falls	LSM	$ 339,095
	Subtotal	**$ 1,209,710**
Noxon	PLC	$ 730,061
Cabinet Gorge	PLC	$ 563,497
	Subtotal	**$ 1,293,558**
	Total Capital	**$ 4,218,128**

6.5.1.1.1 High Side Meter Project Actuals

The High-Side Meter (HSM) projects installed SEL-735 meters on the substation-side of the Generation Step-up Units (GSU) in accordance with Avista's *SEL-735 Combined (interchange and generation) Meter Setting Standard*. Under GPSS direction, Avista delivered HSM upgrades at Noxon Rapids Hydro Electric Dam (HED), Cabinet George HED and the Rathdrum Combustion Turbine (CT), with a total cost of $1.71 million.

6.5.1.1.2 Low Side Meter Project Actuals

The Low-side meter (LSM) projects installed SEL-735 meters at plant-side of the GSU in accordance with Avista's *SEL-735 Combined Meter Setting Standard*. Under GPSS direction, Avista delivered LSM upgrades at Long Lake HED, Nine Mile HED, Post Falls HED and Boulder Park CT, with a total cost of $1.20 million.

6.5.1.1.3 Programmable Logic Control Project Actuals

The Programmable Logic Control projects (PLC) installed an EIM PLC system to act as an interface point between SCADA system, plant high-side meters, low-side meters and plant unit controllers, with an input switch for EIM participation and non-EIM participation mode. Under GPSS direction, Avista delivered PLC upgrades at Noxon Rapids HED and Cabinet George HED, with a total cost of $1.29 million.

6.5.1.2 *GPSS Implementation Expense Projects – Expense Actuals Summary*

The below table represents GPSS EIM implementation expense projects completed between spring 2019 and June 2021, with combined Avista and Utilicast costs per location and project type. An estimated expense threshold of $10k was established to track expense costs associated with an individual project. The LSM and HSM projects listed below were conducted with existing Avista labor, while the metering research project was conducted with contracted labor.

Table 12 – GPSS Implementation Expense Actuals as of September 2022

GPSS Implementation Expense - Final Closed Actuals		
Location	**Project Type**	**Actual Expense Cost**
Little Falls	LSM	$ 76,078
Kettle Falls	LSM	$ 97,284
Hydro	Metering Research	$ 46,688
Thermal	Metering Research	$ 3,113
Steam	Metering Research	$ 12,450
Total Implementation Expense		**$ 235,613**

6.5.1.2.1 Meter Reconfiguration Implementation Expense Actuals

At some generation sites, the unit and/or station service meters were already upgraded to SEL-735 meters as part of a previous project. These low-side meters required reconfiguration in accordance with Avista's most current *SEL-735 Combined Meter Setting Standard.* No new assets were planned for installation; therefore, the work was classified as expense. Under GPSS direction, Avista conducted low side meter reconfiguration at Little Falls HED and Kettle Falls CT, with a total expense cost of $0.17 million.

6.5.1.2.2 Metering & Transformer Research Implementation Expense Actuals

At some generation locations, the accuracy of the equipment burden rating was unknown and correction factors would need to be applied. To determine where a correction factor was needed, metering and transformer research was required. No new assets were planned for installation; therefore, this work was classified as expense. Under GPSS direction, Avista conducted metering and transformer research at various hydro and thermal generation locations with a total expense cost of $0.06 million

6.5.2 Substation Interconnection & Third-Party Generation Delivery Summary

In 2018, Utilicast and Avista partnered to conduct a site-by-site metering assessment to document Avista's substation interchange and third-party generation metering, highlighting existing assets that were insufficient for EIM entry. Sites were divided into two categories: meter replacement and meter reconfiguration, and very high-level cost estimates were assigned. These costs were estimated in the EIM Program Charter at $0.85 million.

Early in the first quarter of 2019, design for Substation interconnection projects began, while additional outreach to third-party generation owners was needed before capital projects could begin. Throughout 2019, additional planning efforts resulted in scope changes at various locations, the removal of some upgrade locations based on existing non-EIM funded projects, and the need for centralized, substation-led project management. The capital cost estimates were updated in the October 2020 EIM Program Scope document at $1.85 million, including Utilicast support costs of $0.07 million, and $0.05 million in implementation expense.

By June of 2021, Avista transferred to plant 23 capital metering projects and by March 2022 all projects had closed with a total capital investment of $2.11 million, approximately $0.26 million over the approved Scope Document approvals. The Utilicast contribution to Substation projects closed at $0.04 million, approximately $0.03 million under the Scope

Document approvals. The total implementation expense charges completed at $0.01 million, approximately $0.05 million under the Scope Document approvals.

Table 13 – Substation Interconnection & Third-Party Generation
Financial Comparison as of September 2022

Track 5 - Substation	Charter Estimates (as of 2019)			Scope Estimates (as of 08/2020)			Closed Actuals (as of 09/2022)		
Project Type	*Capital*	*Implementation Expense*	*Ongoing Expense*	*Capital*	*Implementation Expense*	*Ongoing Expense*	*Capital*	*Implementation Expense*	*Ongoing Expense*
Substation Interchange									
Meter Replace	$ 610,200	$ -	$ -	$ 1,312,291	$ -	$ -	$ 1,416,634	$ -	$ -
Meter Reconfiguration	$ -	$ -	$ -	$ -	$ 18,720	$ -	$ -	$ -	$ -
Third-Party Generation									
Meter Replace	$ 242,000	$ -	$ -	$ 315,515	$ -	$ -	$ 407,507	$ -	$ -
Meter Reconfiguration	$ -	$ -	$ -	$ -	$ 36,100	$ -	$ -	$ 6,410	$ -
AGC	$ -	$ -	$ -	$ 157,724	$ -	$ -	$ 259,162	$ -	$ -
Totals	**$ 852,200**	**$ -**	**$ -**	**$ 1,785,530**	**$ 54,820**	**$ -**	**$ 2,083,303**	**$ 6,410**	$ -
Utilicast	$ -	$ -	$ -	$ 67,060	$ -	$ -	$ 35,539	$ -	$ -
Grand Totals	**$ 852,200**	**$ -**	**$ -**	**$ 1,852,590**	**$ 54,820**	**$ -**	**$ 2,118,842**	**$ 6,410**	$ -

6.5.2.1 *Substation Interconnection & Third-Party Generation Projects – Actuals Summary*

The below table represents Substation Interconnection and Third-Party Generation EIM capital projects completed between first quarter 2019 and June 2021, with combined Avista and Utilicast costs per location and project type.

Table 14 – Substation Interconnection & Third-Party Generation
Capital Actuals as of September 2022

Substation Interconnection Capital - Final Closed Actuals		
Location	**Project Type**	**Actual Capital Cost**
Northeast	Meter Replace	$ 62,629
Burke	Meter Replace	$ 133,792
Sagle	Meter Replace	$ 34,935
Priest River	Meter Replace	$ 50,160
Loon Lake	Meter Replace	$ 43,142
Noxon 13kV	Meter Replace	$ 53,009
Milan	Meter Replace	$ 87,859
Kettle Falls	Meter Replace	$ 133,921
Dry Creek	Meter Replace	$ 131,958
Lolo	Meter Replace	$ 121,684
Wilbur	Meter Replace	$ 78,492
Mead	Meter Replace	$ 125,398
Stratford	Meter Replace	$ 94,200
Warden	Meter Replace	$ 122,037
Noxon 230kV	Meter Replace	$ 161,915
POPUD Distribution	Meter Replace	$ 5,768
POPUD Transmission	Meter Replace	$ 9,453
	Substation Capital Subtotal	**$ 1,450,352**
Third-Party Generation Capital - Final Closed Actuals		
Location	**Project Type**	**Actual Capital Cost**
Fighting Creek	Meter Replace	$ 74,025
Waste to Energy	Meter Replace	$ 88,036
Plummer Saw Mill	Meter Replace	$ 80,276
Upriver	Meter Replace	$ 87,775
Palouse Wind	Meter Replace	$ 79,216
Lancaster	AGC	$ 259,162
	Third-Party Generation Capital Subtotal	**$ 668,490**
	Total Capital	**$ 2,118,842**

6.5.2.1.1 Meter Replacement Project Actuals

At some interconnection and third-party generation locations, meter replacement projects were planned to install one or more SEL-735 meters in accordance with Avista's most current *SEL-735 Combined Meter Setting Standard*. At some locations, accompanying integration and security equipment was also planned for installation. Under Substation direction, Avista delivered new meters at 17 substation interconnection locations, with a total cost of $1.45 million and five third-party generation sites, including automated generation controls (AGC) at Lancaster CT with a total cost of $0.67 million.

6.5.2.2 *Implementation Expense Projects – Financial Actuals Summary*

The below table represents Substation and Third-Party Generation EIM implementation expense projects completed between spring 2019 and June 2021, with combined Avista and Utilicast costs per location and project type.

Table 15 – Substation Interconnection & Third-Party Generation Implementation Expense Actuals as of September 2022

Substation Interconnection Implementation Expense - Final Closed Actuals			
Location	**Project Type**	**Actual Capital Cost**	
NA	Meter Reconfig	$	-
Substation Expense Subtotal		**$**	**-**
Third-Party Generation Implementation Expense - Final Closed Actuals			
Location	**Project Type**	**Actual Expense Cost**	
Solar Select/Lind Solar	Meter Reconfiguration	$	6,410
Third-Party Generation Expense Subtotal		**$**	**6,410**
Total Implementation Expense		**$**	**6,410**

6.5.2.2.1 Meter Reconfiguration Project Actuals

At one third-party generation location, SEL-735 meters had been installed as part of a previous project. These meters required reconfiguration in accordance with Avista's most current *SEL-735 Combined Meter Setting Standard.* No new assets were planned for installation and the work was classified as expense. Under Substation direction, Avista conducted meter reconfiguration at the third-party generation site, Solar Select/Lind Solar, with a total expense cost of $0.01 million.

6.5.3 Network Communications Delivery Summary

In 2018, Utilicast and Avista partnered to conduct site-specific network assessments to support the metering assessment for generation and substation interconnection sites. At that time, every known generation controls and meter upgrade project assumed a parallel capital network communications project to support asset implementation. It was also assumed Avista would remove dial-up communications in favor of third-party Internet Provided (IP) communications. Each location was assigned a network scope "package," with the goal of implementing an economic reliable and secure network path. Throughout the middle of 2019 and into 2020, network site surveys were conducted, and package assignments were updated based on the scope for each location. By June of 2021, the Network Communications delivery team had transferred to plant 21 EIM network projects with a total capital investment of $2.1 million – approximately $0.5 million over the Program Scope Document approval. The Utilicast contribution to network projects closed at $0.04 million, approximately $0.02 million under Scope Document approvals. No EIM implementation expense charges were incurred under network communications delivery.

Table 16 – Network Communications Financial Comparison as of September 2022

Track 5 - Network	Charter Estimates (as of 2019)			Scope Estimates (as of 08/2020)			Closed Actuals (as of 09/2022)		
Project Type	*Capital*	*Implementation Expense*	*Ongoing Expense*	*Capital*	*Implementation Expense*	*Ongoing Expense*	*Capital*	*Implementation Expense*	*Ongoing Expense*
Package 1	$ 270,000	$ -	$ 91,000	$ -	$ -	$ 1,000	$ 116,828	$ -	$ -
Package 2	$ 1,016,000	$ -	$ 72,800	$ 457,200	$ -	$ 18,200	$ 711,169	$ -	$ -
Package 3	$ 208,000	$ -	$ 36,400	$ -	$ -	$ -	$ -	$ -	$ -
Package 4	$ 225,000	$ -	$ 15,000	$ 323,255	$ -	$ 15,100	$ 521,613	$ -	$ -
Package 5	$ -	$ -	$ -	$ 751,796	$ -	$ 35,200	$ 711,606	$ -	$ -
Package 6	$ -	$ -	$ -	$ -	$ 10,000	$ -	$ -	$ -	$ -
Network PM (Line 24)	$ 416,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Totals	**$ 2,135,000**	**$ -**	**$ 215,200**	**$ 1,532,251**	**$ 10,000**	**$ 69,500**	$ 2,061,216	$ -	$ -
Utilicast	$ -	$ -	$ -	$ 67,060	$ -		$ 42,364	$ -	$ -
Grand Totals	**$ 2,135,000**	**$ -**	**$ 215,200**	**$ 1,599,311**	**$ 10,000**	**$ 69,500**	**$ 2,103,580**	$ -	$ -

6.5.3.1 *Network Communications Projects – Capital Actuals Summary*

The below table represents Network Communications EIM capital projects completed between first quarter 2019 and June 2021, with combined Avista and Utilicast costs per location and project type.

Table 17 – Network Communications Capital Actuals as of September 2022

Network Capital - Final Closed Actuals			
Location	**Project Type**	**Actual Capital Cost**	
Lancaster	Package 1	$	116,828
	Subtotal	**$**	**116,828**
Burke	Package 2	$	383,783
Kettle Falls	Package 2	$	340,345
	Subtotal	**$**	**724,128**
Cabinet Gorge	Package 4	$	79,259
Long Lake	Package 4	$	-
Monroe Street	Package 4	$	129,339
Nine Mile	Package 4	$	51,668
Noxon Rapids	Package 4	$	42,312
Post Falls	Package 4	$	50,133
Upper Falls	Package 4	$	-
Noxon 13 kV Con	Package 4	$	77,803
Coyote Springs 2	Package 4	$	106,983
	Subtotal	**$**	**537,497**
Deer Park	Package 5	$	113,682
Loon Lake	Package 5	$	72,809
Milan	Package 5	$	84,701
Priest River	Package 5	$	134,296
Wilbur	Package 5	$	84,680
Fighting Creek	Package 5	$	51,592
Plummer Saw Mi	Package 5	$	31,991
Spokane Waste t	Package 5	$	91,536
Upriver	Package 5	$	59,840
	Subtotal	**$**	**725,127**
	Total Capital	**$**	**2,103,580**

6.5.3.1.1 Package 1 – Standard Substation Communication Package Actuals

This package was for locations that did not have IP communications. It included contracting IP services from a third-party Local Exchange Carrier (LEC) and the installation of communication hardware. Under Network Communications direction, Avista delivered package 1 to support Automated Generation Controls at Lancaster CT with a completed cost of $0.12 million.

6.5.3.1.2 Package 2 – Standard Substation Communication Package + High Voltage Protection Actuals

This package assumed the base installation of Package 1 and equipment to protect against Ground Potential Rise with High Voltage Protection (HVP). Under Network Communications direction, Avista delivered package 2 at two locations with a total cost of $0.72 million.

6.5.3.1.3 Package 3 – Standard Substation Communication Package + Modified HVP Actuals

This package assumed the installation of packages 1 & 2, with a modification for HVP at the Copper-Fiber Junction Box. Network Communications did not deliver this package at any location.

6.5.3.1.4 Package 4 – Network Capacity Increase and Extension Package Actuals

This package was identified for generation facilities where IP communications already existed, and an extension of the Local Area Network (LAN) was needed to provide connectivity to new meters. Under Network Communications direction, Avista deliver package 4 at seven locations with a total cost of $0.54 million.

6.5.3.1.5 Package 5 – Commercial Cellular Communications Actuals

This package was identified where locations could support IP communications via a wireless cellular option. Under Network Communications direction, Avista delivered package 5 at nine locations with a total cost of $0.73 million.

6.5.3.2 *Network Communications Projects – Implementation Expense Actuals Summary*

Package six was identified for locations where IP communications existed, and network configurations were required to support metering. No new asset was planned for installation and this work was classified as implementation expense. Network Communications did not deliver any expense work.

6.5.3.3 *Network Communications Projects – On-Going Expense Actuals Summary*

Although on-going expense was estimated at $0.07 million, and actual charges have and will continue to be incurred, it is not possible to track network expense costs by location or network service due to the structure of service agreements and invoice details. As a result, the on-going network communication costs are not included in the expense or incremental expense totals.

6.6 Track 6 – Operations Readiness & Training Delivery

6.6.1 Operations Readiness & Training Delivery Summary

Under this track, Avista primarily planned for the hiring of new employees to support market operations, and market training for existing employees and new employees.

Table 18 – Operations Readiness & Training Financial Comparison as of September 2022

Track 6 - Operation Readiness & Training	Charter Estimates (as of 05/2019)			Scope Estimates (as of 08/2020)			Closed Actuals (as of 09/2022)		
	Capital	*Implementation Expense*	*Ongoing Expense*	*Capital*	*Implementation Expense*	*Ongoing Expense*	*Capital*	*Implementation Expense*	*Ongoing Expense*
Training & OCM	$ -	$ 480,000	$ -	$ -	$ 480,000	$ -	$ -	$ 629,514	$ -
EIM HR Plan	$ 550,000	$ 185,000	$ 2,500,000	$ 2,255,219	$ 1,033,570	$ 3,177,467	$ 494,265	$ 1,147,406	$ 2,397,128
System Ops Desk - Mission	$ 233,000	$ -		$ 225,071	$ -	$ 4,000	$ 191,499	$ -	$ -
System Ops Desk - BuCC	$ -	$ -		$ 86,000	$ -	$ 4,000	$ 81,663	$ -	$ -
Noxon 230kV CIP PSP	$ -	$ -		$ 110,624	$ 10,000	$ -	$ 238,226	$ -	$ -
Totals	**$ 783,000**	**$ 665,000**	**$ 2,500,000**	**$ 2,676,914**	**$ 1,523,570**	**$ 3,185,467**	**$ 1,005,653**	**$ 1,776,921**	**$ 2,397,128**
Utilicast	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Grand Totals	**$ 783,000**	**$ 665,000**	**$ 2,500,000**	**$ 2,676,914**	**$ 1,523,570**	**$ 3,185,467**	**$ 1,005,653**	**$ 1,776,921**	**$ 2,397,128**

6.6.1.1 *EIM Training*

Avista personnel completed the CAISO computer-based training, software training, workshops, train-the-trainer workshops and training for the phased testing: Day in the Life, Market Simulation, Parallel Operations and Go-Live initiation. In addition, Avista developed an internal certification plan for the EIM Operator. Training is considered expense and was tracked by department. The training actuals were $0.63 million for both existing and incremental employees (EIM HR Plan). See Table 24 – Total Incremental & Non-Incremental Labor Actuals training costs by business unit for additional detail.

6.6.1.2 *EIM Human Resource Plan*

In June 2020, the EIM Human Resource Plan was signed by the Executive Steering Committee members, approving 17 incremental EIM FTE hires throughout 2020-2022 in preparation for market operations. In August 2020, some hiring date changes were made, with further updates reflected in the October 2020 Scope Document estimates.

In the plan, a financial estimate for the implementation and post-implementation costs were estimated, and all roles assumed an incremental external hire. Each role was assigned an estimated hire date, an annual salary (assumed 78.05% loaded rate) and a breakout of efforts between capital and O&M. These resources were further assigned an estimated annual 3% annual merit increase, and where applicable, incremental step increases based on achieving certain experience levels. This framework provided an estimate of annual capital and O&M FTE costs across 2020-2023, with 2022 representing a shift to primarily O&M expenses based on a market go-live date of March 2022 and 2023 representing a fully burdened O&M year.

Prior to job posting, each position was reviewed and approved by the steering committees. In addition to normal recruitment complexities, hiring for EIM positions was also challenged by replacing roles vacated by Avista retirements and the Covid-19 pandemic. For an EIM hire to be considered incremental, the role had to meet one of the following criteria:

- A new employee hired into an EIM position.
- An existing employee is hired into an EIM position, and the previous position is backfilled (with an external hire).

Avista did not account for partial positions (i.e., an employee working on EIM and non-EIM work). Based on these criteria, 14 of the planned 17 were considered incremental employees. The incremental FTE costs associated with the capital implementation are planned to close at $0.5 million, $1.8 million under the Scope Document estimates. Implementation expense is estimated to complete at $1.1 million, $0.1 million over the Scope Document estimates. Fewer incremental hires, hiring time variance and shifts to O&M contributed to savings in capital. The on-going annual O&M incremental expense is estimated at $2.4 million, $0.78 million under the Scope Document estimates.

Table 19 – EIM Human Resource FTE Comparison

EIM FTE Estimates	Charter Estimates (as of 05/2019)		Scope Estimates (as of 08/2020)		Actual Hire Date
	Quantity	*Hire Date* (mth/yr)	*Quantity*	*Rev. Hire Date* (as of 08/2020)	*Hire Date* (mth/yr)
Implementation Resources					
EIM Program Manager	1	Jan-19	1	Jan-19	Feb-19
Org. Change Management Specialist	1		1	Sep-20	Oct-20
Substation Engineer			1	Jan-20	
Total	**2**		**3**		
Incremental EIM FTEs					
Power Supply Analyst	1	Oct-20	1	Jul-21	Oct-21
Network Model Tech	1	Oct-20	1	Jun-20	Jun-20
SCADA Tech	1	Oct-20	0		
EIM BA Desk Operator	1	Jul-21	1	Feb-20	Dec-20
EIM BA Desk Operator	1	Jul-21	1	Oct-20	Jan-21
EIM BA Desk Operator	1	Jul-21	1	Oct-20	Apr-21
EIM BA Desk Operator	1	Jul-21	1	Jan-21	Jul-21
EIM BA Desk Operator	1	Jul-21	1	Jan-21	Jun-20
EIM BA Desk Operator	0		1	Mar-22	Mar-22
Training Admin	0		1	Aug-22	Mar-22
EIM BA Analyst	0		1	Sep-21	Sep-21
Settlements Manager	0		1	Oct-20	Oct-20
Data Management Operator	1	Oct-20	1	Apr-21	Mar-21
Settlement Analyst	1	Apr-21	1	Apr-21	Apr-21
Settlement Analyst	0		1	Jun-21	May-21
Settlement Analyst	0		1	Aug-22	Nov-21
Compliance	0 or 1	Apr-21	0		
IT Analyst	1 or 2	Oct-20	1	Oct-20	Jun-21
IT Analyst	0		1	Jan-21	Dec-21
Total	**11 to 13**		**17**		

6.6.1.3 *Transmission System Operations EIM Desk Scope – Mission*

To accommodate the EIM Operators, a new workstation was needed at Mission campus in System Operations. This project delivered two new computers, a phone console, new monitors, ergonomic chairs, a projector, and a screen for the Mission Campus. This project began in the first quarter 2020 and transferred to plant in March 2021, with a total cost of $0.20 million.

6.6.1.4 *Transmission System Operations EIM Desk Scope – BuCC*

To accommodate the EIM Operators at the Backup Control Center (BuCC), a new workstation was needed with two new computers, new monitors, and a new phone console. This project began in third quarter 2020 and transferred to plant in March 2021, with a total cost of $0.08 million.

6.6.1.5 *Noxon 230kV Switchyard CIP PSP Project*

As part of the metering and network upgrade projects at the Noxon Hydro Electric Dam (HED) and the Noxon 230kV Switchyard, external routable communications were introduced, thus classifying the Noxon 230kV Switchyard as a Medium Impact BES Cyber System. Due to this new classification, additional infrastructure was needed to remain compliant with all relevant Critical Infrastructure Protection (CIP) requirements. This project began in Q1 2020 and transferred to plant in April 2021, with a total cost of $0.24 million.

7 Program Implementation Costs

7.1 Total Program Costs

As of the Scope Document estimates, the total program costs (incremental and non-incremental) were estimated at $32.1 million including contingency for capital and expense, with on-going O&M expense estimated at $3.9 million. As of accounting period ending September 2022, the EIM program completed with total costs at $29.5 million, with $24.2 million in capital and $5.5 million in implementation expense (incremental and non-incremental). The annual O&M expense associated with incremental EIM labor and software maintenance costs is estimated at $3.1 million, with annual capital is estimated at $0.5 million.

Table 20 – Close Program Actuals as of September 2022

EIM Program Closed Actuals (as of 09/2022)	Implementation	Contingency	Totals	Annual O&M Expenses	Annual Capital
Capital	$ 24,131,373	$ 85,305	$ 24,216,678	$ -	$ 500,000
Expense (existing & incremental)	$ 5,382,967	$ 193,627	$ 5,576,594	$ 3,063,430	$ -
Total Costs	**$ 29,514,340**	**$ 278,932**	**$ 29,793,272**	**$ 3,063,430**	**$ 500,000**

Table 21 – Scope Program Estimate as of August 2020

EIM Program Scope Estimates (as of 08/2020)	Implementation	Contingency	Totals	Annual O&M Expenses	Annual Capital
Capital	$ 24,091,964	$ 2,600,000	$ 26,691,964	$ -	$ 500,000
Expense (existing & incremental)	$ 5,011,026	$ 400,000	$ 5,411,026	$ 3,907,100	$ -
Total Costs	**$ 29,102,990**	**$ 3,000,000**	**$ 32,102,990**	**$ 3,907,100**	**$ 500,000**

Table 22 – Charter Program Estimates as of May 2019

EIM Program Charter Estimates (as of 05/2019)	Implementation	Contingency	Totals	Annual O&M Expenses	Annual Capital
Capital	$ 18,969,000	$ 4,742,250	$ 23,711,250	$ -	$0.0
Expense (existing & incremental)	$ 2,380,000	$ 595,000	$ 2,975,000	$ 3,534,000	$0.0
Total Costs	**$ 21,349,000**	**$ 5,337,250**	**$ 26,686,250**	**$ 3,534,000**	**$0.0**

7.2 Total Program Costs by Business Unit

Table 23 represents the total program costs by business unit as of September 2022. Capital charges are represented as all Avista labor and non-labor charges, and all Utilicast non-labor charges by business unit. Expense charges are represented as incremental and non-incremental with an allocation of corresponding Utilicast charges.

Table 23 – EIM Program Implementation Close Actual Costs by Business Unit as of September 2022

Program Costs by Business Unit Closed Actuals (as of 09/2022)	Capital			Implementation Expense (existing & incremental)			
				Labor	Non-Labor		Totals
	Avista	Utilicast	Totals	Avista	Utilicast	Other	
ET Applications	$ 7,997,169	$ 2,676,885	**$ 10,674,054**	$ 688,618		$ 383,166	$ 1,071,783
ADSS	$ 3,640,136	$ 424,967	**$ 4,065,103**				
Facilities	$ 273,162	$ -	**$ 273,162**				
Accounting, Legal, Rates	$ -	$ -	**$ -**				
ET Network	$ 2,061,216	$ 42,364	**$ 2,103,580**	$ 8,482		$ -	$ 8,482
GPSS	$ 4,185,489	$ 32,639	**$ 4,218,128**	$ 399,652		$ 88,523	$ 488,174
Substation	$ 2,321,529	$ 35,539	**$ 2,357,068**	$ 83,434		$ 16,555	$ 99,989
Transmission	$ 499,742	$ 25,841	**$ 525,583**	$ 1,650,922		$ -	$ 1,650,922
Power Supply	$ -	$ -	**$ -**	$ 687,742		$ 328,247	$ 1,015,989
EIM Program	$ -	$ -	$ -		$ 1,216,486	$ 24,769	$ 1,241,255
Totals	**$ 20,978,443**	**$ 3,238,235**	**$ 24,216,678**	**$ 3,518,849**	**$ 1,216,486**	**$ 841,259**	**$ 5,576,594**
Grand Totals	**$24,216,678**			**$5,576,594**			

7.3 Total Expense Labor Costs by Business Unit

Table 24 below identifies actual program implementation labor by business unit and separated by incremental labor (EIM HR Plan) and non-incremental labor, including labor loadings. Tracking labor associated with the implementation, and as documented in the totals below, ended February 28, 2022, prior to market entry to align with set pay periods.

Table 24 – Total Incremental & Non-Incremental Labor Close Actuals as of May 2022

Labor Expense by Department (Existing & Incremental)	Actuals (as of 05/2022)						
	Incremental			Non-Incremental			Grand Total
	Training	Other	Totals	Training	Other	Totals	
A&G Support (IS/IT, rates, legal, accounting, supply chain)	$ 52,042	$ 289,048	$ 341,090	$ 15,358	$ 332,170	$ 347,527	$ 688,618
Transmission Operations	$ 239,942	$ 407,718	$ 647,659	$ 117,154	$ 886,109	$ 1,003,262	$ 1,650,922
Substation	$ -	$ -	$ -	$ -	$ 83,434	$ 83,434	$ 83,434
Power Supply	$ 12,058	$ 146,566	$ 158,624	$ 126,539	$ 402,579	$ 529,118	$ 687,742
GPSS	$ -	$ -	$ -	$ 66,215	$ 333,437	$ 399,652	$ 399,652
IT Network	$ -	$ 33	$ 33	$ 206	$ 8,243	$ 8,449	$ 8,482
Total	**$ 304,042**	**$ 843,364**	**$ 1,147,406**	**$ 325,472**	**$ 2,045,971**	**$ 2,371,443**	**$ 3,518,849**

7.4 Total Incremental Non-Labor Expense Costs

As of accounting period ending September 2022, the EIM implementation program completed all financial transactions. Table 25 below identifies actual incremental non-labor expense items.

Table 25 – Incremental Non-Labor Expense Close Actuals as of September 2022

Non-Labor Expense Closed Actuals Detail (as of 09/2022)	Totals
Utilicast	$ 1,216,486
CAISO Milestones	$ 50,000
CAISO Grid Management Fee	$ 216,281
Contractors - Substation Projects	$ 16,555
Contractors - GPSS Projects	$ 25,048
Market Based Rates Study	$ 50,216
Metering Research/CTPT Testing	$ 63,475
Contractors - ET Projects	$ 30,798
Software Licensing Costs	$ 298,992
Membership	$ 11,750
Misc Gifts	$ 4,861
Employee Meal, Travel, & Lodging	$ 19,907
Vendor Software Training	$ 53,376
Total Costs	**$ 2,057,745**

7.5 Total Incremental Costs

As of accounting period ending September 2022, all EIM implementation transactions completed. Table 26 represents total actual incremental implementation costs (capital and incremental expense) at $27.4 million and the anticipated on-going total O&M costs at $3.1 million, with annual capital estimate of $0.5 million to support EIM software upgrades. After a three-year implementation program, Avista successfully entered the WEIM one month ahead of the original schedule on March 2, 2022, under the allocated budget and delivered the required scope for market operations – all while navigating the challenges of the COVID-19 Pandemic.

Table 26 – Close Program Incremental Actuals as of September 2022

EIM Program Closed Actuals (as of 09/2022)	Implementation	Contingency	Totals	Annual O&M Expenses	Annual Capital
Capital	$ 24,131,373	$ 85,305	$ 24,216,678	$ -	$ 500,000
Incremental Expense	$ 3,062,980	$ 142,171	$ 3,205,151	$ 3,063,430	$ -
Total Costs	**$ 27,194,353**	**$ 227,476**	**$ 27,421,829**	**$ 3,063,430**	**$ 500,000**

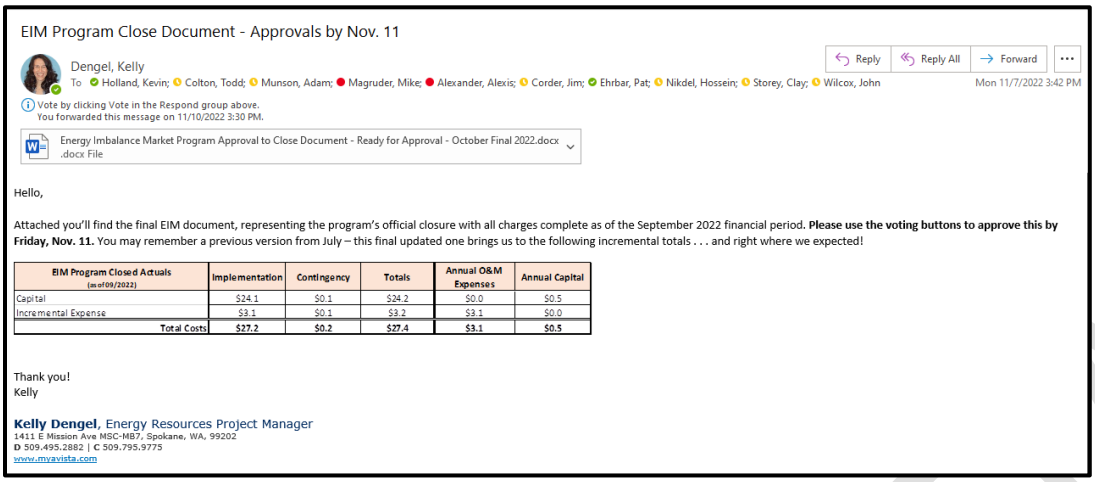
Table 27 – Scope Program Incremental Cost Estimates as of August 2020

EIM Program Scope Estimates (as of 08/2019)	Implementation	Contingency	Totals	Annual O&M Expenses	Annual Capital
Capital	$ 24,091,964	$ 2,600,000	$ 26,691,964	$ -	$ 500,000
Incremental Expense	$ 3,608,880	$ 400,000	$ 4,008,880	$ 3,907,100	$ -
Total Costs	**$ 27,700,844**	**$ 3,000,000**	**$ 30,700,844**	**$ 3,907,100**	**$ 500,000**

Table 28 – Charter Program Incremental Cost Estimates as of May 2019

EIM Program Charter Estimates (as of 05/2019)	Implementation	Contingency	Totals	Annual O&M Expenses	Annual Capital
Capital	$ 18,129,000	$ 4,532,250	$ 22,661,250	$ -	$0.0
Incremental Expense	$ 1,465,000	$ -	$ 1,465,000	$ 3,534,000	$0.0
Total Costs	**$ 19,594,000**	**$ 4,532,250**	**$ 24,126,250**	**$ 3,534,000**	**$0.0**

8 Director Approvals



EIM Program Close Document - Approvals by Nov. 11

Dengel, Kelly

To Holland, Kevin; Colton, Todd; Munson, Adam; Magruder, Mike; Alexander, Alexis; Corder, Jim; Ehrbar, Pat; Nikdel, Hossein; Storey, Clay; Wilcox, John

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Attached you'll find the final EIM document, representing the program's official closure with all charges complete as of the September 2022 financial period. **Please use the voting buttons to approve this by Friday, Nov. 11.** You may remember a previous version from July – this final updated one brings us to the following incremental totals . . . and right where we expected!

EIM Program Closed Actuals (as of 09/2022)	Implementation	Contingency	Totals	Annual O&M Expenses	Annual Capital
Capital	$24.1	$0.1	$24.2	$0.0	$0.5
Incremental Expense	$3.1	$0.1	$3.2	$3.1	$0.0
Total Costs	$27.2	$0.2	$27.4	$3.1	$0.5

Thank you!
Kelly

Kelly Dengel, Energy Resources Project Manager
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Approve EIM Program Close Document - Approvals by Nov. 11 - Kevin Holland - 11.22.2022

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Kevin Holland, Director of Power Supply

Approve EIM Program Close Document - Approvals by Nov. 11 - Alexis Alexander - 11.29.2022

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Alexis Alexander, Director of Generation Production & Substation Support

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Mike Magruder, Director of System Operations & Planning

Approve EIM Program Close Document - Approvals by Nov. 11 - Jim Corder – 11.7.2022

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Jim Corder, Director of Information Technology & Security

Approve EIM Program Close Document - Approvals by Nov. 11 - Hossein Nikdel – 11.8.2022

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Hossein Nikdel, Director of Applications & System Planning

Approve EIM Program Close Document - Approvals by Nov. 11 - Clay Storey - 11.17.2022

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Clay Storey, Director of Security

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John Wilcox, Director of Accounting

Approve EIM Program Close Document - Approvals by Nov. 11 - Adam Munson - 11.9.2022

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Adam Munson, Director of Financial Planning & Analysis

Approve EIM Program Close Document - Approvals by Nov. 11 - Pat Ehrbar 11.7.2022

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Pat Ehrbar, Director of Regulatory Affairs

Approve EIM Program Close Document - Approvals by Nov. 11 - Todd Colton – 11.7.2022

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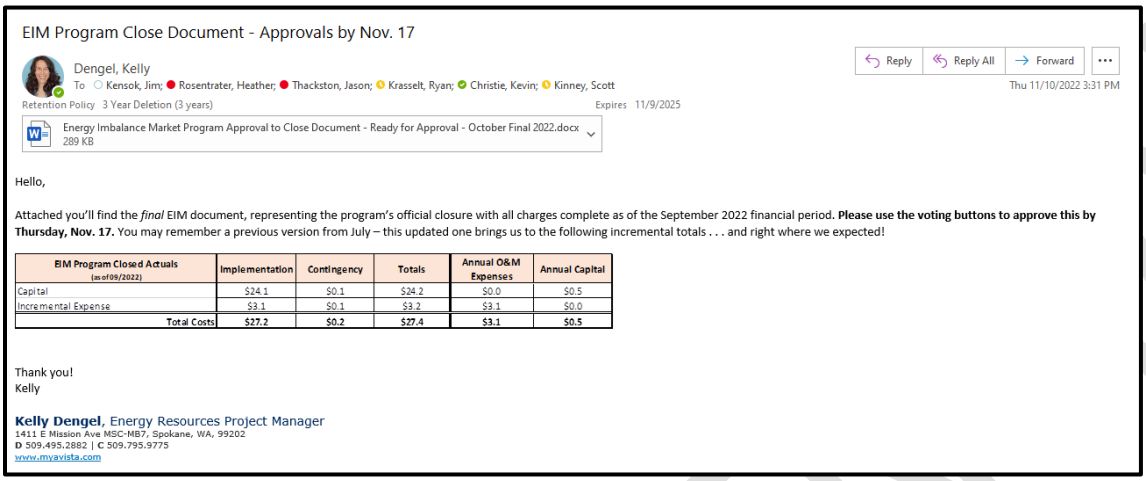
Todd Colton, Senior Legal Counsel

9 Executive Approvals



EIM Program Close Document - Approvals by Nov. 17

Dengel, Kelly

To Kensok, Jim; Rosentrater, Heather; Thackston, Jason; Krasselt, Ryan; Christie, Kevin; Kinney, Scott

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Hello,

Attached you'll find the *final* EIM document, representing the program's official closure with all charges complete as of the September 2022 financial period. **Please use the voting buttons to approve this by Thursday, Nov. 17.** You may remember a previous version from July – this updated one brings us to the following incremental totals . . . and right where we expected!

EIM Program Closed Actuals (as of 09/2022)	Implementation	Contingency	Totals	Annual O&M Expenses	Annual Capital
Capital	$24.1	$0.1	$24.2	$0.0	$0.5
Incremental Expense	$3.1	$0.1	$3.2	$3.1	$0.0
Total Costs	$27.2	$0.2	$27.4	$3.1	$0.5

Thank you!
Kelly

Kelly Dengel, Energy Resources Project Manager
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Approve EIM Program Close Document - Approvals by Nov. 17 - Heather Rosentrater - 11.14.2022

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Heather Rosentrater, Sr. VP of Energy Delivery

Approve EIM Program Close Document - Approvals by Nov. 17 - Jason Thackston - 11.22.2022

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Jason Thackston, Sr. VP of Energy Resources

Re EIM Program Close Document - Approvals by Nov. 17 - Kevin Christie - 11.11.2022

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Kevin Christie, Sr. VP of External Affairs

Approve EIM Program Close Document - Approvals by Nov. 17 - Jim Kensok - 11.11.2022

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Jim Kensok, VP Chief Information & Security Officer

Approve EIM Program Close Document - Approvals by Nov. 17 - Ryan Krasselt - 11.23.2022

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Ryan Krasselt, VP & Controller

Approve EIM Program Close Document - Approvals by Nov. 17 - Scott Kinney - 11.11.2022

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Scott Kinney, VP of Energy Resources

ATTACHMENT B

ENERGY IMBALANCE MARKET
LIFE-TO-DATE (03/01/2023) CAPITAL INVESTMENT

Attachment B
Life To Date (03/01/2023 EIM Capital Investment

Sum of Actual Amount			Year					
Business Case	**ER_Description**	**Svc.Jur**	**2020**	**2021**	**2022**	**Jan-Apr 2023**	**Grand Total**	
Energy Imbalance Market	**ER_7141 - Energy Imbalance Market**	CD.AA	571,908	1,390,077	25,837		1,987,822	
		ED.AN	2,226,135	8,631,139	10,809,523		21,666,797	
		ED.ID	34,284	205,025			239,310	
		ED.MT		53,009			53,009	
		ED.WA		305,679	2,811		308,491	
	ER_7141 - Energy Imbalance Market Total		**2,832,327**	**10,584,930**	**10,838,171**		**24,255,428**	
Energy Imbalance Market Total			**2,832,327**	**10,584,930**	**10,838,171**		**24,255,428**	(1)
Energy Market Modernization & Operational Efficiency					485,829	17,919	503,748	(2)
Grand Total			**2,832,327**	**10,584,930**	**11,324,000**	**17,919**	**24,759,175**	

(1) Energy Imbalance Market Investment to implement EIM at "go-live" 03.01.2022, plus trailing charges.
(2) Energy Market Modernization & Operational Efficiency project - annual additions related to the on-going annual capital investment needed to keep the EIM operational going forward.

ATTACHMENT C

ENERGY IMBALANCE MARKET
LIFE-TO-DATE (03/01/2023) EIM EXPENSES, PRELIMINARY BENEFIT CALCULATION AND NET REVENUES AND SALES

Attachment C

Life to date (3/1/2023) EIM Expenses, Preliminary Benefit Calculation and Net Revenues and Sales

Table No. 1 - O & M Expense

Year	Month	EIM Incremental O&M
2022	March	NA
2022	April	NA
2022	May	NA
2022	June	$ 257,367.00
2022	July	$ 73,471.00
2022	August	$ 74,681.00
2022	September	$ 85,264.00
2022	October	$ 83,009.00
2022	November	$ 65,348.00
2022	December	$ 54,278.00
2023	January	$ 39,924.00
2023	February	$ 49,912.00

Table No. 2 Preliminary Benefit Calculation

Year	Month	Preliminary Benefit Estimate
2022	March	$ 1,804,150.00
2022	April	$ 1,934,303.00
2022	May	$ 1,421,074.00
2022	June	$ 1,155,229.00
2022	July	$ 745,971.00
2022	August	$ 2,255,096.00
2022	September	$ 3,799,470.00
2022	October	$ 1,422,529.00
2022	November	$ 2,228,826.00
2022	December	$ 5,075,308.00
2023	January	$ 2,396,977.00
2023	February	$ 1,447,202.00

Table No. 3 Net Revenue and Sales

Period	Account	Account Description	PTD $
Mar-22	447740	SALE FOR RESALE - EIM	$ (1,676,297)
Apr-22	447740	SALE FOR RESALE - EIM	$ (1,519,257)
May-22	447740	SALE FOR RESALE - EIM	$ (906,081)
Jun-22	447740	SALE FOR RESALE - EIM	$ (1,454,402)
Jul-22	447740	SALE FOR RESALE - EIM	$ (1,115,537)
Aug-22	447740	SALE FOR RESALE - EIM	$ (84,192)
Sep-22	447740	SALE FOR RESALE - EIM	$ (1,583,409)
Oct-22	447740	SALE FOR RESALE - EIM	$ (667,012)
Nov-22	447740	SALE FOR RESALE - EIM	$ (1,487,145)
Dec-22	447740	SALE FOR RESALE - EIM	$ (1,302,373)
Jan-23	447740	SALE FOR RESALE - EIM	$ (1,449,798)
Feb-23	447740	SALE FOR RESALE - EIM	$ (1,525,010)
Mar-23	447740	SALE FOR RESALE - EIM	$ (1,531,088)

Period	Account	Account Description	PTD $
Mar-22	555740	PURCHASED POWER - EIM	$ -
Apr-22	555740	PURCHASED POWER - EIM	$ 481
May-22	555740	PURCHASED POWER - EIM	$ 567,779
Jun-22	555740	PURCHASED POWER - EIM	$ 265,320
Jul-22	555740	PURCHASED POWER - EIM	$ 97,411
Aug-22	555740	PURCHASED POWER - EIM	$ 2,851,038
Sep-22	555740	PURCHASED POWER - EIM	$ 1,450,586
Oct-22	555740	PURCHASED POWER - EIM	$ 1,065,753
Nov-22	555740	PURCHASED POWER - EIM	$ 61,284
Dec-22	555740	PURCHASED POWER - EIM	$ 2,396,555
Jan-23	555740	PURCHASED POWER - EIM	$ 6,988,712
Feb-23	555740	PURCHASED POWER - EIM	$ (113,855)
Mar-23	555740	PURCHASED POWER - EIM	$ 1,463,726

ATTACHMENT D

ENERGY IMBALANCE MARKET
AVISTA'S OCTOBER 11, 2022 BENEFIT COMPLIANCE REPORT
(PER CASE NO. AVU-E-22-11)

Avista Corp.
1411 East Mission P.O. Box 3727
Spokane. Washington 99220-0500
Telephone 509-489-0500
Toll Free 800-727-9170

Via Electronic Mail

October 11, 2022

Commission Secretary
Idaho Public Utilities Commission
472 W. Washington St.
Boise, ID 83702

RE: Avista's Annual Power Cost Adjustment (PCA)
Case No. AVU-E-22-11

Compliance Filing – Energy Imbalance Market (EIM) Benefit Methodology
Commission Order No. 35543 - Case No. AVU-E-22-11

Enclosed for electronic filing with the Commission is the Company's Confidential EIM Benefit Methodology Report, which explains the Company's methodology for measuring EIM benefits, and how that method differs from CAISO's method, as required per Commission Order No. 35543.

The enclosed report is CONFIDENTIAL, rendering this document exempt from public inspection, examination and copying pursuant to Sections 74-101 through 74-126 of the Idaho Code. Avista believes that the identified CONFIDENTIAL document contains valuable Company and third-party information.

If you have any questions regarding this filing, please contact Kaylene Schultz at (509) 495-2482.

Sincerely,

/s/ Patrick Ehrbar

Patrick D. Ehrbar
Director of Regulatory Affairs

Enclosures

CONFIDENTIAL

AVISTA CORPORATION

STATE OF IDAHO
CASE NO. AVU-E-22-11
ANNUAL POWER COST ADJUSTMENT (PCA)

COMPLIANCE FILING

AVISTA'S ENERGY IMBLANCE MARKET (EIM) BENEFIT METHODOLOGY

EIM Benefit Methodology

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Document Version Control

Version	Date	Author	Comments
1.0	07/07/2022	Xin Shane	This includes revised content from Xin Shane, Robert Follini, Brandon Taylor, Brian Holmes (Utilicast), Russell Miller (Utilicast)
2.0	07/27/2022	Xin Shane	Reviewed and Edited by Clint Kalich

Document Sign Off

Person	Role	Signature	Date
Xin Shane	Manager, EIM Settlement & Analytics		10-06-2022
Robert Follini	Manager, Power Trading		10-06-2022
Brandon Taylor	Organized Market Manager		10-06-2002

1.0 Introduction

Avista joined the Western Energy Imbalance Market (EIM) on March 2, 2022. Based on previous studies by Energy and Environmental Economics (E3) and CAISO, Avista expects to realize multiple benefits through EIM participation. This document details Avista's approach to quantifying those benefits.

Avista's EIM Benefit Methodology described within is based on CAISO's EIM Benefit Methodology, adjusted to more accurately quantify Avista's EIM benefit. Previous entrants to the Western EIM have utilized different techniques for calculating EIM Net Benefit, thus no standard has been established among EIM entities. Beyond the CAISO EIM Benefit Methodology, Avista contracted with Energy and Environmental Economics (E3) in the fall of 2017 to perform an exploratory EIM benefit analysis. Further, Avista had multiple conversations with other western utilities who had previously joined the Western EIM.

This document is structured into the following sections:

1. Existing Methodologies Summary & Reference
2. Avista EIM Benefit Methodology Overview
3. Gap Analysis of CAISO's Benefits Methodology
4. Avista's EIM Benefits Calculation Process
5. Future Methodology Consideration

Avista believes its EIM Benefit Methodology is aligned with the spirit of the broader CAISO EIM Benefit Methodology and is generally congruent with other EIM entities' methodologies.

2.0 Existing Methodologies Summary & Reference

This section contains descriptions of some existing methodologies.

2.1 CAISO Benefit Methodology

CAISO publishes quarterly benefits for each EIM participant. Detailed calculations are described in the Methodology document attached as Appendix A.

2.2 Power Settlement Benefits Methodology

Power Settlements has developed a methodology to shadow the CAISO's EIM benefits. Detailed calculations are described in the Methodology document attached as Confidential Appendix B.

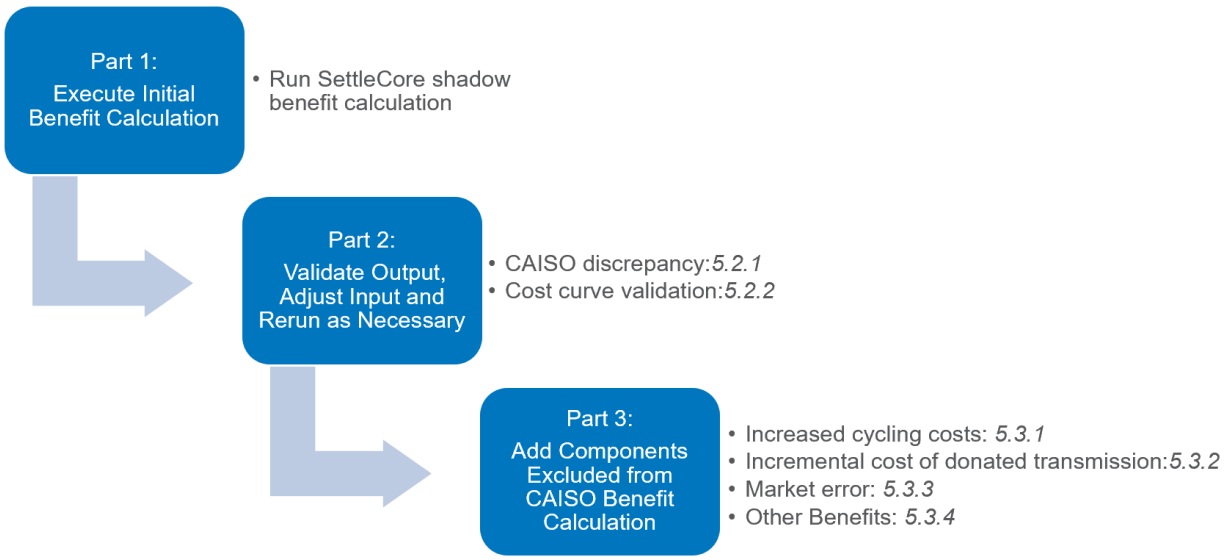
3.0 Avista's EIM Benefit Methodology Overview

This section contains a description of the Methodology Avista will use to calculate EIM Benefits.

The CAISO EIM Benefit Methodology is relatively straightforward and intuitive. However, in its attempt to create a single methodology for all EIM participants, certain components do not apply well to Avista and some important components are excluded, leaving discrepancies. Discrepancy examples are provided later in this document. Each can mask costs or over-state benefits. Nevertheless, this methodology is widely known and thus serves as a starting point for Avista's approach.

Avista built upon CAISO's EIM Benefit Methodology by leveraging the vendor-supplied solution "*SettleCore,*" allowing Avista to "shadow" CAISO daily settlement statements and validate for correctness and completeness. Further, SettleCore provides "Shadow EIM Benefit" functionality, enabling Avista to calculate potential benefits. Several other EIM entities also use the SettleCore module to evaluate their expected Western EIM Benefits. Avista will continue evaluating its EIM Benefits Methodology and refine it as improvements are identified.

The flow chart below summarizes Avista's current EIM benefit calculation process, which will be further detailed in section 5.0:



4.0 Gap Analysis of CAISO's EIM Benefit Methodology

Through discussions with other EIM entities and internal analyses, Avista has identified several areas for which the CAISO EIM Benefits Methodology does not align well with Avista. A list of key divergences is identified and addressed in this document. Some of the identified items are included in Avista's EIM Benefit Methodology scope, while others are excluded with justification. The in/out-of-scope decision is based on the estimated magnitude of impact on EIM benefits, and the amount and availability of data.

4.1 Commitment Costs in EIM Are Not Included

The CAISO EIM Benefit calculation considers commitment costs for ISO BAAs (Balancing Authority Areas), and not EIM BAAs like Avista. Thus, an EIM benefit calculation for Avista using CAISO's methodology incorrectly inflates or deflates benefits depending on the net load imbalance direction. SettleCore, from Avista's chosen vendor, also does not consider Avista's commitment costs.

4.2 Benefits Not Adjusted for Third Party Loads and Generation

The Avista BAA includes Avista load and 3rd party loads served by Avista under contract, including those of the Bonneville Power Administration (BPA). CAISO's methodology incorrectly attributes benefits and costs accruing to all loads to the Avista BAA.

Depending on the time of year, BPA loads alone can represent roughly 15% of the total Avista BAA load. Any benefits methodology should pass load-related charges to the 3rd party load. Therefore, any EIM benefit estimate associated should accrue reductions in the cost of serving BPA and other 3rd party loads to those loads, not Avista.

Non-BPA 3rd party load served by the Avista's merchant function under contracts includes Pend Oreille PUD, Clearwater, Inland Paper and Kaiser. The EIM charge/payment associated with these contracts is currently absorbed by Avista, but going forward it is reasonable to assume that contracts may be modified to reflect best efforts to transfer these impacts to the 3rd party. As long as the contract follows the contracting price, and not binding with EIM terms, this is not a relevant item to consider for Avista's EIM Benefit calculation.

4.3 Discrepancy between Resource Bids and Actual Costs

The CAISO's EIM Benefit Methodology assumes that incremental Energy Bids, including mitigated Incremental Energy Bids, represent an entity's true cost structure. There are several reasons that this may not be true.

1. Incremental costs are represented in ways other than in the incremental Energy Bid (e.g., Startup or Minimum Load Bids). This is highlighted in Section 4.1.
2. Mitigated Incremental Energy Bids can understate Avista's true costs, including opportunity costs.
3. Resource-related dispatch limitations require bids be placed strategically. Some further details around bidding costs other than true opportunity are detailed in Section 4.3.1

4.3.1 Equipment Limitations Preventing Dispatch to Market

The EIM market design cannot represent certain capabilities and constraints of Avista's generation fleet. Avista has spent a great deal of time determining how to represent its capabilities, costs and constraints

to EIM to ensure the best operational and financial outcomes in its marketplace. However, some techniques used result in inflated benefits within the relatively simplistic CAISO counter-factual dispatch.

An example scenario is benefits being erroneously credited to Avista for the commitment of either its Colstrip or Kettle Falls Biomass plants. Avista's modified methodology identifies these CAISO-assigned benefits and deduct them as appropriate. This section explains this risk.

Avista is a joint owner of Colstrip units 3 and 4. Avista has the rights to dispatch this plant on a 15-minute basis with 20 minutes notice. However, the Colstrip plant is not capable of responding to CAISO's 5-minute market instructions. Thus, should Avista need to bid Colstrip in support of its Flexible Ramping Sufficiency or Bid Range Capacity tests, Avista would likely do so at a higher cost to avoid 5-minute dispatch instructions. Even with this bidding strategy, should the Avista EIM benefits counter-factual analysis dispatch Colstrip, while in reality CAISO did not, CAISO's benefit calculation would incorrectly attribute the benefit of the avoidance of commitment costs when in fact we did not avoid a commitment.

Erroneous benefits can also arise within the Flexible Ramping Sufficiency Test itself. Avista must demonstrate adequate capacity and flexibility via this test, and the Capacity Resource Sufficiency Test, each hour – which Avista does via its bids. In situations where Avista needs to count Colstrip flexibility or capacity, Avista may bid Colstrip at an inflated bid price (e.g., $100 instead of the cost, which we can assume to be $25 in this example) because Avista will be unable to comply with market dispatches on a 5-minute basis and would need to ensure its bid would contain enough revenue to offset CAISO penalties associated with Colstrip's inability to follow 5-minute dispatch direction.

To the extent the CAISO EIM Benefits counter-factual dispatched Colstrip, while the actual market solution did not, it would appear EIM provided benefits. However, no benefit is received. Pre-EIM operations, if Avista had been short and needed to dispatch Colstrip intra-hour, it would do so at the dispatch cost. As a result, any apparent EIM benefit for Colstrip is due to limitations around: the Colstrip plant, EIM, and the CAISO EIM Benefit counter-factual, and thus do not represent reduced operational costs to Avista.

The same conditions exist for the Kettle Falls biomass and Northeast plants.

4.3.2 Fossil Use Limits

Two Avista plants have use limits as a function of their air permits – the duct burners at the Lancaster plant, and the Northeast CT. At Lancaster, the limit applies on an annual basis; at Northeast CT the limit is daily. The EIM solution horizon is just 4.5 hours, much shorter than both permit limits, and so these limits cannot be accommodated by the market directly and must be accounted for through our bidding strategy.

Should Avista need to bid in either resource in support of the Flexible Ramping Sufficiency Test or the Bid Range Capacity Test, Avista must do so at bid prices above our short-term costs to account for any penalties incurred when we are unable to meet EIM-directed dispatch levels due to these limitations. Any CAISO EIM benefit counter-factual based on these higher bid curves would result in over-stated benefits.

4.3.3 Hydro Use Limits

Avista owns a significant number of hydro resources, and they play a key role in daily EIM operations. CAISO's EIM market was designed around thermal plant operations, not hydro. Their operational flexibility and limits cannot be represented in the EIM and so our bids must reflect the risks of EIM

dispatch directions violating our capabilities. These bids can differ from our actual generation price, causing the CAISO EIM benefit calculation to overstate benefits.

4.4 Added Maintenance Cost driven by Increased Cycling

Avista has a respectable amount of ramping capability within its fleet, which is called upon by EIM at various times throughout the day. This leads to more resource movement than Avista has historically experienced. Like its peers, Avista has noticed a significant increase in resource movement. This movement leads to increased maintenance costs. Avista requires more time to better estimate these potential increases in maintenance cost and include them in its bidding strategies.

4.5 Incremental Cost of Donated Transmission by Avista Merchant

The costs related to Avista EIM-donated transmission reduces our benefit and should reduce CAISO/SettleCore benefit calculations. Two categories are associated with donated transmission:

- Lost transmission revenues: This requires the identification of the transfer enabled by the redirect, and the estimated value of selling that amount of transmission.
- New transmission purchases specifically used to enable EIM Transfers: identify the amount of the purchase intended for EIM vs. Non-EIM.

4.6 Impact from Market Errors

The EIM relies on input models and data to calculate its market solution. These inputs are numerous and complex. Avista has noticed multiple instances where one or more modeling or data input were incorrect and expects this behavior to continue in the future. As a result of these issues, market dispatches, ETSR (Energy Transfer System Resource) transfers, and LMPs (Locational Marginal Prices) are not always an accurate representation of what EIM participants' costs would have been absent EIM. In some cases, Avista may be able to successfully argue for a modification through a settlement dispute, or CAISO may perform a price correction. In many cases, CAISO is unwilling or unable to make a correction.

In one recent example of a utility that joined in 2021, CAISO incorrectly modeled a linkage between a generator and a dynamic export. The result was a false shortage of hundreds of MWs for several hours in the BAA. The EIM market solution backfilled this apparent shortage, creating operational issues and significant charges for the affected utility. CAISO was unable or unwilling to correct this issue because other entities relied on the same market solution and provided energy incorrectly as identified by the EIM solution. This was a significant loss for the entity not correctly reflected in CAISO's EIM benefit calculation.

In another example, a May 2022 CAISO price correction had a direct negative financial impact on Avista. We followed CAISO dispatch, leading to profitable operation of Avista resources. However, a CAISO price correction later expunged those profits, creating significant lost opportunity costs having a direct impact on Avista's financial performance. This impact was not accounted for in CAISO's EIM benefit calculation.

Unfortunately, modeling and data errors oftentimes are undetected. However, to the extent Avista can identify the errors with its modified benefits calculation, we will ensure accurate accounting. The market error identification process will evolve over time. Avista's merchant group will leverage the recurring CAISO market quality call and CAISO EIM Market Analysis report to identify market errors daily. A log will be kept, and further analysis of the impact from market errors will be conducted between the merchant and settlement group.

4.7 Other EIM Benefit Related Components

While Avista earns greenhouse gas (GHG) payments from market participation, it is critical that Avista has enough credits to meet its GHG compliance requirements. Any costs of GHG credit purchases will offset benefits assumed in the CAISO EIM calculation.

4.8 Wind Contract Curtailment Cost

Avista wind resources are all controlled through contract; we do not own any wind resources directly. When wind generation is curtailed, Avista must pay the resource owner the curtailed energy. If the curtailment is directly caused by EIM market dispatch, the associated cost will be considered as an offset component of the EIM benefit calculation. It is not considered by the CAISO EIM benefits methodology.

Avista expects other items impacting the benefit calculation are yet to be discovered. We will continue monitoring for these impactors.

5.0 Avista's EIM Benefit Methodology Details

Avista's EIM Benefit Methodology is a three-part process developed to address findings in the Gap Analysis of CAISO's EIM Benefit Methodology. Avista executes this process monthly.

5.1 Part 1: Execute Initial Benefit Calculation

The initial execution of the shadow benefit calculation uses the SettleCore software and CAISO inputs. Avista expects to receive CAISO's benefit calculation output file three weeks after the trading month ends.

5.2 Part 2: Validate Output, Adjust Input and Rerun as Necessary

After the initial shadow benefit calculation runs, Avista receives the CAISO and SettleCore benefit calculation files and a thorough review and validation can be conducted. During review, the SettleCore shadow benefits calculation is rerun with any identified input adjustments, mainly resource bids.

5.2.1 CAISO Discrepancies

Avista's settlement team reviews and compares CAISO Benefit calculation output with the SettleCore Benefit calculation output, as this comparison forms the basis for Avista's methodology. Typical review areas include:

- Total benefit value.
- EIM transfer revenue.
- EIM dispatch cost.
- Counterfactual dispatch cost.
- GHG Revenue.
- GHG transfer revenue.
- Flex transfer revenue.

Avista applies the following thresholds to determine whether a further investigation is warranted:

a) Discrepancy in percentage of total CAISO Benefit value for the month > 2.5%

b) Absolute value of discrepancy for the month > $100,000

If these thresholds are not met, no further adjustments or analyses are completed.

5.2.2 Cost Curve Adjustment

Most bids submitted to the EIM deviate from actual costs, for reasons described in Section 4.3. Avista will address this by overwriting bids sourced from the CAISO SIBR (Scheduling Infrastructure & Business Rules) with a value more closely reflecting its actual operating costs. The specific resources for which this applies to are:

- Colstrip
- Kettle Falls Steam Turbine
- Northeast Combustion Turbine
- Long Lake (Ambient Rerate/derate)
- Little Falls (Ambient Rerate/derate)
- Boulder Park (Ambient Rerate/derate)
- Lancaster
- Noxon Rapids
- Cabinet Gorge
- Mid-C Contracted

Process:

1. Use Avista Merchant logs or other communications to identify where bids deviated from opportunity cost.
2. In an internal workshop format or email communication, Avista Merchant and Settlement groups review effective bid costs to confirm if any input adjustments are needed (Avista expects a more systematic approach to be established, after the process is executed multiple times. As various entities use a different price basis for adjustments, so too will Avista establish its own basis based on accumulated EIM business expertise).
3. If an adjustment is necessary, Avista updates inputs for a potential rerun of the shadow benefit calculation.

5.3 Add Components Excluded from CAISO Benefit Calculation

Once a review has established confidence in the shadow benefit calculation, a simple addition/subtraction calculation is performed to include costs or benefits not addressed in the CAISO Benefit Methodology.

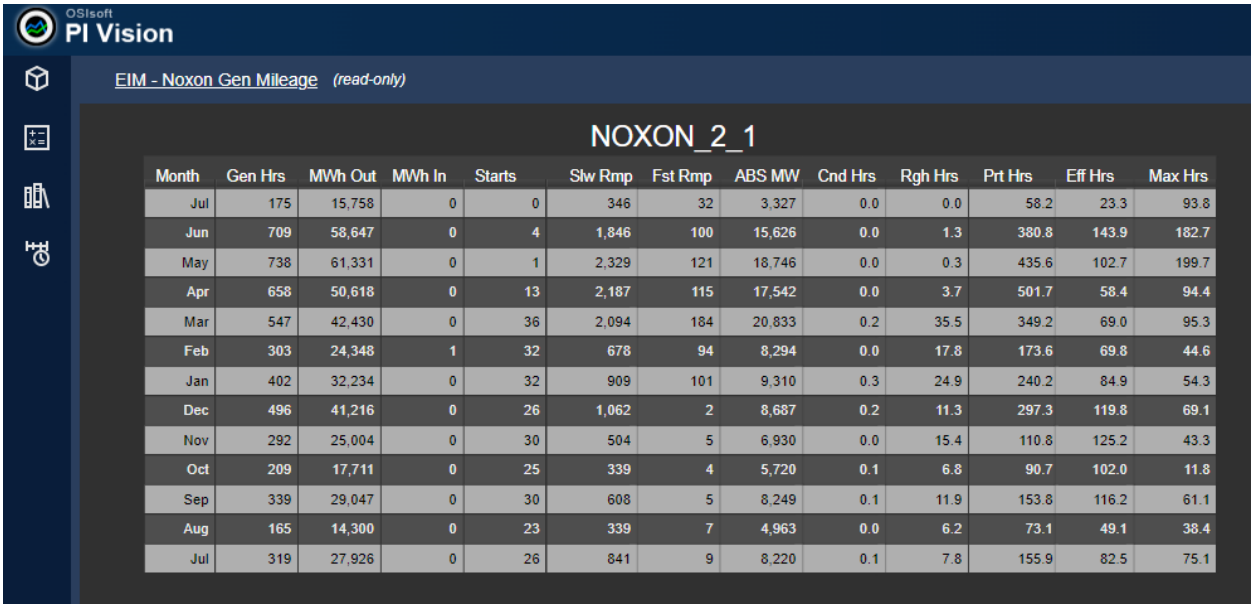
5.3.1 Increased Cycling Maintenance Costs

Avista needs adequate time participating in EIM to evaluate the effect of increased cycling on the maintenance requirements for the Avista generation fleet, so this cost component will likely affect the EIM benefit in 2023. Therefore, a process is defined and will be further developed through practice over time. The method includes detailed monitoring and inputs from the GPSS group and calculations performed by the merchant group.

Avista has implemented a standard method of tracking cycling data, where a consistent interpretation of data is enforced:

- **Mileage:** MW "distance" that the unit ramps. It is calculated by comparing the metered actual every 5 minutes to the metered actual in the prior 5 minutes. The MW value is calculated when that difference is greater than 1 MW in an absolute value sense. These values are summed over the period, which, at least initially, is monthly.
- **ON/OFF:** Measurement of breaker operations when generating plants are being cycled online and offline.

The data is summarized in EIM Gen Mileage report in PI data system, and below is an example screenshot



NOXON_2_1

Month	Gen Hrs	MWh Out	MWh In	Starts	Slw Rmp	Fst Rmp	ABS MW	Cnd Hrs	Rgh Hrs	Prt Hrs	Eff Hrs	Max Hrs
Jul	175	15,758	0	0	346	32	3,327	0.0	0.0	58.2	23.3	93.8
Jun	709	58,647	0	4	1,846	100	15,626	0.0	1.3	380.8	143.9	182.7
May	738	61,331	0	1	2,329	121	18,746	0.0	0.3	435.6	102.7	199.7
Apr	658	50,618	0	13	2,187	115	17,542	0.0	3.7	501.7	58.4	94.4
Mar	547	42,430	0	36	2,094	184	20,833	0.2	35.5	349.2	69.0	95.3
Feb	303	24,348	1	32	678	94	8,294	0.0	17.8	173.6	69.8	44.6
Jan	402	32,234	0	32	909	101	9,310	0.3	24.9	240.2	84.9	54.3
Dec	496	41,216	0	26	1,062	2	8,687	0.2	11.3	297.3	119.8	69.1
Nov	292	25,004	0	30	504	5	6,930	0.0	15.4	110.8	125.2	43.3
Oct	209	17,711	0	25	339	4	5,720	0.1	6.8	90.7	102.0	11.8
Sep	339	29,047	0	30	608	5	8,249	0.1	11.9	153.8	116.2	61.1
Aug	165	14,300	0	23	339	7	4,963	0.0	6.2	73.1	49.1	38.4
Jul	319	27,926	0	26	841	9	8,220	0.1	7.8	155.9	82.5	75.1

Due to the level of effort the evaluation process requires, Avista will likely evaluate increased cycling maintenance costs on an annual basis to determine if adequate data exists to use in its EIM benefit calculations.

5.3.2 Donated Transmission Incremental Costs

The Avista Merchant periodically has residual transmission from day-ahead and real-time market optimization activities. After these markets close, the unused transmission typically has zero terminal value. With Avista's entrance to EIM, Avista plans to donate this transmission to the EIM to benefit Avista's load and marketing at zero cost. However, there may also be instances (due to transmission constraints or optimization opportunities in the region) where Avista would allocate transmission earlier in the optimization cycle to EIM.

To account for these activities, Avista has created an EIM Transmission Cost Book in their ETRM (Energy Trading Risk Management) system to capture these types of donations and transfer any costs the Merchant incurs to this book. Avista's Merchant will calculate the value of the quarterly early optimization cycle transmission donations and provide them to the Avista staff preparing the Avista EIM Benefits Report. In addition, Avista staff will note in the quarterly process log the values of any donated transmission. These values will then be appropriately removed from the Avista EIM Benefit calculation.

5.3.3 Market Error Corrections

"One-off" CAISO errors can impact Avista benefits. Where Avista identifies significant one-off errors by CAISO, we will apply corrections to the benefits calculation.

We will use at least two general avenues to identify these market errors:

- From an operations perspective, Avista Merchant group will report market errors.
- From a settlement perspective, a valid CAISO dispute that isn't financially resolved will be a source of record for the benefit adjustment.

When a significant market error is identified, a thorough financial analysis will be conducted. Any financial impact from market errors will be deducted in the final benefit calculation. May 2022 CAISO price correction financial impact analysis will be an excellent example to demonstrate this process.

5.3.4 GHG Offset Purchase Cost

The monthly GHG offset cost will be provided by Avista Merchant group. Avista's GHG analysis will leverage a standard report in the PRSC (Participating Resource Schedule Coordinator) application.

5.3.5 Wind Curtailment Cost

Compensable curtailed energy charges will be reviewed monthly, upon receipt of Clearway invoices. The amount associated with the compensable curtailed energy will be directly deducted from the final benefit.

6.0 Future Methodology Considerations

Avista will continue refining its EIM Benefit methodology, identifying opportunities to further improve the accuracy of its EIM benefit calculation. As a new entrant, we will be on a steep learning curve for some time. With limited experience in the market, the focus required on the daily EIM operations limits the scope of consideration in our initial EIM Benefit methodology. Below are some opportunities identified for future consideration.

6.1 Variable Energy Resource (VER) PMax (max generation of resource) Review

Avista has preliminarily identified discrepancies between its VER (Variable Energy Resource) PMax in CMRI (Customer Market Result Interface) and the ADS (Automatic Dispatch System) Dispatch report, due to a data gap caused by data granularity issues in the CAISO VER forecast report. This leads to a potential inaccurate benefits calculation when a VER resource is involved in the counter factual dispatch run at the time interval. To accurately estimate this impact, and properly factor the effect in our benefit calculation, a large data analysis effort is required. The proposed process will consist of: (1) performing a data gap analysis, and (2) taking one of the following actions, should an adjustment be required:

- Adjust inputs for the rerun of the Shadow benefit calculation. This approach will require vendor engagement and support, and we have not engaged in a conversation with the vendor on this topic yet.
- Post process SettleCore Benefit Calculation output file to calculate the over-estimated benefit portion. This approach will require a complex data model to be built.

6.2 Commitment Cost Adjustments

As shared earlier in this document, the CAISO Benefit Methodology doesn't consider unit commitment cost, negatively impacting EIM dispatch cost and the counter factual dispatch cost calculation. Two areas should be analyzed:

- CAISO's ISO Commitment Cost Report captures start-up costs, minimum load costs, multi-stage generation transition costs, and shut down costs for market committed resources. This report can potentially be used to quantify the commitment cost that needs to be added to the EIM dispatch cost. Start-up costs are straightforward to calculate, yet complications are expected with the minimum load cost associated with the market-committed resource.
- An approach considering commitment cost in the counter factual cost calculation likely will be done by post processing with the SettleCore shadow benefit run output file, with a calculation model yet to be built.

6.3 FMM Settlements Value is not Considered

When EIM dispatch and counter factual dispatch costs are calculated, only RTD dispatch is considered. The impact from RTPD dispatch is unknown but might negatively impact benefit calculations.

6.4 Impact of BPA Rate of Change Constraints

Avista relies on the BPA transmission system to move Mid-C generation and Coyote Springs generation across BPA and to Avista's BAA. There are many constraints associated with this transmission. Some of these are reflected through a set of "rate of change constraints". These constraints limit the change in the dispatch between the FMM solution and the RTD solution. When these constraints are binding, they will impact the LMPs that Avista pays and receives.

In current pre-EIM operations, Avista has certain contractual rights and obligations but is not directly subject to financial impacts from the Rate of Change Constraints. Avista is attempting to learn more about these constraints and how they will impact benefits achieved from EIM v. current operations, if at all.

6.5 Third Party Loads and Generation is Included at BAA Level

As mentioned previously, BPA can account for up to roughly 15% of the AVA BAA load during specific periods. Non-BPA loads also affect the calculations. This could impact Avista's EIM Benefits calculation. Options have been identified to quantify the BPA portion in the EIM benefit calculation number produced by the SettleCore Shadow Benefit Calculation.

Option 1: Assume that a load-ratio share of the benefits is accruing to BPA. In this approach, Avista would take the Adjusted EIM Benefits and pro-rate them based on a load ratio share. This would likely be derived from the hourly Load Meters used in sub-allocations. The primary value of this approach is simplicity. However, a significant drawback is that generation profits and fuel savings primarily accrue to Avista. BPA would only benefit from reduced costs to serve its imbalance around its hourly schedule. This method likely will understate Avista benefits.

Option 2: Evaluate BPA cost of imbalance directly using the LMP from the market and from the counter-factual analysis. This approach would use the imbalance directly from sub-allocations multiplied by the price differential and then deducted from the Adjusted EIM Benefits and provide a much better

estimate of BPA benefits. However, it is unclear if counter factual LMP data will be available to support this option; and, if so, if and how it can be normalized to the hourly LMP that BPA pays.

At this point, critical data availability will impede the analysis of a reasonable ratio assumption to net out the BPA portion of the benefit. Therefore, further learning and investigation are required to evaluate this component.

AVISTA CORPORATION

STATE OF IDAHO
CASE NO. AVU-E-22-11
ANNUAL POWER COST ADJUSTMENT (PCA)

COMPLIANCE FILING

APPENDIX A

EIM QUARTERLY BENEFIT REPORT METHODOLOGY

EIM Quarterly Benefit Report Methodology

Effective with Q1 2021 EIM benefits report

Prior to the creation of this document, the methodology for the benefits calculation was posted in a technical bulletin and in the benefit report itself. This document consolidates these prior materials into a concise paper for easier understanding of how the EIM benefits are calculated.

The total EIM benefit is the cost saving of the EIM dispatch compared with a counterfactual (CF) without EIM dispatch. The counterfactual dispatch meets the same amount of real-time load imbalance in each BAA without EIM transfers between neighboring EIM BAAs. For an EIM BAA, the benefit can take the form of cost savings or profit or their combination. A BAA will be likely to have energy cost savings when the BAA is importing energy economically, or its base schedules are being optimized by the EIM. To the extent an entity base schedule is optimized prior its submission into the EIM, the benefits may be lessened when compared to an entity that has not submitted optimized base schedules into the EIM. A BAA will be likely to have an energy profit when the BAA is exporting energy economically to other BAAs and being paid a price higher than the bid cost. A BAA other than the ISO may also have a GHG profit when the resource is allocated GHG MWs and is receiving GHG revenue based on marginal GHG cost that is likely higher than its own GHG bid cost.

For each 5-minute interval, the **EIM benefit for a BAA = counterfactual dispatch cost – (EIM dispatch cost + transfer cost + flex ramp transfer cost) + GHG revenue – GHG cost.** The 5-minute level EIM benefits are then aggregated each month with a multiplier 1/12 to convert ($/5 min) to a dollar amount.

EIM Benefit Calculation Components

EIM Dispatch Cost

The total dispatch cost for a BAA for an interval is the sum of all the unit level EIM dispatch costs for that BAA for that interval.

For all BAAs other than CAISO, the dispatch cost only includes variable dispatch cost, i.e. the bids submitted by the corresponding Scheduling Coordinator.

For the ISO's long start units, we only consider variable dispatch cost. For the ISO's short start units, we use a generic cost formula, which includes variable dispatch cost, no load cost, and startup cost. Specifically, the three-part cost for short start units includes:

- The variable dispatch cost of RTD, which is equal to the bid cost associated with the delta instruction above or below the base schedule for each interval,
- the no load cost associated with the incremental dispatch, which is equal to the no load cost divided by Pmax, then multiplied by the delta instruction from the base schedule,
- The startup cost associated with the incremental dispatch, which is equal to the startup cost divided by the minimum online hours, then multiplied by the delta instruction from base schedule divided by the Pmax.

The purpose of this generic cost formula is to evaluate cost differences between EIM dispatches and counterfactual dispatches without performing sophisticated unit commitment simulations. Prior to Q1 2016, only variable dispatch cost was considered in the EIM benefit calculation. With NV Energy joining EIM and improving the transfer capabilities from and to the ISO, we observed a significantly increased transfer volume in EIM. The higher transfer volume cannot be sufficiently replaced by resources online in EIM without committing or de-committing resources, and hence the ISO adopted a three-part cost formula as of Q1 2016 to allow for unit commitment decisions to better evaluate the production difference between EIM and the counterfactual dispatch of the ISO. The unit commitment decisions were made only for short start units that were not combined cycle units. The combined cycle units have complicated models in EIM, so their counterfactual commitment status is fixed at the EIM commitment status to avoid oversimplification.

We approximate the ISO's commitment costs by converting the startup cost and no load cost into variable dispatch cost, assuming a committed short start resource will be fully loaded for minimum online hours. For each supply segment, the corresponding three-part variable cost is equal to

bid_price + no_load_cost/Pmax + startup_cost/min_up_hour/Pmax

Note the formula above converts startup cost (in unit $) and no load cost (in unit $/h) into variable dispatch cost (in unit $/MWh). By doing this, the commitment for the ISO's short start units can be determined based on the economic metric order of the three-part variable cost.

Transfer Cost

As a convention, select the importing direction as the default direction for a transfer, so the importing transfer is positive and the exporting transfer is negative. The transfer cost is equal to the transfer MW times the transfer price. For transfers involving the ISO in either the importing direction or the exporting direction, the transfer price is the other BAA's LMP plus the shadow price of the transfer. In doing this, the congestion rent on the transfer will be fully attributed to the other BAA. For transfers involving two BAAs that are not the ISO, the transfer price will split the congestion shadow price on the transfer in half. For an importing BAA, the transfer price is the LMP of the BAA minus half of the absolute value of the transfer shadow price. For an exporting BAA, the transfer price is the LMP of the BAA plus half of the absolute value of the transfer shadow price. The transfer could occur in both the 15-minute market and the 5-minute market. In this case, the transfer cost is 15-minute transfer * 15-minute transfer price + (5-minute transfer – 15-minute transfer) * 5-minute transfer price for each 5-minute interval.

For the prices (LMPs) used in the EIM benefits, the calculation uses the corresponding ELAP prices of each EIM area. For CAISO prices, the calculation uses the prices associated at the corresponding scheduling points at the Malin, Palo Verde, El Dorado or Rancho Seco interties. The specific scheduling price to be used among these intertie locations is in relationship to the benefit calculated to a specific EIM area. For instance, when calculating the benefits between PAC West and CAISO, the calculation will use Malin scheduling point price (CAISO side).

Flex Ramp Transfer Cost

In 2016, the ISO implemented the flexible ramping products to replace flexible ramping constraints. The flexible ramping products are available capacities to handle future load and generation uncertainties, and include both the upward ramping capacity and downward ramping capacity. They may be put aside in RTD to enhance dispatch flexibility. One BAA's flexible ramping capacities in RTD may be helping other BAAs. In this case, the BAA that exports flexible ramping products should receive payment from other BAAs to compensate the dispatch cost of keeping flexible ramping capacities, and the BAA that imports flexible ramping products should pay other BAAs to reflect its dispatch cost to handle future uncertainties. This is similar to how energy transfer is treated in the EIM benefit calculation. Energy transfer is explicitly modeled in EIM, while flexible ramping transfer is not. We need to calculate a BAA's flexible ramping transfer. First, we allocate the system flex ramp award to each BAA in proportion to its individual BAA requirement. Then we calculate the flex ramp transfer as the BAA's RTD flexible ramping award minus its allocated share. The flex ramp transfer cost is equal to the flex ramp transfer multiplied by the EIM whole footprint flex ramp shadow price.

Counterfactual Dispatch Cost

The counterfactual dispatch for an EIM BAA mimics the market operations without importing or exporting through the EIM transfers. The counterfactual dispatch moves units inside the BAA to meet the same real-time load imbalance as the EIM dispatch based on economic merit order without considering transmission constraints. For PacifiCorp, the transfer limit between PACE and PACW is enforced in the counterfactual dispatch.

Neglecting transmission constraints in a BAA tends to underestimate the EIM benefit. The magnitude depends on how significant the congestion is. Severe congestion impacting EIM benefits was not observed until October 2017, where transmission congestion happened between the generation in Wyoming and PACE's load in PacifiCorp. The impact of this congestion to the EIM benefit calculation can be demonstrated with the following example.

Assume in PACE, load increased 10 MW from the base schedule, generation decreased 100 MW from the base schedule, and PACE imported 110 MW in EIM. Note that energy is balanced in PACE with 110 MW of transfer import replacing 100 MW of generation and serving 10 MW of load above the base schedule. Assume the decremented generation cost is $20/MWh, and the import cost is $120/MWh. From an economic standpoint, the EIM dispatched the resources out-of-merit with high cost supply being incremented and low cost supply being decremented. If we were to calculate the EIM benefit ignoring the congestion effect, the benefit will be negative. The calculation is as follows:

EIM dispatch cost = -100 MW * $20 = –$2,000.

EIM transfer cost = 110 MW * $120 = $13,200.

Counterfactual dispatch cost = 10 MW * $20 = $200.

For simplicity, ignore flex ramp and GHG. The EIM benefit is calculated as $200 – (–$2,000 + $13,200) = –$11,000.

To better understand the root cause of the negative benefit, we break the calculated benefit into two components: infeasible base schedule and infeasible counterfactual.

1. Infeasible base schedule: In the EIM, the imported $120 transfer replaced 100 MW of $20 internal generation, and produced a negative benefit equal to 100*($20-$120) = -$10,000. The extra dispatch cost in EIM is not due to economics, but due to infeasible base schedules for certain constraints, which forces the EIM to mitigate congestion, and incurs additional cost. For this reason, we need to add the congestion management cost to the counterfactual dispatch cost to reflect the need to perform the same congestion management dispatch as in the EIM. In the example, we add $10,000 to the counterfactual dispatch cost.

2. Infeasible counterfactual: In the counterfactual, the merit order dispatch did not know that dispatching up the $20 generation would overload the transmission, and produced a negative benefit equal to 10*($20-$120) = -$1,000. The counterfactual should recognize the economic $20 supply is subject to transmission congestion, and cannot be dispatched. Therefore, in the counterfactual dispatch, for increased net load, we dispatch only supply offers with a bid price >= the transfer LMP. For decreased net load, we dispatch down only supply offers with a bid price <= the transfer LMP. In the example, the net load is 10 MW, so we only dispatch resources that bid above $120, assume these supplies cost $125/MWh.

With these two enhancements, we revise the benefit calculation as follows:

EIM dispatch cost = -100 MW * $20 = –$2,000.

EIM transfer cost = 110 MW * $120 = $13,200.

Counterfactual dispatch cost = 10 MW * $125 + $10,000 = $11,250.

The new EIM benefit is calculated to be $11,250 – (–$2,000 + $13,200) = $50.

These enhancements only apply when we detect significant congestion indicated by the LMP difference between the BA's ELAP and DGAP greater than a tolerance setting. Currently, the tolerance is set to $5/MWh.

The counterfactual dispatch makes unit commitment decisions only for the ISO's short start units. The unit commitment decisions are based on the generic three-part variable cost formula, which has converted startup cost and no load cost into variable dispatch cost, so unit commitment can be determined by the economic metric order of the three-part cost.

Prior to the 2016 Q4 report, we used the resources' RTD dispatching limits from the EIM in the counterfactual. The EIM dispatching limits are 10-minute ramp limited in RTD, and they may be overly constraining for the counterfactual theoretically. The counterfactual will replace the transfers with internal dispatches, but it does not need to do it within 10-minute timeframe. When EIM transfer volumes are moderate relative to the EIM dispatching range, this limitation may not be a real problem, because the EIM dispatch range is mostly sufficient to replace the transfers. As the EIM footprint increases, the transfer volume between BAAs also increases. We

observed that some EIM transfers exceeded 1,000 MW frequently. The EIM dispatching range started to show its limitation. In Q4 of 2016, we expanded the resources' dispatching range to base schedule and FMM dispatching limits. From Q2 of 2017, we decided not to use EIM calculated limits. Instead, the dispatching range is constructed based on the resource's economic bid range in the following way:

a) Start with the resource's bid range [bid_MW_min, bid_MW_max]
b) Block the ancillary service provisions, so the new range is [bid_MW_min+reg_down, bid_MW_max – reg_up – spin – nonspin]
c) If the resource is a wind or solar resource, limit its upper limit by the forecasted output, so the new range is [bid_MW_min+reg_down, min(bid_MW_max – reg_up – spin – nonspin, wind or solar forecast)]

In cases where a counterfactual dispatch does not have sufficient supply offers to meet net load imbalance, we assign a penalty cost for procuring more energy. If the BA does not import from EIM, we extend its last economic bid segment. If the BA imports from EIM, we compare its last economic segment against the EIM LMP, and set the penalty price to the higher of the two. In summary, the penalty price per MWh is

- The highest offer price from the BA if the BA does not import from EIM,
- Max (the highest offer price from the BA, the transfer LMP) if the BA imports from EIM.

An EIM BAA may restrict the pool of dispatchable units in the counterfactual dispatch if that the BAA's practice prior to joining EIM was to balance real-time load from a limited pool.

ISO Counterfactual Dispatch

The ISO would need to meet load without EIM transfers in the counterfactual dispatch. The counterfactual dispatch is constructed in the following way:

1. Calculate the ISO's net EIM transfer;
2. Economically dispatch resources from the ISO to replace the transfer
   A. If the ISO is importing from the EIM,
      a. Find the ISO's undispatched supply with the variable cost (bid and three-part converted) greater than or equal to the reference transfer price;
      b. Sort and stack the supply by the variable cost from low cost to high cost; and
      c. Clear the supply stack from low cost to high cost up to the transfer megawatts
   B. If the ISO is exporting to the EIM,
      a. Find the ISO's dispatched supply with the variable cost (bid and three-part converted) less than or equal to the reference FMM transfer price;
      b. Sort and stack them by the variable cost from high cost to low cost; and

c. Clear the supply stack from high cost to low cost up to the transfer megawatts

The reference transfer price for the ISO is the maximum price of the incoming transfer points if the ISO is a net transfer importer, and the minimum price of the outgoing transfer points if the ISO is a net transfer exporter in RTD. Undispatched supply at lower bid cost than the reference price is dispatched out of merit when the ISO is importing transfer at the reference price. Dispatched supply at higher bid cost than the reference price is also dispatched out of merit when the ISO is exporting transfer at the reference price. The ISO has complex networks and constraints that are modeled in the EIM but not in the counterfactual. For example, supplies can be locally transmission constrained and undispatched in the EIM, which have available supply at lower bid cost than the LMP of the rest of the ISO. They should remain undispatched in the counterfactual even they have lower supply cost, because they are constrained by transmission. In the ISO's counterfactual dispatch, we only consider supplies above the reference transfer price to replace incoming transfer into the ISO, and thus preventing the transmission constrained lower cost supply being dispatched. Vice versa for the supplies below the reference transfer price to replace outgoing transfer. The counter factual dispatch (applies for whole EIM, not just the ISO) was based on 5-minute dispatch capability, and the reference price is the RTD price.

Counterfactual Dispatch

All EIM entities, with the exception of Pacificorp, have their counterfactual dispatch constructed in the following way. We will use NVE as an example.

1. Calculate the real-time net load imbalance for NVE;
2. Economically dispatch resources from NVE on top of the base schedules to meet NVE's net load imbalance
   A. If the net load imbalance is positive,
      a. Dispatch NV Energy's bid-in supply above base schedules;
      b. Sort and stack them by the variable cost from low cost to high cost; and
      c. Clear the supply stack from low cost to high cost up to the net load imbalance.
   B. If the net load imbalance is negative,
      a. Dispatch NV Energy's bid-in supply below base schedules;
      b. Sort and stack them by the variable cost from high cost to low cost; and
      c. Clear the supply stack from high cost to low cost up to the net load imbalance.

PacifiCorp Counterfactual Dispatch

PacifiCorp East BAA and PacifiCorp West BAA would need to meet demand without intra-hour transfers between PacifiCorp and the ISO, but transfers could occur between PACE and PACW in the counterfactual dispatch. The PacifiCorp counter factual dispatch will be constructed in the following way:

1. Calculate the real-time net load imbalance for each BAA;
2. Economically dispatch resources from PacifiCorp on top of the base schedules to meet net PacifiCorp load imbalance without violating the transfer limitations between PACE and PACW.
   A. If the net load imbalance is positive,
      a. Find PacifiCorp's bid-in supply above base schedules;
      b. Sort and stack them by the variable cost from low cost to high cost; and
      c. Clear the supply stack from low cost to high cost up to the net load imbalance subject to the transfer limit between PACE and PACW
   B. If the net load imbalance is negative,
      a. Find PacifiCorp's bid-in supply below base schedules;
      b. Sort and stack them by the variable cost from high cost to low cost; and
      c. Clear the supply stack from high cost to low cost up to the net load imbalance subject to the transfer limit between PACE and PACW

GHG Revenue

Greenhouse gas (GHG) revenue for a resource is equal to its GHG allocation MW times the GHG price.

GHG Cost

GHG cost for a resource is equal to its GHG allocation MW times its GHG bid.

Example

This example illustrates how the EIM benefit is calculated.

The transfers out of the EIM optimization are listed in Table 1. Base scheduled transfers have been excluded in the FMM transfers and RTD transfers.

From BAA	To BAA	FMM transfer	FMM transfer price	RTD incremental transfer	RTD transfer price	Transfer cost
PACE	NEVP	140	$26	10	$25	$3,890
NEVP	CISO	160	$26	20	$30	$4,760
PACE	PACW	190	$26	10	$25	$5,190

PACW	CISO	110	$26	-10	$30	$2,560

Table 1. An example of BAA to BAA transfers and prices

Assume the EIM energy imbalance and prices are as follows. Every BAA is balanced with Gen + Transfer – Load = 0. Assume the EIM optimization results in $1 GHG price, which means the ISO's LMP is $1 higher than the neighboring BAA (NEVP and PACW), because there is no congestion going into the ISO in the example. In the table below, positive transfer MW means the BAA is importing and negative transfer MW means it is exporting. Also, transfers in the table are sum of the transfers occur in both the FMM and the RTD with base scheduled transfer being excluded.

BAA	Gen	Load	Net transfer in MW	LMP	GHG price
CISO	0	280	280	$31	$1
NEVP	50	20	-30	$30	
PACE	150	-200	-350	$20	
PACW	100	200	100	$30	

Table 2. EIM energy imbalance and prices by BAA for one 5-minute interval

Transfer Cost

The transfers occur in both FMM and RTD, and their volume and prices are listed in Table 3. They are calculated from applying the convention that importing is positive and exporting is negative the BAA to BAA transfers, and summing them over all the neighboring BAAs.

BAA	transfer cost
CISO	$7,320 = $4,760+$2,560
NEVP	($870) = $3,890-$4,760
PACE	($9,080) = -$3,890-$5,190
PACW	$2,630 = $5,190-$2,560

Table 3. EIM transfer cost by BAA

For flex ramp, we calculate its transfer and transfer cost in Table 4.

BAA	Direction	Req.	Award	Allocation	Flex ramp transfer in	Flex ramp price	Flex ramp transfer cost

CISO	upward	150	100	75	-25	$1	-$25
NEVP	upward	10	0	5	5	$1	$5
PACE	upward	20	0	10	10	$1	$10
PACW	upward	20	0	10	10	$1	$10
CISO	downward	0	0	0	0	$2	$0
NEVP	downward	10	10	2	-8	$2	-$16
PACE	downward	20	0	4	4	$2	$8
PACW	downward	20	0	4	4	$2	$8

Table 4. Flex ramp transfer example

EIM Dispatch Cost

Now calculate the total bid cost associated with the EIM dispatches (delta from base schedules). The EIM dispatch costs are listed in Table 5.

BAA	Gen_EIM	EIM dispatch cost
CISO	0	$0
NEVP	50	$1,450
PACE	150	$2,700
PACW	100	$2,800

Table 5. EIM dispatch cost by BAA

Counterfactual Dispatch Cost

Then construct the counterfactual dispatches as described in the previous section, and sum up the counter factual dispatch cost for each BAA as shown in Table 6.

BAA	Gen_CF	Counterfactual dispatch cost
CISO	280	$9,240
NEVP	20	$640
PACE	-200	($3,800)

PACW	200	$6,200

Table 6. Counterfactual dispatch cost by BAA

GHG Cost and Revenue

The GHG costs associated with the 280 MW of importing transfer into CISO, and the revenues received by the GHG allocated MWs in both FMM and RTD are listed in Table 7.

BAA	GHG FMM MW	GHG RTD MW	GHG cost	GHG revenue
CISO	270	280	$0	-$280
NEVP	0	0	$0	$0
PACE	200	200	$20	$200
PACW	70	80	$75	$80

Table 7. GHG cost and revenue by BAA

EIM Benefit

With all the cost and revenue for each BAA available, we can use the formula EIM benefit for a BAA = counterfactual dispatch cost – (EIM dispatch cost + transfer cost + flex ramp transfer cost) + GHG revenue – GHG cost to calculate EIM benefit for each BAA. The results are shown in Table 8.

BAA	CF dispatch cost	EIM dispatch cost	Transfer cost	Flex transfer cost	GHG cost	GHG revenue	EIM benefit
CISO	$9,240	$0	$7,320	($25)	$0	($280)	**$1,665**
NEVP	$640	$1,450	($870)	($11)	$0	$0	**$71**
PACE	($3,800)	$2,700	($9,080)	$18	$20	$200	**$2,742**
PACW	$6,200	$2,800	$2,630	$18	$75	$80	**$757**

Table 8. EIM benefit for one 5-minute interval

This calculation is performed for each 5-minute interval with unit $/hr. We convert the $/hr benefit into the dollar benefit by multiplying 1/12. Then the 5-minute interval benefits in dollar

amount can be aggregated into the monthly benefit by summing all the 5-minute intervals in the month.

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STATE OF IDAHO
CASE NO. AVU-E-22-11
ANNUAL POWER COST ADJUSTMENT (PCA)

COMPLIANCE FILING

CONFIDENTIAL APPENDIX B

EIM BENEFITS EVALUATION FOR EIM CUSTOMERS

EIM Benefits Evaluation

for EIM Customers

May 07, 2019

Change log:

Date	Change description	Author
03/26/2018	Initial version of phase 1 design notes	Ying Xiao
4/12/2018	Updated Logic to handle Configuration Change of MSG with overlapping ranges	Ying Xiao
4/30/2018	Updated logic to calculate dispatch range and price used for extended segment in CF	Ying Xiao
10/2/2018	Excluded renewable units from EIM dispatch costs calculation	Ying Xiao
1/25/2019	Updated NLI and transfer benefit logic to handle base transfer	Ying Xiao
3/25/2019	Added logic for PacifiCorp to handle the model with two BAAs; Added an option, CFDispatchwithCongestionModel, to allow to switch on/off the congestion model.	Ying Xiao
05/07/2019	Included renewables in CF and EIM dispatch costs calculation	Ying Xiao

Reference:

1. EIM Quarterly Benefit Report Methodology, https://www.westerneim.com/Documents/EIM_BenefitMethodology.pdf

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1 Background

CAISO has published the general methodology for EIM benefits calculation (as seen in the reference of this document). The heuristic approach allows to estimate EIM benefits without performing sophisticated optimization-based unit commitment and dispatch studies.

By using the same methodology described in the CAISO document in high-level, the goal of this design is to replicate CAISO benefit calculation for EIM customers.

2 EIM Benefit Evaluation Methodology

For an EIM balancing authority area (BAA), the benefit can take the form of cost savings or profit or their combination[1]:

- Energy Cost Savings: BAA imports energy economically, or its base schedules (BS) are re-optimized by the EIM on an intra-hour basis.
- Energy Profit: BAA exports energy which are paid above the resource costs.
- Green House Gas (GHG) profit: BAA exports of GHG resources into California, that are paid the GHG price.
- Flexible Ramp Product (FRP) profit : BAA exports FRP and is paid at the FRP price (profit occurs when the FRP price is higher than the opportunity cost of not providing FRP).

The EIM Benefits calculation, from a summarized level, is the following. It calculates the cost savings of the EIM's dispatch compared to what would have occurred if there was no EIM dispatch (counterfactual dispatch).

EIM benefit = CF dispatch cost – EIM dispatch cost + EIM net transfer revenue + GHG net revenue + FRP net revenue

The following components of the EIM Benefits Calculation are performed at the 5-minute level. The results are then summed to the monthly-level, which is the level at which the CAISO posts their EIM Benefits Calculation results.

3 EIM Benefit Calculation Components

3.1 EIM Dispatch Cost

For participating resources (PR), the EIM dispatch cost is calculated as the EIM Dispatch from the base schedule (BS) in order to meet the net load imbalance with the EIM Transfer. The EIM dispatch cost uses the resource's bid price.

For non-participating resources (NPR), their output may deviate from the BS too. With the assumption of consistent deviation behavior between in EIM and not in EIM, the impacts should be the same to CF dispatch cost and EIM dispatch cost, that is, they cancel out each other. Therefore, there is no need to add the costs in the terms.

The current CAISO rule is, if a unit in transition, the transition period will not be included in EIM dispatch cost calculation. The reason is, the cost impact on EIM dispatch and CF are the same, so they wash-out.

For MSG with DOT and BS at different configurations, please refer to appendix "Logic to handle Configuration Change of Multi-Stage Generators (MSG)".

3.1.1 Examples of EIM Dispatch Cost Calculation in EIM Study

In the table below, Inc MW stands for unit incremental dispatch above the BS, Dec MW for unit decremental dispatch below the BS.

Table 1. EIM Dispatch Cost Calculation

EIM Dispatch segment	Bid price ($/MWh)	Inc MW	Dec MW	Inc/Dec cost ($)
Unit 1, Segment 1	20	20	-	20*20/12= 33.4
Unit 2, Segment 2	30	-	10	- 10*30/12= - 25

3.2 CF Dispatch Cost

For a specific EIM customer, the CF study simulates the system operations without importing or exporting through the EIM transfers. Using hourly BS as the baseline, it redispatches the resources to meet the real-time net load imbalance.

3.2.1 Net Load Imbalance Calculation

Conceptually, net load imbalance is the imbalance caused by:

- Load forecast (LF) error: Deviation between the LF value used for T-40 BS submission and the LF for real time dispatch (RTD) market clearing;
- Supply deviations caused by
    - outage/derate of units with BS; or
    - dispatch of renewable resources away from the BS based on the actual output or curtailment.

Net load imbalance is calculated based on EIM RTD dispatch and EIM RTD transfer. In this design, the convention is, exporting transfer is positive and importing transfer is negative.

Net load imbalance MW= Total RTD dispatch MW of PRs - Total BS MW of PRs - EIM RTD transfer MW

Here

EIM RTD transfer MW is the delta transfer MW dispatched by EIM on top of base transfer. It's calculated as:

RTD transfer MW – RTD_Base_transfer.

where

RTD transfer MW: overall transfer MW cleared in CAISO RT market;

RTD_Base_transfer: base transfer submitted by EIM customers.

Note： RTD transfer MW is the transfer result from CAISO; RTD_Base_transfer is the tagged transfer MW from EIM customers.

If a unit in transition, at transition period it's not included in net load imbalance calculation.

For MSG with DOT and BS at different configurations, please refer to appendix "Logic to handle Configuration Change of Multi-Stage Generators (MSG)".

Table 2.1 Net Load Imbalance Calculation

Scenario	Total RTD dispatch MW of PRs	Total BS MW of PRs	EIM transfer MW	Net Load imbalance
1	2000	1500	50	(2000- 1500)-50= 450MW
2	2400	2500	-50	(2400- 2500)- (-50)= -50MW

The dispatch will be based on merit order of bid price to ensure minimum bid costs, with consideration of congestion as needed. Resource ramp rate limit and Losses are ignored in the dispatch.

Currently, it's assumed by CAISO that there is no need to commit/decommit resources for load imbalance. The general logic for CF calculation is, to stack up available capacity economically to meet load imbalance. Here available capacity includes all online resources in RTD and offline non-MSG resources. For MSG resources, only the configuration dispatched by RTD shall be considered. The CF dispatch range is constructed based on the resource's economic bid range in the following way:
a) Start with the resource's bid range [bid_MW_min, bid_MW_max] , which should not exceed the economic dispatch range[Pmin, Pmax]
b) Block the ancillary service provisions, so the new range is [bid_MW_min+Reg_down, bid_MW_max – Reg_up – Spin]
c) If the resource is renewable resource, such as wind or solar resource, limit its upper limit by the forecasted output, so the new range is [bid_MW_min+Reg_down, min(bid_MW_max – Reg_up – Spin, wind or solar forecast)]

If load imbalance cannot be satisfied using available capacity, the highest available bid (including both online and offline) will be extended as the bid price to procure more supply. Here the highest available bid is identified among all the available resources, that is, not include offline configuration of MSGs.

In cases CF does not have sufficient supply offers to meet net load imbalance, a pseudo price will be assigned to the extended segment for procuring more energy.

- If the BA does not import from EIM in RTD, we extend its last economic bid segment. Here the import is net over all RTD transfers.
- If the BA imports from EIM, we compare its last economic segment against the EIM transfer price, and set the pseudo price to the higher of the two.

In summary, the pseudo price per MWh is:
• the highest offer price from the BA if the BA does not import from EIM,
• max(the highest offer price from the BA, the EIM transfer price) if the BA imports from EIM.
Here, the EIM transfer price is a weighted average transfer revenue from imports. Taking EIM customer A as an example, with net import, A may import from both CAISO and NVE, and export to PACE. The EIM transfer price can be calculated as:

abs (***Transfer Revenue_with CAISO + Transfer Revenue_with NVE) / (RTD import MW from CAISO + RTD import MW from NVE)***

3.2.2 Detailed logic of CF dispatch

Detailed steps for the CF dispatch and cost calculation are described in the below sections.
If a unit in transition, during the transition period, it's not eligible for CF dispatch.

3.2.2.1 Detailed logic of CF dispatch for Non- PacifiCorp BAAs

1. For each 5-min interval, calculate the real-time net load imbalance based on the corresponding EIM case;
2. Based on the BS, re-dispatch non-outaged resources economically to meet the net load imbalance:
   A. If the net load imbalance is positive,
      a. Find resources' bid-in supply above BS.
      b. The bid-in supply is sorted by the respective resources' bid price in ascending order.
      c. Clear the bid-in supply from the lowest cost to the highest cost, until the net load is re-balanced.
   B. If the net load imbalance is negative,
      a. Find resources' bid-in supply below BS;
      b. The bid-in supply is sorted by the respective resources' bid price in descending order.
      c. Clear the bid-in supply from highest cost to lowest cost, until the net load is re-balanced.

3.2.2.2 Detailed logic of CF dispatch for PacifiCorp BAAs

With consideration of transfers between PACE and PACW in the counterfactual dispatch, the PacifiCorp counter factual dispatch will be constructed using the below method:

1. For each 5-min interval, calculate the real-time net load imbalance for each BAA respectively, i.e., PACE BAA and PACW BAA, based on the corresponding EIM case;
2. Based on the BS, re-dispatch non-outaged resources economically to meet the net load imbalance without violating the transfer limitations between PACE and PACW:
   A. If the net load imbalance is positive,
      a. Find resources' bid-in supply above BS;
      b. Sort the bid-in supply by the respective resources' bid price in ascending order;
      c. Clear the supply stack from the lowest cost to the highest cost subject to the transfer limit between PACE and PACW, until the net load is re-balanced.
   B. If the net load imbalance is negative,
      a. Find resources' bid-in supply below BS;
      b. Sort the bid-in supply by the respective resources' bid price in descending order;
      c. Clear the supply stack from the highest cost to the lowest cost subject to the transfer limit between PACE and PACW, until the net load is re-balanced.

   Here the transfer limit only considers export transfer limits on the HMWY tie from PACE to PACW, that is, in CF dispatch, only allow the flow from PACE to PACW. The export transfer limits on the HMWY tie can be retrieved from the OASIS report "EIM Transfer Limits by Tie".

(For implementation, make sure the logic to cover at least the two scenarios below:

1. PACW sees positive net load imbalance, and PACE has cheaper available bid-in capacity, PACE resources are dispatched up, and transfer to PACW to support PACW's power balance;
2. PACE sees negative net load imbalance, and PACW has more expensive available bid-in capacity to reduce, PACW resources are dispatched down to support PACE's power balance with transfer from PACE to PACW)

3.2.3 Examples of CF Dispatch

There are four scenarios of CF Dispatch shown in below tables. The scenarios include: 1) a net load imbalance of 50 MW, 2) a net load imbalance of 100 MW, 3) a net load imbalance of – 50 MW, and a net load imbalance of – 100 MW.

Inc stands for unit incremental dispatch above the BS, Dec for unit decremental dispatch below the BS. Unless the capacity is extended, the Inc/Dec dispatch shall be within the range of [Pmin, Pmax] and with ancillary services (AS) MW being carved out. Since offline units are considered in this dispatch, in addition to regulation and spinning reserve, we also need to consider non-spinning reserve MW as well.

Table 3.1. Scenario 1: Ordered bid stack and bids clearing with net load imbalance 50MW

Available bid stack	Bid price ($/Mwh)	Available Inc MW	Extended Inc MW	Inc MW	Inc cost ($)
Unit 1, Segment 2	20	20	-	20	400/12= 33.3
Unit 2, Segment 4	25	10	-	10	250/12=20.8
Unit 2, Segment 5	34	25	-	20	850/12=70.83
Unit 3, Segment 3	40	10	-	0	-

Table 3.2. Scenario 2: Ordered bid stack and bids clearing with net load imbalance 100 MW

Available bid stack	Bid price ($/Mwh)	Available Inc MW	Extended Inc MW	Inc MW	Inc cost ($)
Unit 1, Segment 2	20	20	-	20	400/12= 33.3
Unit 2, Segment 4	25	10	-	10	250/12=20.8
Unit 2, Segment 5	34	25	-	25	850/12=70.8
Unit 3, Segment 3	40	10	45	45	1800/12=150

Table 3.3. Scenario 3: Ordered bid stack and bids clearing with net load imbalance -50MW

Available bid stack	Bid price ($/Mwh)	Available Dec MW	Extended Dec MW	Dec MW	Dec saving ($)
Unit 3, Segment 3	40	10	-	10	400/12= 33.3
Unit 2, Segment 5	34	25	-	25	850/12=70.8
Unit 2, Segment 4	25	20	-	15	375/12=31.25
Unit 1, Segment 2	20	20	-	0	-

Table 3.4. Scenario 4: Ordered bid stack and bids clearing with net load imbalance -100MW

Available bid stack	Bid price ($/Mwh)	Available Dec MW	Extended Dec MW	Dec MW	Dec saving ($)
Unit 3, Segment 3	40	10	-	10	400/12= 33.3
Unit 2, Segment 5	34	25	-	25	850/12=70.8
Unit 2, Segment 4	25	20	-	20	500/12=41.67
Unit 1, Segment 2	20	20	45	45	900/12= 75

3.3 EIM Net Transfer Revenue

The EIM net transfer revenue formula is (EIM export revenue - EIM import cost). For a BAA, EIM export revenue is the revenue of sales to other BAAs. The EIM import cost is the cost of purchases from other BAAs.

Transfers may occur in both the fifteen-minute market (FMM) and the 5-minute markets (RTD). Transfers in the two markets at the same period can be in opposite directions. For example, a BAA can import in the FMM and export in the RTD, or vice versa. In this design document, exporting transfer is positive and importing transfer is negative.

In general, for a 5-minute interval, the transfer revenue of with each transfer counterparty can be calculated as:

Transfer Revenue_withCounterparty = EIM FMM transfer * FMM transfer price + (EIM RTD transfer – EIM FMM transfer) * RTD transfer price.

Here
EIM FMM transfer = FMM transfer – FMM base transfer;
EIM RTD transfer = RTD transfer – RTD base transfer.

Due to tagging change, RTD base transfer can be different from FMM base transfer. This happened to IPC in the past months.
For EIM BAA A, it may transfer with multiple BAAs, say CAISO, NVE and PACE, as shown in below diagram.

The total net transfer revenue will be:

Transfer Revenue_with CAISO + Transfer Revenue_with NVE + Transfer Revenue_with PACE

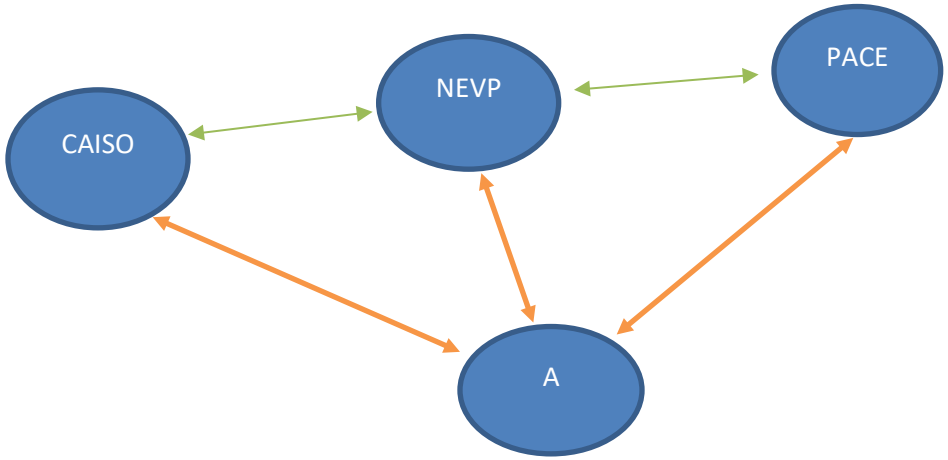

Figure 1. EIM BAA A direct interconnection with other EIM BAAs

3.3.1 Transfer Price calculation

Currently, if BAA A transfers with CAISO, A always collects the congestion rent; if counter party is not CAISO, A only collects half of the congestion rent. The detailed calculation is described below.

If counter party is CAISO, then

Transfer price = if A exports, then

LMP_ELAP_A + abs(transfer constraint shadow price)

Else if A imports, then

LMP_ELAP_A - abs(transfer constraint shadow price)

Endif;

Else (i.e., counter party is not CAISO)

Transfer price = 0.5*(LMP_ELAP_A + ELAP of Counterparty)

Endif.

Where

for ELAP of counterparty, taking transfer with NVE as an example,

If NVE is not locked out, then

ELAP of Counterparty = LMP_ELAP_NVE

Else (i.e., NVE got locked out due to failing sufficiency test)ELAP of Counterparty* (can be Magnolia's LMP)

endif

* As currently none of the EIM customers has access to other BAAs' failure information, for monthly EIM benefit evaluation of a specific month, EIM customers will have to request a spreadsheet from CAISO with the HE, interval and adjustment to the counterparties' transfer price. Both FMM and RTD adjustments are included. The PowerSettlements's benefit calculation tool needs to subtract the adjustment price from the CAISO price to obtain the ELAP of Counterparty. (CAISO is working on a long-term solution to post the data on public GUIs.)

Table 7.1: Examples of Transfer Net Revenue Calculation between A and CAISO

	FMM	RTD	

Sce-nario	MW	LMP_ELAP_A ($/MWh)	Abs(Shadow price) ($/MWh)	Transfer price ($/MWh)	MW	LMP_ELAP_A ($/MWh)	Abs(Shadow price) ($/MWh)	Transfer price ($/MWh)	Transfer net revenue ($)
1	300	30	20	50	280	28	16	44	14,120/12=1176.67
2	300	30	20	50	-300	20	10	10	9,000/12=750

Table 7.2: Examples of Transfer Net Revenue Calculation

Sce-nario	FMM				RTD				Transfer net revenue ($)
	MW	LMP_ELAP_NVE ($/MWh)	LMP_ELAP_A ($/MWh)	Transfer price ($/MWh)	MW	LMP_ELAP_NVE ($/MWh)	LMP_ELAP_A ($/MWh)	Transfer price ($/MWh)	
1	300	30	20	25	280	28	16	22	7,060/12=588.3
2	300	30	20	25	-300	20	50	35	-13,500/12=-1,125

3.4 GHG Net Revenue

GHG net revenue is calculated as (GHG Revenue - GHG Cost).

For each 5-minute interval, the GHG revenue can be calculated as:
FMM GHG allocation MW * FMM GHG price + (RTD GHG allocation MW – FMM GHG allocation MW) * RTD GHG price.

For each 5-minute interval, the GHG cost can be calculated as:
RTD GHG allocation MW * GHG bid price.

Table 8: Examples of GHG Net Revenue Calculation

Sce-nario	GHG bid price ($/MWh)	FMM		RTD		GHG revenue ($)	GHG cost ($)	GHG net revenue ($)
		GHG MW	GHG price ($/MWh)	GHG MW	GHG price ($/MWh)			

1	0	180	5	220	6	1,140/12= 95	0	95
2	8	100	6	120	5	700/12= 58.3	960/12= 80	-31.7

3.5 FRP Net Revenue

FRP net revenue is calculated as (FRP revenue - FRP Cost). FRP revenue represents the payment received from other BAAs importing FRP capacity from BAA A; FRP cost A's payment to other BAAs exporting FRP capacity to A.

In general, for a 5-minute interval, the FRP net revenue can be calculated as for FRP Up:

RTD FRP up export * RTD FRP up price+ RTD FRP down export * RTD FRP down price

where

- RTD FRP export = A's total RTD FRP award – EIM area's RTD FRP award* (A's RTD FRP requirement /sum of each BAA's RTD FRP requirement)
- RTD FRP price = A's RTD FRP price

The same calculation applies to FRP down as well.

4 Appendix I: Logic to handle Configuration Change of Multi-Stage Generators (MSG)

The current rules to handle configuration changes/commitment status changes in EIM benefit calculation are:

- If the BS of a MSG is in a different configuration from the current dispatch in RTD:
    1. Reset BS using Pmin_current_config;
    2. Net load imbalance will be calculated with the updated BS;
    3. EIM dispatch cost and CF cost calculation will be based on the updated BS;
    4. Current configuration's bid shall be treated as available for CF calculation (no change).
- If FMM commit a unit with zero BS:
    1. Reset BS using Pmin;
    2. Net load imbalance will be calculated with the updated BS;

3. EIM dispatch cost and CF cost calculation will be based on the updated BS

If a unit is committed by CAISO, it's assumed to be online in CF as well.

5 Appendix II: Detailed Logic of CF Dispatch with Heavy Congestion in BS

This logic is controlled by an option, CFDispatchwithCongestionModel. The default value of this option is 0, that is, the logic is switched off in all BAAs' EIM benefit evaluation.

5.1 Background

Neglecting transmission congestion within a BAA during BS calculation will lead to underestimate the EIM benefit. The impact can be explained with the following example, as shown in Table 5.1.

In this example, the reason behind that EIM dispatched the resources out-of-merit with high cost import being incremented and low cost internal generation being decremented is congestion. EIM dispatch considers impacts of congestion. If we were to calculate the CF dispatch cost ignoring the congestion, the benefit would be inaccurate, sometimes even negative. The calculation is described in Table 5.1. For simplicity, flex ramp and GHG terms are ignored in this example, and there is no consideration of 5 min granularity in the dispatch.

Table 5.1. EIM benefit with no congestion impacts

	Actual Deviation/ EIM redispatch MW	Price ($/MWh)	EIM dispatch cost ($)	EIM transfer cost ($)	Counterfactual dispatch cost ($)
Load	+10	-			200 (=10 * $20)
Generation	-100	20	–2,000		
Import	+110	120		13,200	
EIM benefit calculated without considering congestion ($)			200 – (–2,000 + 13,200) = –11,000		

To better understand the root cause of the negative benefit, we break the cause into two components: infeasible BS and infeasible CF:

- Infeasible BS:

In the EIM dispatch, the imported $120 transfer replaced 100 MW of $20 internal generation, and produced an extra cost of 100*($120-$20) = $10,000. This extra cost is caused by infeasible BS. Therefore, this congestion management cost should also incur to the CF dispatch, to reflect the need to perform the same congestion management dispatch as in the EIM. That is, in the example, $10,000 needs to be added to the CF cost term.

- Infeasible CF:

The CF dispatch should recognize the economic $20 generation will cause transmission congestion, therefore cannot be dispatched.

  - For increased net load, the CF can only dispatch up supply offers with a bid price >= the transfer price;
  - For decreased net load, it can only dispatch down supply offers with a bid price <= the transfer price.

In the example, the CF can only dispatch resources that bid above $120 to meet the 10 MW net load. It's assumed that the next supply in the offer stack costs $125/MWh.

Table 5.2. EIM benefit considering congestion impacts

	Actual Deviation/ EIM redispatch MW	Price ($/MWh)	Supply Price >= Transfer price($/MWh)	EIM dispatch cost ($)	EIM transfer cost ($)	Counterfactual dispatch cost ($)
Load	+10	-				100*(120-20)+ 10*125
Generation	-100	20		–2,000		
Import	+110	120	125		13,200	
EIM benefit considering congestion ($)				11,250 – (–2,000 + 13,200) = 50		

5.2 CF Dispatch Cost Calculation Logic Considering Congestion Impacts

If significant congestion is detected, the below logic will be triggered to ensure congestion impacts to be considered in the CF study. The situation is indicated by the LMP difference between the BAA's ELAP and DGAP greater than a tolerance setting. Currently, the tolerance is set to $5/MWh in CAISO calculation.

If LMP_ELAP - LMP_DGAP > 5 then

CF dispatch cost = Infeasible BS cost + Infeasible CF cost

Else

CF dispatch cost is calculated based on the logic described in section 3.2.2.

End if

Detailed logic to calculate Infeasible BS cost and Infeasible CF cost is:

For any RTD interval, if (total net RTD transfer is import)

and (Total RTD redispatch MW of PRs < Total BS of PRs) (i.e., RTD dispatches down PRs)

and exists(bid segment, RTD import price > bid price of EIM dispatched bid segment) then (i.e., import expensive MW to replace cheaper internal resources)

Infeasible BS cost = if net load imbalance > 0 , then

[sum(BAA, Import MW*RTD import price) - Sum(bid segment, RTD dispatch down segment MW* segment bid price)]/12

else (i.e., net load imbalance < 0)

[sum(BAA, Import MW*RTD import price) - Sum(bid segment, RTD dispatch down segment MW for BS infeasibility* segment bid price)]/12

endif

Note:

1. For Infeasible BS cost calculation, only consider PRs.
2. Here BAA represents BAAs transfer with the studied BAA. Import MW should be positive.
3. For RTD import price, please refer to section 3.3 RTD transfer price calculation.
4. For a unit, RTD dispatch down MW = RTD dispatch MW – BS MW

5. RTD dispatch down segment MW for BS infeasibility is RTD dispatch down segment MW capped by net transfer MW.

Infeasible CF cost = if net load imbalance > 0 , then

[sum(available bid segment| bid price >= max(BAA, RTD import price), CF dispatch segment MW* segment bid price)]/12

else (i.e., net load imbalance < 0)

[sum(available bid segment | bid price <= min(BAA, RTD import price), CF dispatch segment MW* segment bid price)]/12

end if

End if

Note:

1. For Infeasible CF cost calculation, PRs should be included.
2. Here BAA represents BAAs transfer with the studied BAA.
3. For RT import price, please refer to section 3.3 RT transfer price calculation.

5.3 Examples of CF Cost Components Considering Congestion

Examples are constructed in this section to show how to implement the detailed logic described in the previous section.

- **Scenario 1: Positive net load imbalance**

Table 5.3. Scenario 1: Positive net load imbalance

	Load	**Generation**	**Import**		
			From CAISO	From NVE	From PACE
Actual Deviation/EIM redispatch MW	+10	-100	50	-10 (i.e., Export)	70

RTD Price ($/MWh)	-	Please refer to table 5.2	130	50	120

Table 5.4. Scenario 1: Bid segment dispatched down by EIM for BS infeasibility (Total = - 100MW)

bid stack dispatched down by EIM	Bid price ($/MWh)	Bid Segment (MW)	Dec MW by EIM for BS infeasibility
Unit 1, Segment 2	20	50	30
Unit 2, Segment 4	60	30	30
Unit 2, Segment 5	70	40	40

Infeasible BS cost = [sum(BAA, ImportMW*RTD import price) - Sum(bid segment, RTD dispatch down segment MW* segment bid price)]/12

= [50*130+70*120 – (40*70 + 30*60 +30*20)]/12

= 808.33

Table 5.5. Scenario 1: Bid segments available for CF dispatch up

Available bid stack	Bid price ($/MWh)	Bid Segment (MW)	Inc MW by CF
Unit 10, Segment 1	80	10	0
Unit 11, Segment 2	120	5	0
Unit 12, Segment 1	130	30	10

Infeasible CF cost = [sum(available bid segment| bid price >= max(BAA, RTD import price), CF dispatch segment MW* segment bid price)]/12

= [10*130]/12

= 108.33

CF dispatch cost = Infeasible BS cost+ Infeasible CF cost = $916.66

- **Scenario 2: Negative net load imbalance**

Table 5.6. Scenario 2: Negative net load imbalance

	Load	**Generation**	**Import**		
			From CAISO	From NVE	From PACE

Actual Deviation/EIM redispatch MW	-10	-100	30	-10 (i.e., Export)	70
RTD Price ($/MWh)	-	Please refer to table 6.2	130	50	120

Table 5.7. Scenario 2: Bid segment dispatched down by EIM for BS infeasibility (Total = - 90MW)

bid stack dispatched down by EIM	Bid price ($/MWh)	Bid Segment (MW)	Dec MW by EIM for BS infeasibility
Unit 1, Segment 2	20	50	20
Unit 2, Segment 4	60	30	30
Unit 2, Segment 5	70	40	40

Infeasible BS cost = [sum(BAA, Import MW*RTD import price) - Sum(bid segment, RTD dispatch down segment MW for BS infeasibility* segment bid price)]/12

= [30*130+70*120 – (40*70 + 30*60 +20*20)]/12

= 608.33

Table 5.8. Scenario 2: Bid segments available for CF dispatch down

Available bid stack	Bid price ($/MWh)	Bid Segment (MW)	Dec MW by CF
Unit 10, Segment 1	80	10	5
Unit 11, Segment 2	120	5	5
Unit 12, Segment 1	130	30	0

Infeasible CF cost = [sum(available bid segment | bid price <= min(BAA, RTD import price), CF dispatch segment MW* segment bid price)]/12

= [5*120+5*80]/12

= 83.33

CF dispatch cost = Infeasible BS cost+ Infeasible CF cost = $691.67

ATTACHMENT E

ENERGY IMBALANCE MARKET
CAISO 2022-2023 QUARTERLY BENEFIT REPORTS

WESTERN EIM BENEFITS REPORT

First Quarter 2022

Prepared by: Market Analysis and Forecasting

April 21, 2022

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EXECUTIVE SUMMARY

Gross benefits from EIM since November 2014

$2.10 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.

Q1 2022 Gross Benefits by Participant

	(millions $)
Avista	$1.95
Arizona Public Service	$7.41
BANC	$18.58
California ISO	$63.56
Idaho Power	$6.29
LADWP	$10.35
NorthWestern Energy	$4.41
NV Energy	$5.53
PacifiCorp	$26.40
PNM	$8.59
Portland General Electric	$3.31
Powerex	$3.85
Puget Sound Energy	$1.54
Salt River Project	$3.60
Seattle City Light	$5.50
TID	$1.29
TPWR	$0.15
Total	$172.31

2022 Q1 BENEFITS

ECONOMICAL

$172.31 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

40,304

Metric tons of CO_2** avoided curtailments

OPERATIONAL

54%

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) 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 Western EIM, with both beginning their participation on March 2, 2022.

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.

WESTERN EIM ECONOMIC BENEFITS IN Q1 2022

Table 1 shows the estimated EIM gross benefits by each region per month[1]. The monthly savings presented show $51.55 million for January, $54.31 million for February, and $66.45 million for March with a total estimated benefit of $172.31 million for this quarter[2]. This level of EIM benefits accrued from having additional EIM areas participating in the market and economical transfers displacing more expensive generation.

[1] 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 points of the total intervals.
[2] For several quarterly estimates, CAISO benefits have been calculated on a variation of the counterfactual methodology. For CAISO only the logic has considered offline resources as part of the bid stack in the counterfactual. In Q4 2021, CAISO has identified some questionable results that drove persistent negative benefits for CAISO when considering offline resources. Consequently this logic has been not used for Q4 CAISO benefits in the meantime CAISO further asses this logic component. With this approach the counterfactual calculation for CAISO follows the same methodology applicable to all EIM entities.

Region	January	February	March	Total
AVA			$1.95	$1.95
APS	$2.85	$2.04	$2.52	$7.41
BANC	$5.04	$3.83	$9.71	$18.58
CISO	$15.03	$19.66	$28.87	$63.56
IPCO	$2.66	$2.34	$1.29	$6.29
LADWP	$2.81	$4.25	$3.29	$10.35
NVE	$1.36	$1.61	$1.44	$4.41
NWMT	$1.91	$1.73	$1.89	$5.53
PAC	$10.36	$9.82	$6.22	$26.40
PGE	$2.67	$3.23	$2.69	$8.59
PNM	$1.51	$0.97	$0.83	$3.31
PSE	$1.68	$0.97	$1.20	$3.85
PWRX	$0.15	$0.56	$0.83	$1.54
SCL	$1.55	$1.06	$0.99	$3.60
SRP	$1.63	$1.88	$1.99	$5.50
TID	$0.34	$0.36	$0.59	$1.29
TPWR			$0.15	$0.15
Total	$51.55	$54.31	$66.45	$172.31

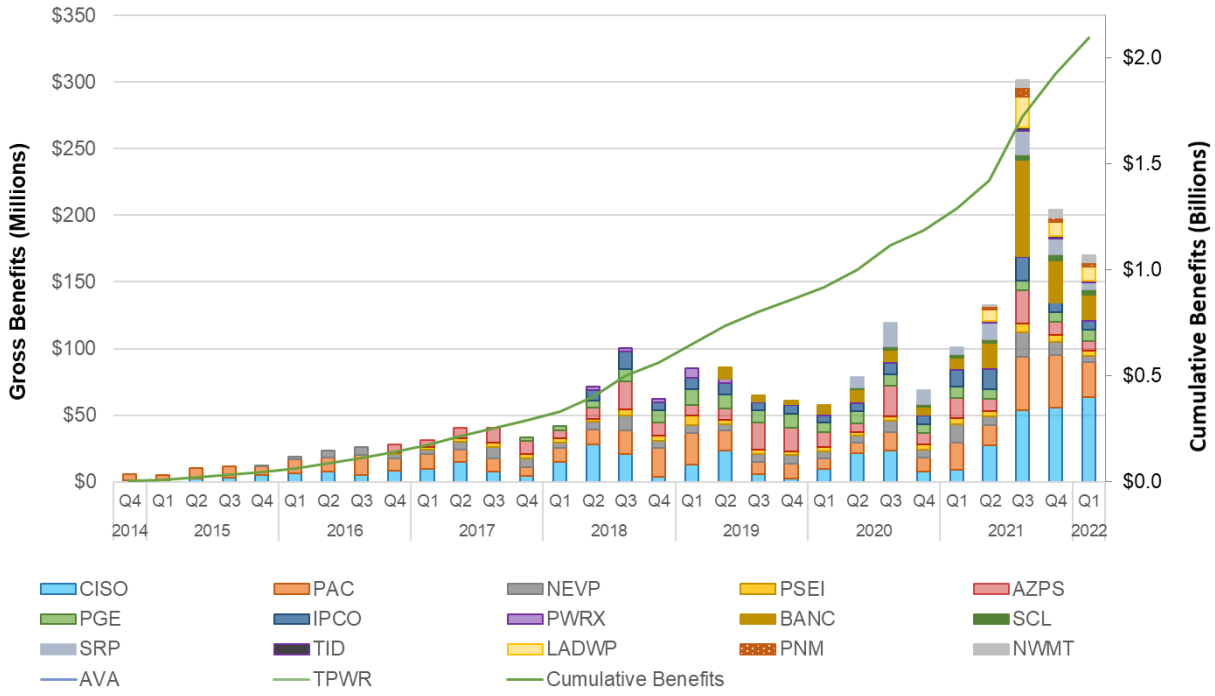
TABLE 1: Q1 2022 benefits in millions USD

CUMULATIVE ECONOMIC BENEFITS SINCE INCEPTION

Since the start of the EIM in November 2014, the cumulative economic benefits of the market have totaled $2.10 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.[3]

Graph 1 illustrates the gross economic benefits of the EIM 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 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)
January	AZPS	CISO	118,743	72,202
	AZPS	LADWP	17,593	19,952
	AZPS	NEVP	5,240	5,947
	AZPS	PACE	18,980	38,259
	AZPS	PNM	39,390	38,395
	AZPS	SRP	26,147	24,154
	BANC	CISO	6,501	2,743
	BANC	TIDC	22	88
	CISO	AZPS	35,068	51,172
	CISO	BANC	87,894	123,607
	CISO	LADWP	32,845	41,818
	CISO	NEVP	57,698	75,616
	CISO	PACW	11,572	38,255
	CISO	PGE	15,777	32,445
	CISO	PWRX	32,316	45,374
	CISO	SRP	38,033	52,578
	CISO	TIDC	9,917	13,188
	IPCO	NEVP	35,809	14,639
	IPCO	NWMT	2,198	2,108
	IPCO	PACE	6,504	2,754
	IPCO	PACW	24,319	20,997
	IPCO	PSEI	0	0
	IPCO	SCL	2,955	3,196

	LADWP	AZPS	2,499	2,983
	LADWP	CISO	110,255	66,932
	LADWP	NEVP	7,764	13,365
	LADWP	PACE	9,819	13,274
	NEVP	AZPS	603	697
	NEVP	CISO	82,891	34,904
	NEVP	IPCO	88,744	109,290
	NEVP	LADWP	11,639	11,550
	NEVP	PACE	14,381	17,254
	NWMT	IPCO	10,483	10,886
	NWMT	PACE	6,560	3,857
	NWMT	PACW	39	49
	NWMT	PGE	2	48
	NWMT	PSEI	4	44
	PACE	AZPS	66,803	54,583
	PACE	IPCO	84,861	99,770
	PACE	LADWP	101,746	79,610
	PACE	NEVP	85,711	73,798
	PACE	NWMT	16,441	22,356
January	PACE	PACW	12,168	17,532
	PACE	SRP	0	0
	PACW	CISO	43,940	68,282
	PACW	IPCO	39,803	36,397
	PACW	NWMT	0	2
	PACW	PGE	31,998	26,535
	PACW	PSEI	16,214	20,511
	PACW	SCL	843	808
	PGE	CISO	32,750	27,570

	PGE	NWMT	126	70
	PGE	PACW	34,210	37,935
	PGE	PSEI	0	0
	PGE	SCL	1,151	1,090
	PNM	AZPS	19,222	18,520
	PNM	SRP	312	360
	PSEI	IPCO	0	0
	PSEI	NWMT	5	42
	PSEI	PACW	47,747	50,679
	PSEI	PGE	0	0
	PSEI	PWRX	13,773	15,743
	PSEI	SCL	21,217	24,309
	PWRX	CISO	0	0
	PWRX	PSEI	12,946	11,866
	SCL	IPCO	11,803	11,429
	SCL	PACW	1,294	1,499
	SCL	PGE	1,580	1,780
	SCL	PSEI	18,800	13,864
	SRP	AZPS	33,808	27,442
	SRP	CISO	48,933	41,814
	SRP	PACE	0	0
	SRP	PNM	1,661	2,127
	TIDC	BANC	15	88
	TIDC	CISO	10,199	5,785
February	AZPS	CISO	64,740	33,432
	AZPS	LADWP	12,726	11,670
	AZPS	NEVP	2,979	6,546
	AZPS	PACE	36,868	37,003

	AZPS	PNM	33,789	36,984
	AZPS	SRP	20,211	13,646
	BANC	CISO	5,393	2,879
	BANC	TIDC	75	153
	CISO	AZPS	91,629	90,842
	CISO	BANC	90,169	114,869
	CISO	LADWP	93,651	111,393
	CISO	NEVP	98,608	114,495
	CISO	PACW	8,025	25,307
	CISO	PGE	19,898	30,506
	CISO	PWRX	50,574	63,110
	CISO	SRP	55,299	66,382
	CISO	TIDC	6,634	8,786
	IPCO	NEVP	33,090	17,165
	IPCO	NWMT	3,549	3,519
	IPCO	PACE	8,691	4,326
	IPCO	PACW	13,523	15,421
	IPCO	PSEI	0	0
	IPCO	SCL	3,639	4,237
	LADWP	AZPS	1,401	1,956
	LADWP	CISO	44,004	27,577
	LADWP	NEVP	10,989	12,432
	LADWP	PACE	20,430	21,959
February	NEVP	AZPS	1,999	2,058
	NEVP	CISO	64,069	28,650
	NEVP	IPCO	73,018	86,247
	NEVP	LADWP	24,884	23,174
	NEVP	PACE	36,121	34,598

	NWMT	IPCO	8,047	7,862
	NWMT	PACE	4,896	3,244
	NWMT	PACW	54	13
	NWMT	PGE	6	50
	NWMT	PSEI	8	30
	PACE	AZPS	64,346	55,733
	PACE	IPCO	66,977	71,276
	PACE	LADWP	69,256	59,490
	PACE	NEVP	50,173	32,607
	PACE	NWMT	15,196	17,340
	PACE	PACW	12,210	13,675
	PACE	SRP	0	0
	PACW	CISO	44,430	91,933
February	PACW	IPCO	34,274	32,700
	PACW	NWMT	0	6
	PACW	PGE	25,339	21,244
	PACW	PSEI	27,220	27,962
	PACW	SCL	1,347	1,199
	PGE	CISO	46,152	35,837
	PGE	NWMT	1	49
	PGE	PACW	32,444	45,060
	PGE	PSEI	0	0
	PGE	SCL	1,542	1,557
	PNM	AZPS	24,075	20,191
	PNM	SRP	5,260	4,259
	PSEI	IPCO	0	0
	PSEI	NWMT	1	29
	PSEI	PACW	29,025	32,855

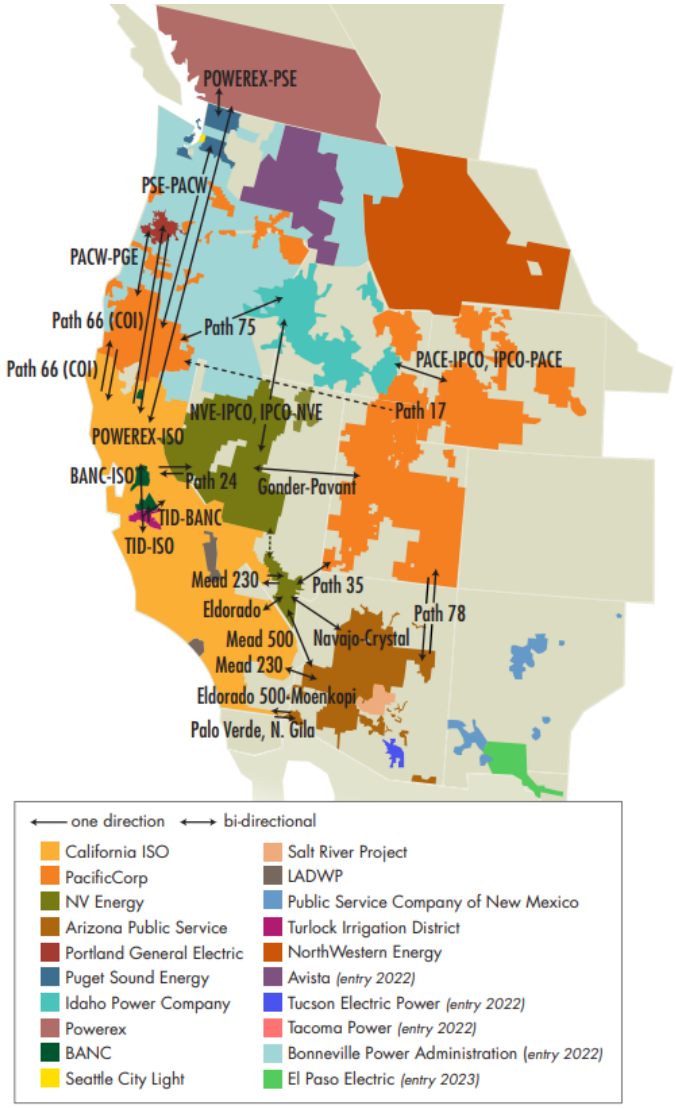
	PSEI	PGE	0	0
	PSEI	PWRX	14,595	15,700
	PSEI	SCL	30,478	30,119
	PWRX	CISO	0	0
	PWRX	PSEI	11,200	11,315
	SCL	IPCO	12,239	11,581
	SCL	PACW	685	907
	SCL	PGE	940	1,033
	SCL	PSEI	6,165	6,049
	SRP	AZPS	13,542	19,966
	SRP	CISO	54,897	40,795
	SRP	PACE	0	0
	SRP	PNM	1,072	2,058
	TIDC	BANC	3,513	2,603
	TIDC	CISO	8,730	5,714
March	AVA	CISO	36	35
	AVA	IPCO	41,079	30,694
	AVA	NWMT	20,262	13,976
	AVA	PACW	492	934
	AVA	PGE	0	62
	AVA	PSEI	2	42
	AVA	SCL	4	2
	AZPS	CISO	118,636	60,827
	AZPS	LADWP	13,543	12,957
	AZPS	NEVP	3,359	4,346
	AZPS	PACE	70,436	94,386
	AZPS	PNM	36,302	40,678
	AZPS	SRP	31,055	26,305

	BANC	CISO	9,468	4,768
	BANC	TIDC	145	157
	CISO	AVA	0	0
	CISO	AZPS	128,838	147,868
	CISO	BANC	135,926	151,421
	CISO	LADWP	91,221	113,805
	CISO	NEVP	155,740	190,858
	CISO	PACW	10,484	44,930
	CISO	PGE	23,431	49,823
	CISO	PWRX	70,105	87,960
	CISO	SRP	71,743	82,831
	CISO	TIDC	8,870	11,526
	IPCO	AVA	6,766	11,113
	IPCO	NEVP	40,989	22,055
	IPCO	NWMT	3,196	4,284
	IPCO	PACE	43,574	20,184
	IPCO	PACW	14,394	22,587
	IPCO	PSEI	0	0
	IPCO	SCL	3,515	5,295
	LADWP	AZPS	1,597	2,993
	LADWP	CISO	35,241	24,140
	LADWP	NEVP	3,317	4,833
	LADWP	PACE	7,525	8,585
	NEVP	AZPS	800	1,131
March	NEVP	CISO	127,997	56,105
	NEVP	IPCO	38,306	59,337
	NEVP	LADWP	51,570	45,547
	NEVP	PACE	84,835	110,488

	NWMT	AVA	18,172	27,943
	NWMT	IPCO	6,996	7,745
	NWMT	PACE	17,012	10,016
	NWMT	PACW	32	16
	NWMT	PGE	62	85
	NWMT	PSEI	4	37
March	PACE	AZPS	117,183	84,121
	PACE	IPCO	75,351	90,801
	PACE	LADWP	26,324	22,494
	PACE	NEVP	102,187	55,974
	PACE	NWMT	22,459	33,316
	PACE	PACW	28,363	37,696
	PACE	SRP	0	0
	PACW	AVA	10,199	10,169
	PACW	CISO	37,888	79,115
	PACW	IPCO	43,457	35,531
	PACW	NWMT	0	3
	PACW	PGE	37,555	31,476
	PACW	PSEI	27,452	41,994
	PACW	SCL	1,013	1,029
	PGE	AVA	0	63
	PGE	CISO	24,281	19,273
	PGE	NWMT	48	48
	PGE	PACW	28,165	32,661
	PGE	PSEI	0	0
	PGE	SCL	1,172	1,322
	PGE	TPWR	32	60
	PNM	AZPS	22,036	21,389

PNM	SRP	4,832	2,788
PSEI	AVA	0	41
PSEI	IPCO	0	0
PSEI	NWMT	5	37
PSEI	PACW	32,839	33,619
PSEI	PGE	0	0
PSEI	PWRX	18,220	20,675
PSEI	SCL	20,542	18,715
PSEI	TPWR	4,539	5,345
PWRX	CISO	0	0
PWRX	PSEI	9,950	8,828
SCL	AVA	13	10
SCL	IPCO	12,814	10,554
SCL	PACW	885	1,101
SCL	PGE	1,480	1,364
SCL	PSEI	11,788	15,118
SRP	AZPS	4,890	8,533
SRP	CISO	36,340	23,202
SRP	PACE	0	0
SRP	PNM	282	447
TIDC	BANC	4,112	2,716
TIDC	CISO	8,868	4,532
TPWR	PGE	1	31
TPWR	PSEI	6,687	6,442

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

[1] *Is an optional path available for PACE-PACW EIM transfers and the capacity is a subset of PACE-IPCO/IPCO-PACE and Path 75 capacity.*

[2] *When in use, the available capacity on PACE-IPCO/IPCO-PACE and Path 75 will be subsequently reduced by the used amount on Path 17, and not double counted.*

Current as of July 2021

GRAPH 2: Estimated maximum transfer capacity (EIM entities operating in Q4 2021)

WHEEL THROUGH TRANSFERS

As the footprint of the Western EIM grows, wheel-through transfers may become more common. 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.

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.

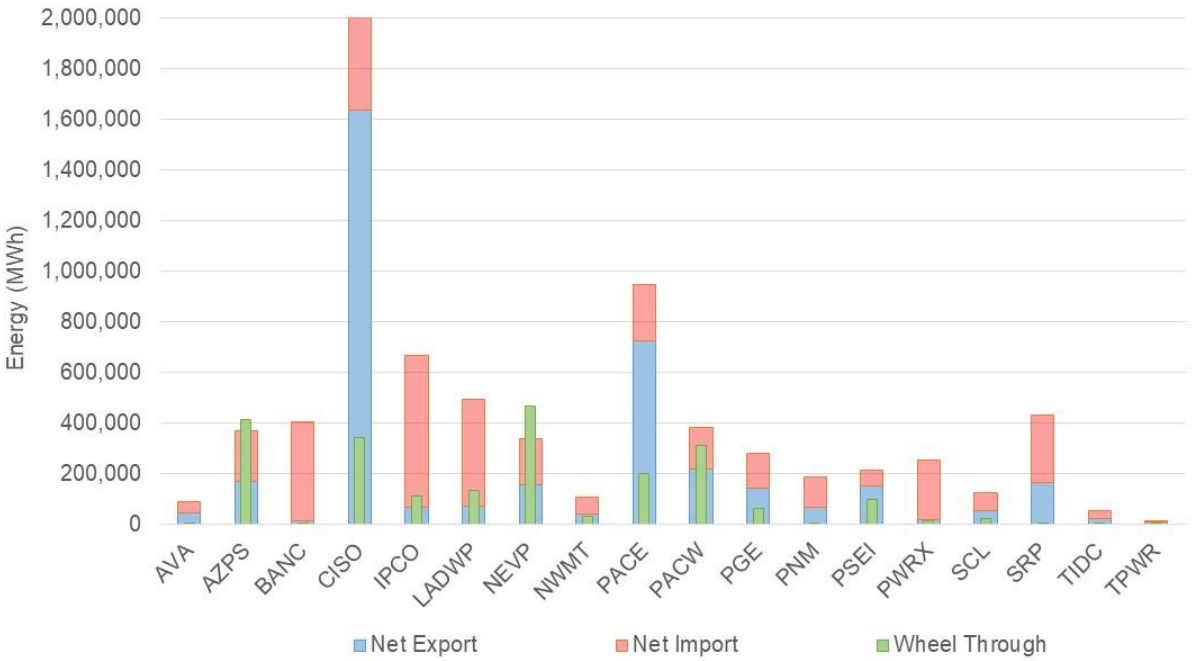
This volume reflects the total wheel-through transfers for each EIM BAA, regardless of the potential paths used to wheel through. The net imports and exports estimated in this section reflect the overall volume of net imports and exports; in contrast, the imports and exports provided in Table 2 reflect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

BAA	Net Export	Net Import	Wheel Through
AVA	43,306	46,901	2,440
AZPS	166,484	200,973	411,205
BANC	10,493	395,010	295
CISO	1,638,892	517,173	341,873
IPCO	63,929	602,149	109,952
LADWP	70,422	422,855	130,606
NEVP	156,110	179,757	464,919
NWMT	40,301	65,558	31,625
PACE	723,253	224,613	198,918
PACW	219,342	162,824	310,904
PGE	143,166	137,055	59,428

PNM	67,062	120,243	446
PSEI	149,085	65,281	98,823
PWRX	17,740	234,291	14,270
SCL	54,694	71,285	21,596
SRP	161,794	268,713	4,590
TIDC	21,091	33,551	347
TPWR	6,412	5,343	62

TABLE 3: Estimated wheel-through transfers in Q1 2022

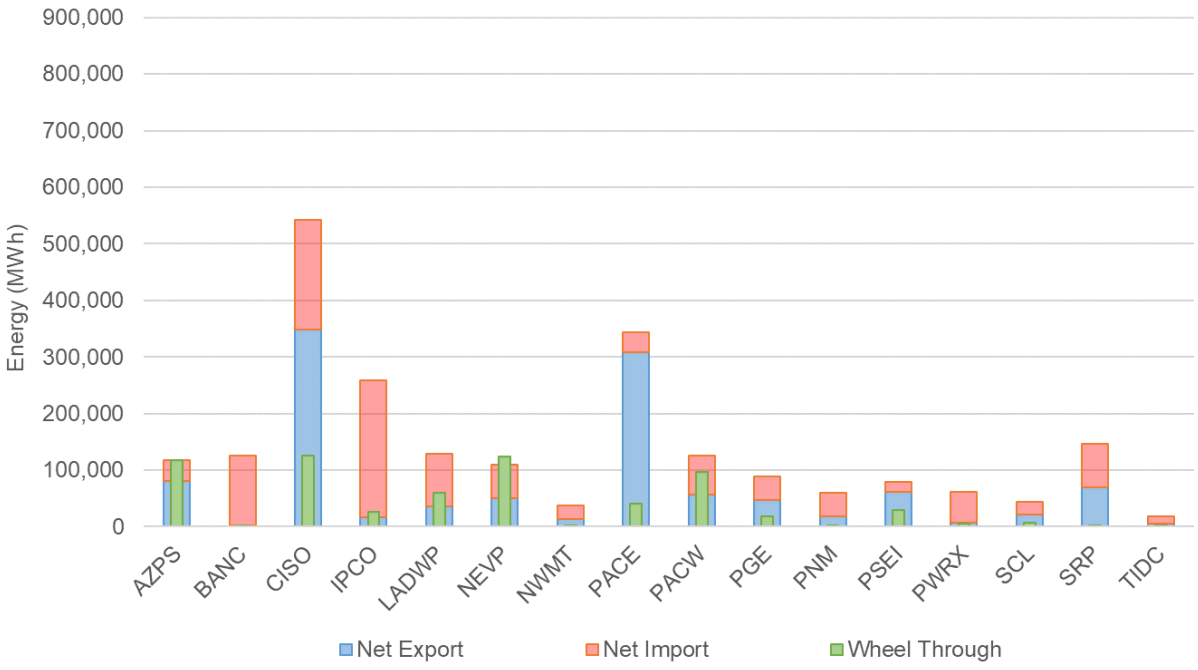


GRAPH 3: Estimated wheel-through transfers in Q4 2021

BAA	Net Export	Net Import	Wheel-Through
AZPS	**80,872**	**37,360**	**118,037**
BANC	2,744	123,608	87
CISO	347,913	194,094	126,139
IPCO	17,171	241,249	26,523

LADWP	36,061	92,437	60,493
NEVP	50,033	59,702	123,661
NWMT	14,045	23,739	838
PACE	307,611	36,519	40,037
PACW	56,453	69,703	97,242
PGE	47,549	41,692	19,117
PNM	18,774	40,416	106
PSEI	61,849	17,362	28,924
PWRX	6,539	55,790	5,327
SCL	21,816	22,648	6,757
SRP	70,183	75,893	1,199
TIDC	5,788	13,190	86

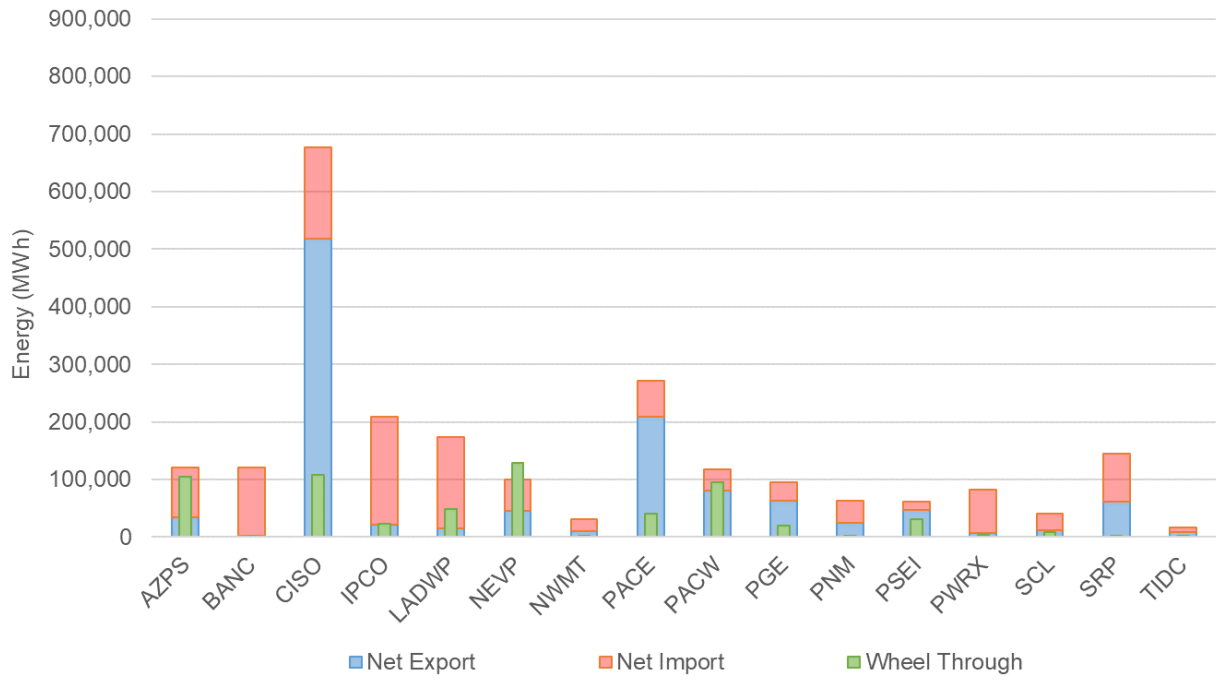
TABLE 4: Estimated wheel-through transfers in January 2022



GRAPH 4: Estimated wheel-through transfers in January 2022

BAA	Net Export	Net Import	Wheel- Through
AZPS	34,347	85,813	104,934
BANC	2,935	117,374	98
CISO	517,910	159,037	107,781
IPCO	22,128	187,127	22,540
LADWP	15,884	157,688	48,040
NEVP	45,735	54,254	128,992
NWMT	10,313	20,056	886
PACE	209,609	61,687	40,513
PACW	80,557	37,680	95,559
PGE	62,800	33,131	19,702
PNM	24,331	38,924	119
PSEI	47,616	14,270	31,087
PWRX	7,092	74,587	4,223
SCL	11,669	29,212	7,901
SRP	61,596	83,064	1,223
TIDC	8,218	8,840	99

TABLE 5: Estimated wheel-through transfers in February 2022

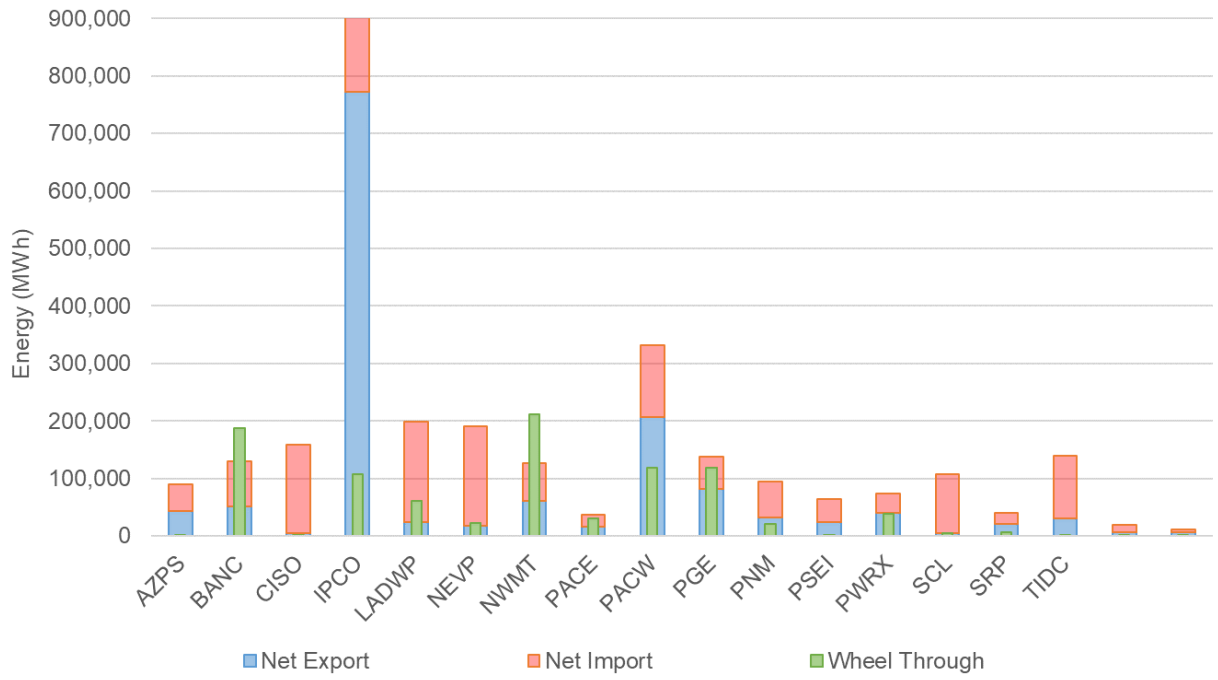


GRAPH 5: Estimated wheel-through transfers in February 2022

BAA	Net Export	Net Import	Wheel Through
AVA	**43,306**	**46,901**	**2,440**
AZPS	**51,264**	**77,801**	**188,234**
BANC	4,815	154,027	110
CISO	773,070	164,043	107,953
IPCO	24,629	173,774	60,889
LADWP	18,477	172,730	22,074
NEVP	60,343	65,802	212,265
NWMT	15,942	21,763	29,901
PACE	206,033	126,407	118,369
PACW	82,333	55,441	118,102
PGE	32,816	62,233	20,610
PNM	23,957	40,904	221
PSEI	39,620	33,649	38,812

PWRX	4,108	103,915	4,720
SCL	21,209	19,426	6,938
SRP	30,015	109,757	2,167
TIDC	7,085	11,521	163
TPWR	6,412	5,343	62

TABLE 6: Estimated wheel-through transfers in March 2022



GRAPH 6: Estimated wheel-through transfers in March 2022

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 2022 was calculated to be 18,160 MWh (January) + 29,740 MWh (February) + 46,268 MWh (March) = 94,168 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_2/MWh, avoided curtailments displaced an

estimated 40,304 metric tons of CO_2 for Q1 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 CO_2, 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
Total		1,664,368	712,270

TABLE 7: Total reduction in curtailment of renewable energy and associated reductions in CO_2

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
January	*AZPS*	up	21	251
	BANC	up	8	120
	CISO	up	209	2,437
	IPCO	up	30	140
	LADWP	up	38	295
	NEVP	up	17	328
	NWMT	up	26	156
	PACE	up	146	612
	PACW	up	57	222
	PGE	up	64	212
	PNM	up	31	148
	PSEI	up	51	192
	PWRX	up	82	366
	SCL	up	7	45
	SRP	up	14	151
	TIDC	up	2	14

	ALL EIM	**up**	**390**	**2,917**
	AZPS	down	6	278
	BANC	down	5	85
	CISO	down	57	1,577
	IPCO	down	43	184
	LADWP	down	28	272
	NEVP	down	14	328
	NWMT	down	39	159
	PACE	down	120	484
	PACW	down	43	232
	PGE	down	23	217
	PNM	down	41	161
January	*PSEI*	down	35	200
	PWRX	down	72	339
	SCL	down	4	49
	SRP	down	16	207
	TIDC	down	0	16
	ALL EIM	**down**	**221**	**2,021**
	AZPS	up	19	261
February	*BANC*	up	9	120
	CISO	up	257	2,226
	IPCO	up	39	150
	LADWP	up	44	295
	NEVP	up	23	337
	NWMT	up	43	129
	PACE	up	112	463
	PACW	up	48	222
	PGE	up	43	212
	PNM	up	43	143
	PSEI	up	38	187
	PWRX	up	68	259

	SCL	up	8	44
	SRP	up	24	151
	TIDC	up	2	14
	ALL EIM	**up**	**464**	**2,661**
	AZPS	down	22	254
	BANC	down	5	81
	CISO	down	54	1,577
	IPCO	down	49	203
	LADWP	down	51	272
	NEVP	down	12	355
	NWMT	down	35	159
	PACE	down	124	484
February	*PACW*	down	38	232
	PGE	down	34	230
	PNM	down	36	150
	PSEI	down	26	156
	PWRX	down	93	339
	SCL	down	5	49
	SRP	down	22	170
	TIDC	down	1	17
	ALL EIM	**down**	**284**	**2,021**
	AVA	up	17	91
March	*AZPS*	up	32	286
	BANC	up	7	113
	CISO	up	281	2,120
	IPCO	up	34	159
	LADWP	up	37	315
	NEVP	up	26	337
	NWMT	up	26	115
	PACE	up	111	495
	PACW	up	47	222

	PGE	up	33	177
	PNM	up	28	177
	PSEI	up	43	162
	PWRX	up	67	319
	SCL	up	5	45
	SRP	up	24	169
	TIDC	up	2	14
	TPWR	up	3	29
	ALL EIM	**up**	**459**	**2,710**
	AVA	down	19	87
	AZPS	down	22	229
March	*BANC*	down	5	88
	CISO	down	110	1,623
	IPCO	down	35	223
	LADWP	down	50	279
	NEVP	down	15	395
	NWMT	down	33	161
	PACE	down	142	470
	PACW	down	53	179
	PGE	down	40	219
	PNM	down	36	150
	PSEI	down	27	174
	PWRX	down	93	314
	SCL	down	4	49
	SRP	down	20	175
	TIDC	down	0	19
	TPWR	down	4	34
	ALL EIM	**down**	**283**	**2,122**

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.

	January		**February**		**March**	
Direction	Up	Down	Up	Down	Up	Down
Average MW saving	1,247	1,229	1,236	1,246	1,317	1,350
Sum of BAA requirements	2,487	2,148	2,364	2,217	2,488	2,370
Percentage savings	50%	57%	52%	56%	53%	57%

Table 9: Flexible ramping procurement diversity savings in Q1 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 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 712,270 metric tons of CO_2, roughly the equivalent of avoiding the emissions from 149,752 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

Western Energy Imbalance Market Benefits

Second Quarter 2022

July 29, 2022

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EXECUTIVE SUMMARY

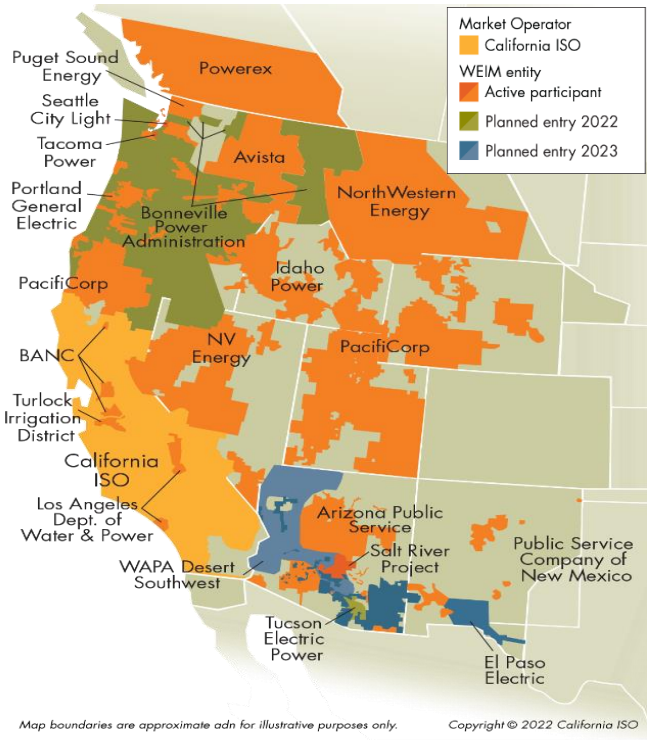
Gross benefits from WEIM since November 2014

$2.39 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.



Q2 2022 Gross Benefits by Participant

	(millions $)
Arizona Public Service	$10.14
Avista	$5.16
BANC	$68.09
BPA	$4.36
California ISO	$71.75
Idaho Power	$8.44
LADWP	$13.78
NV Energy	$8.63
NorthWestern Energy	$5.90
PacifiCorp	$35.21
Portland General Electric	$11.92
PNM	$3.10
Puget Sound Energy	$4.90
Powerex	$4.66
Seattle City Light	$2.90
Salt River Project	$21.26
Tacoma Power	$1.55
TEP	$2.84
TID	$2.85
Total	$287.44

2022 Q2 BENEFITS

ECONOMICAL

$287.44 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

50,655

Metric tons of CO_2** avoided curtailments

OPERATIONAL

54%

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 Q2 2022

Table 1 shows the estimated WEIM gross benefits by each region per month[1]. The monthly savings presented show $93.66 million for April, $83.84 million for May, and $109.94 million for June with a total estimated benefit of $287.44 million for this quarter[2]. 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.

Region	April	May	June	Total
APS	$3.69	$3.83	$2.62	$10.14
AVA	$1.98	$1.72	$1.46	$5.16
BANC	$4.71	$13.78	$49.60	$68.09
BPA		$2.26	$2.10	$4.36
CISO	$42.10	$14.56	$15.09	$71.75
IPCO	$3.89	$2.78	$1.77	$8.44
LADWP	$4.42	$5.30	$4.06	$13.78
NVE	$2.49	$2.40	$3.74	$8.63
NWMT	$2.50	$2.44	$0.96	$5.90
PAC	$13.35	$15.43	$6.43	$35.21
PGE	$3.60	$3.43	$4.89	$11.92
PNM	$0.07	$1.26	$1.77	$3.10
PSE	$1.79	$1.94	$1.17	$4.90
PWRX	$0.64	$2.05	$1.97	$4.66
SCL	$1.10	$1.00	$0.80	$2.90
SRP	$5.95	$7.04	$8.27	$21.26
TPWR	$0.40	$0.43	$0.72	$1.55
TEP		$1.29	$1.55	$2.84
TID	$0.98	$0.90	$0.97	$2.85
Total	$93.66	$83.84	$109.94	$287.44

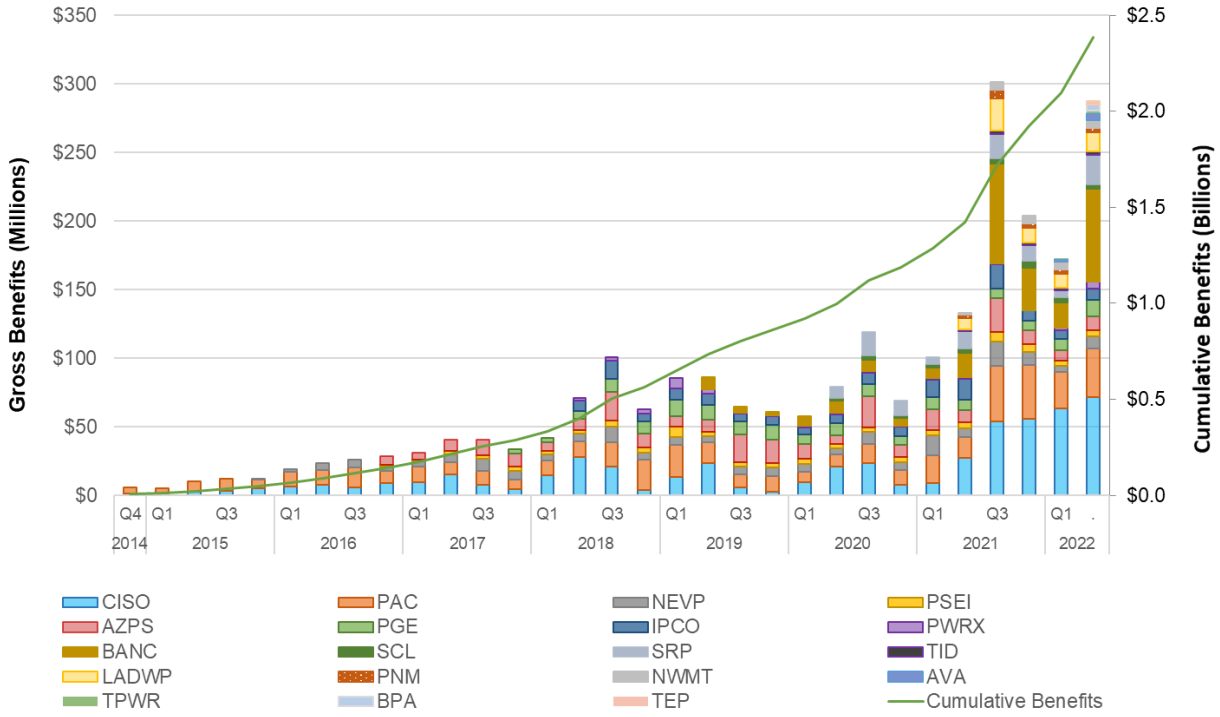
TABLE 1: Q2 2022 benefits in millions USD

CUMULATIVE ECONOMIC BENEFITS SINCE INCEPTION

Since the start of the WEIM in November 2014, the cumulative economic benefits of the market have totaled $2.39 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)
April	AVA	CISO	0	0
	AVA	IPCO	20,394	16,524
	AVA	NWMT	6,205	5,541
	AVA	PACW	10,480	12,791
	AVA	PGE	48	62
	AVA	PSEI	0	1
	AVA	SCL	2	1
	AVA	TPWR	2,909	3,389
	AZPS	CISO	106,535	70,984
	AZPS	LADWP	6,478	7,404
	AZPS	NEVP	8,905	16,269
	AZPS	PACE	31,007	36,001
	AZPS	PNM	18,144	15,167
	AZPS	SRP	44,298	47,638
	BANC	CISO	7,941	3,264
	BANC	TIDC	30	145
	CISO	AVA	87	20
	CISO	AZPS	69,708	73,122
	CISO	BANC	85,021	100,826
	CISO	LADWP	76,743	80,241
	CISO	NEVP	73,631	78,704
	CISO	PACW	0	8,331

CISO	PGE	11,468	15,791
CISO	PWRX	41,738	50,391
CISO	SRP	173,251	176,313
CISO	TIDC	11,060	12,811
IPCO	AVA	27,722	33,028
IPCO	NEVP	45,717	33,915
IPCO	NWMT	2,648	3,081
IPCO	PACE	19,505	14,309
IPCO	PACW	30,365	40,626
IPCO	PSEI	0	0
IPCO	SCL	9,280	10,695
LADWP	AZPS	2,428	3,116
LADWP	CISO	92,685	66,908
LADWP	NEVP	11,999	16,419
LADWP	PACE	34,565	37,081
NEVP	AZPS	3,021	3,101
NEVP	CISO	75,594	53,435
NEVP	IPCO	34,940	45,747
NEVP	LADWP	19,953	23,871
NEVP	PACE	10,672	12,977
NWMT	AVA	21,314	26,256
NWMT	IPCO	3,773	4,108
NWMT	PACE	8,283	5,869
NWMT	PACW	0	4
NWMT	PGE	10	29
NWMT	PSEI	20	33
NWMT	TPWR	3,119	3,684
PACE	AZPS	163,693	150,630

	PACE	IPCO	51,491	64,637
	PACE	LADWP	84,511	69,606
	PACE	NEVP	23,563	20,808
	PACE	NWMT	24,092	27,565
	PACE	PACW	32,675	41,067
	PACE	SRP	0	0
	PACW	AVA	8,656	9,452
	PACW	CISO	60,528	80,218
	PACW	IPCO	21,181	14,035
	PACW	NWMT	5	5
	PACW	PGE	39,297	45,740
	PACW	PSEI	30,125	32,468
	PACW	SCL	998	972
	PGE	AVA	0	61
April	PGE	CISO	30,727	29,991
	PGE	NWMT	34	29
	PGE	PACW	21,307	24,282
	PGE	PSEI	0	0
	PGE	SCL	1,067	996
	PGE	TPWR	2,843	2,905
	PNM	AZPS	28,441	36,596
	PNM	SRP	15,061	16,969
	PSEI	AVA	0	1
	PSEI	IPCO	0	0
	PSEI	NWMT	8	33
	PSEI	PACW	34,478	37,186
	PSEI	PGE	0	0
	PSEI	PWRX	5,578	6,972

	PSEI	SCL	12,480	11,398
	PSEI	TPWR	5,344	5,461
	PWRX	CISO	0	0
	PWRX	PSEI	21,825	21,249
	SCL	AVA	1	1
	SCL	IPCO	1,474	1,341
	SCL	PACW	920	1,112
	SCL	PGE	1,374	1,607
	SCL	PSEI	12,048	16,353
	SRP	AZPS	4,575	6,585
	SRP	CISO	49,283	40,892
	SRP	PACE	0	0
	SRP	PNM	1,580	1,225
	TIDC	BANC	74	148
	TIDC	CISO	14,826	12,010
	TPWR	AVA	2,038	1,631
	TPWR	NWMT	1,796	1,493
	TPWR	PGE	3,053	3,061
	TPWR	PSEI	10,632	10,722
May	AVA	BPAT	4,997	3,193
	AVA	CISO	321	320
	AVA	IPCO	12,634	12,924
	AVA	NWMT	20,196	14,720
	AVA	PACW	7,459	9,702
	AVA	PGE	0	27
	AVA	PSEI	0	0
	AVA	SCL	8	3
	AVA	TPWR	1,915	1,951

May	AZPS	CISO	56,237	34,273
	AZPS	LADWP	526	1,364
	AZPS	NEVP	1,175	2,596
	AZPS	PACE	29,605	38,059
	AZPS	PNM	42,248	34,449
	AZPS	SRP	94,492	90,578
	AZPS	TEPC	11,098	11,526
	BANC	BPAT	1,112	1,264
	BANC	CISO	7,397	6,010
	BANC	TIDC	33	76
	BPAT	AVA	3,264	2,655
	BPAT	BANC	45	171
	BPAT	CISO	9,105	13,408
	BPAT	IPCO	1,277	1,325
	BPAT	LADWP	1,928	818
	BPAT	NEVP	389	220
	BPAT	NWMT	8,458	4,973
	BPAT	PACW	3,747	1,938
	BPAT	PGE	15,217	10,544
	BPAT	PSEI	13,355	15,088
	BPAT	PWRX	13,404	2,790
	BPAT	SCL	964	1,242
	BPAT	TPWR	4,105	4,675
	CISO	AVA	0	0
	CISO	AZPS	108,931	119,324
	CISO	BANC	140,055	144,032
	CISO	BPAT	5,329	9,780
	CISO	LADWP	65,629	76,466

	CISO	NEVP	114,631	142,138
May	CISO	PACW	898	13,245
	CISO	PGE	13,869	35,171
	CISO	PWRX	103,222	116,329
	CISO	SRP	233,061	251,791
	CISO	TEPC	3,935	3,799
	CISO	TIDC	16,133	16,403
	IPCO	AVA	22,176	25,776
	IPCO	BPAT	4,252	1,603
	IPCO	NEVP	4,572	2,682
	IPCO	NWMT	4,814	5,912
	IPCO	PACE	62,009	39,574
	IPCO	PACW	27,098	32,785
	IPCO	PSEI	0	0
	IPCO	SCL	8,334	9,465
	LADWP	AZPS	2,322	3,093
	LADWP	BPAT	1,735	800
	LADWP	CISO	71,092	50,524
	LADWP	NEVP	15,764	21,057
	LADWP	PACE	28,235	32,900
	LADWP	TEPC	0	83
	NEVP	AZPS	9,672	8,583
	NEVP	BPAT	743	502
	NEVP	CISO	100,199	65,338
	NEVP	IPCO	18,269	20,665
	NEVP	LADWP	24,255	27,189
	NEVP	PACE	62,305	75,527
	NWMT	AVA	13,111	16,444

	NWMT	BPAT	8,236	5,871
May	NWMT	IPCO	2,319	3,858
	NWMT	PACE	18,733	13,988
	NWMT	PACW	0	1
	NWMT	PGE	31	16
	NWMT	PSEI	43	7
	NWMT	TPWR	1,679	2,136
	PACE	AZPS	188,726	166,512
	PACE	IPCO	59,360	86,462
	PACE	LADWP	107,420	95,825
	PACE	NEVP	95,324	73,337
	PACE	NWMT	24,644	28,147
	PACE	PACW	17,234	21,078
	PACE	SRP	0	0
	PACE	TEPC	2,868	1,649
	PACW	AVA	10,429	11,849
	PACW	BPAT	6,114	8,427
	PACW	CISO	40,522	74,582
	PACW	IPCO	41,422	36,860
	PACW	NWMT	1	1
	PACW	PGE	61,168	52,085
	PACW	PSEI	23,739	24,918
May	PACW	SCL	1,476	1,513
	PGE	AVA	24	28
	PGE	BPAT	10,097	9,760
	PGE	CISO	25,689	23,700
	PGE	NWMT	38	12
	PGE	PACW	18,473	26,855

	PGE	PSEI	0	2
	PGE	SCL	1,396	1,621
	PGE	TPWR	5,783	7,298
	PNM	AZPS	7,443	9,283
	PNM	SRP	3,717	3,799
	PNM	TEPC	19,551	19,898
	PSEI	AVA	0	0
	PSEI	BPAT	23,116	24,524
	PSEI	IPCO	0	0
	PSEI	NWMT	14	3
	PSEI	PACW	13,399	14,445
	PSEI	PGE	0	2
May	PSEI	PWRX	19,784	20,398
	PSEI	SCL	7,287	7,266
	PSEI	TPWR	5,988	6,051
	PWRX	BPAT	3,143	2,461
	PWRX	CISO	0	0
	PWRX	PSEI	9,627	9,607
	SCL	AVA	4	2
	SCL	BPAT	1,583	1,514
	SCL	IPCO	6,414	6,157
	SCL	PACW	502	652
	SCL	PGE	1,001	1,031
	SCL	PSEI	10,783	13,798
	SRP	AZPS	8,960	13,548
	SRP	CISO	35,923	32,898
	SRP	PACE	0	0
	SRP	PNM	777	1,096

	SRP	TEPC	80,131	91,726
May	TEPC	AZPS	250	72
	TEPC	CISO	13,630	2,924
	TEPC	LADWP	0	0
	TEPC	PACE	158	225
	TEPC	PNM	8,882	6,798
	TEPC	SRP	8,763	17,041
	TIDC	BANC	148	226
	TIDC	CISO	7,454	6,662
	TPWR	AVA	991	1,194
	TPWR	BPAT	5,938	5,746
	TPWR	NWMT	594	371
	TPWR	PGE	3,586	2,963
	TPWR	PSEI	6,116	7,682
June	AVA	BPAT	5,697	406
	AVA	CISO	0	0
	AVA	IPCO	19,387	9,691
	AVA	NWMT	8,671	8,888
	AVA	PACW	4,100	2,252
	AVA	PGE	0	0
	AVA	PSEI	0	0
	AVA	SCL	7	0
	AVA	TPWR	0	0
	AZPS	CISO	62,964	27,082
	AZPS	LADWP	20,883	18,279
	AZPS	NEVP	8,203	9,826
	AZPS	PACE	78,792	95,501
	AZPS	PNM	28,526	29,050

	AZPS	SRP	30,063	17,897
June	AZPS	TEPC	26,059	23,874
	BANC	BPAT	2,035	0
	BANC	CISO	6,626	9,577
	BANC	TIDC	161	309
	BPAT	AVA	5,927	3,735
	BPAT	BANC	136	0
	BPAT	CISO	970	2,042
	BPAT	IPCO	1,597	31
	BPAT	LADWP	2,748	0
	BPAT	NEVP	267	0
	BPAT	NWMT	25,521	3,725
	BPAT	PACW	9,990	3,840
	BPAT	PGE	26,200	16,429
	BPAT	PSEI	28,247	28,987
	BPAT	PWRX	13,371	0
	BPAT	SCL	5,389	4,838
	BPAT	TPWR	11,342	9,848
	CISO	AVA	0	0
	CISO	AZPS	95,766	117,824
	CISO	BANC	189,226	186,320
	CISO	BPAT	862	1,968
	CISO	LADWP	92,507	120,240
	CISO	NEVP	114,963	134,766
	CISO	PACW	5,909	48,873
	CISO	PGE	22,744	62,760
	CISO	PWRX	63,709	83,326
	CISO	SRP	205,170	240,137

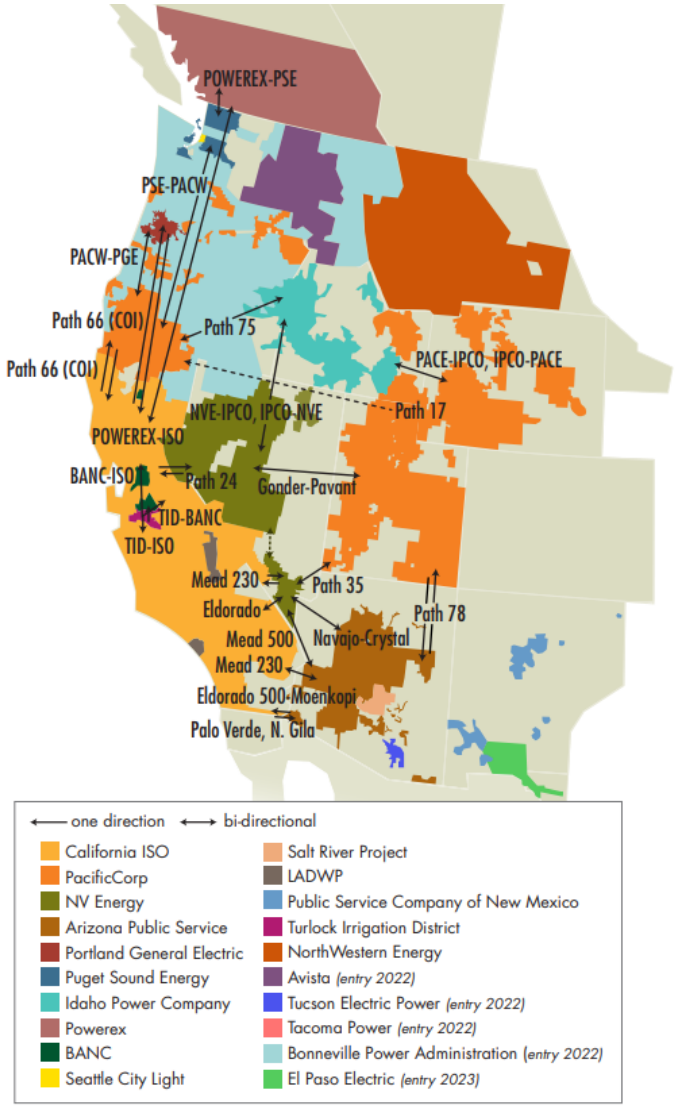
	CISO	TEPC	2,011	2,538
June	CISO	TIDC	9,640	9,452
	IPCO	AVA	21,875	23,515
	IPCO	BPAT	1,411	0
	IPCO	NEVP	23,059	11,967
	IPCO	NWMT	4,394	7,790
	IPCO	PACE	25,922	15,769
	IPCO	PACW	37,118	19,512
	IPCO	PSEI	0	0
	IPCO	SCL	7,773	10,522
	LADWP	AZPS	3,850	5,604
	LADWP	BPAT	5,096	0
	LADWP	CISO	14,438	6,421
	LADWP	NEVP	13,680	17,035
	LADWP	PACE	13,217	12,022
	LADWP	TEPC	0	0
	NEVP	AZPS	6,668	7,636
	NEVP	BPAT	1,347	0
	NEVP	CISO	43,430	10,628
	NEVP	IPCO	70,804	77,974
	NEVP	LADWP	39,289	34,228
	NEVP	PACE	43,582	47,042
	NWMT	AVA	21,277	19,088
	NWMT	BPAT	6,028	625
	NWMT	IPCO	3,571	2,858
	NWMT	PACE	5,959	2,625
	NWMT	PACW	282	0
	NWMT	PGE	174	0

	NWMT	PSEI	77	0
	NWMT	TPWR	1,229	2,492
June	PACE	AZPS	74,780	55,992
	PACE	IPCO	57,496	62,736
	PACE	LADWP	49,749	51,623
	PACE	NEVP	39,964	22,428
	PACE	NWMT	30,729	27,130
	PACE	PACW	51,580	40,357
	PACE	SRP	0	0
	PACE	TEPC	1,536	1,103
	PACW	AVA	15,528	16,880
	PACW	BPAT	4,176	656
	PACW	CISO	7,124	21,286
	PACW	IPCO	14,579	13,248
	PACW	NWMT	0	0
	PACW	PGE	54,893	47,383
	PACW	PSEI	22,296	29,307
	PACW	SCL	1,680	2,024
	PGE	AVA	0	0
June	PGE	BPAT	9,824	14,726
	PGE	CISO	9,436	5,703
	PGE	NWMT	108	0
	PGE	PACW	19,654	18,578
	PGE	PSEI	3	0
	PGE	SCL	1,469	1,868
	PGE	TPWR	1,339	2,453
	PNM	AZPS	24,924	25,722
	PNM	SRP	4,149	2,826

	PNM	TEPC	25,169	24,931
June	PSEI	AVA	0	0
	PSEI	BPAT	9,819	13,642
	PSEI	IPCO	0	0
	PSEI	NWMT	17	0
	PSEI	PACW	11	0
	PSEI	PGE	1	0
	PSEI	PWRX	15,518	16,414
	PSEI	SCL	20,565	17,180
	PSEI	TPWR	6,136	6,662
	PWRX	BPAT	4,255	34
	PWRX	CISO	0	0
	PWRX	PSEI	12,295	12,347
	SCL	AVA	17	0
	SCL	BPAT	118	46
	SCL	IPCO	9,305	6,415
	SCL	PACW	1,098	798
	SCL	PGE	1,170	867
	SCL	PSEI	3,912	6,684
	SRP	AZPS	15,979	19,695
	SRP	CISO	50,824	38,195
	SRP	PACE	0	0
	SRP	PNM	947	1,651
	SRP	TEPC	65,964	77,789
	TEPC	AZPS	399	0
	TEPC	CISO	16,959	10,582
	TEPC	LADWP	0	0
	TEPC	PACE	864	1,578

June	TEPC	PNM	17,131	13,585
	TEPC	SRP	12,777	10,796
	TIDC	BANC	203	0
	TIDC	CISO	12,951	14,046
	TPWR	AVA	0	0
	TPWR	BPAT	1,275	2,462
	TPWR	NWMT	2,957	1,689
	TPWR	PGE	2,372	1,449
	TPWR	PSEI	7,000	9,278

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

[1] *Is an optional path available for PACE-PACW EIM transfers and the capacity is a subset of PACE-IPCO/IPCO-PACE and Path 75 capacity.*

[2] *When in use, the available capacity on PACE-IPCO/IPCO-PACE and Path 75 will be subsequently reduced by the used amount on Path 17, and not double counted.*

Current as of July 2021

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.

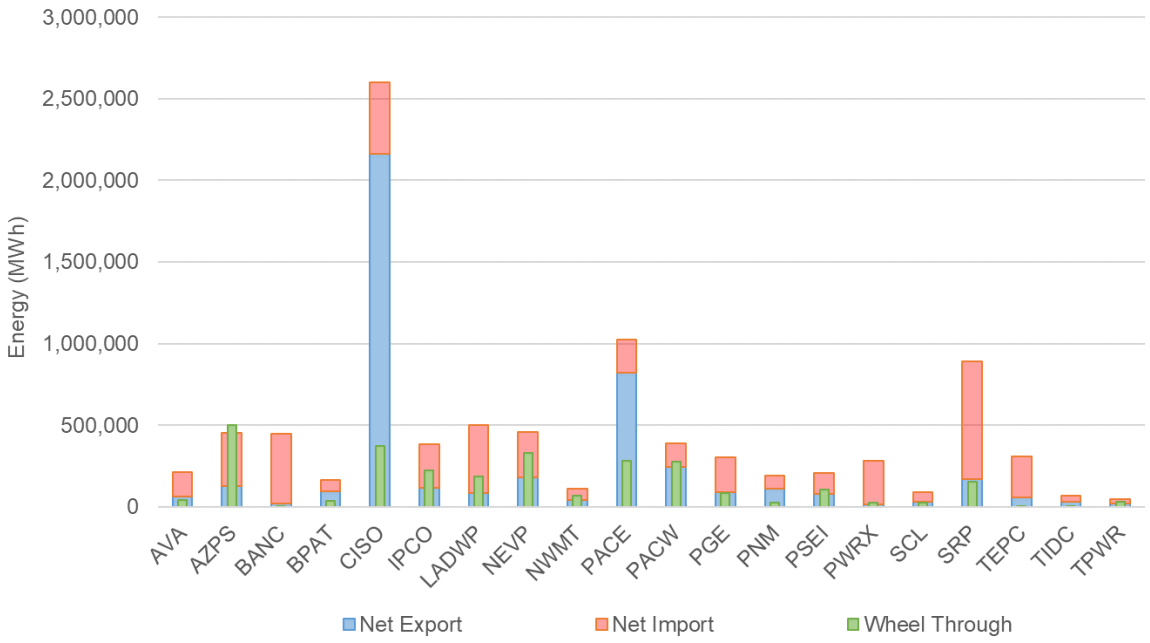
This volume reflects the total wheel-through transfers for each WEIM BAA, regardless of the potential paths used to wheel through. The net imports and exports estimated in this section reflect the overall volume of net imports and exports; in contrast, the imports and exports provided in Table 2 reflect 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	62,566	151,797	39,821
AZPS	127,260	325,482	500,557
BANC	19,328	430,405	1,317
BPAT	93,752	70,440	39,571
CISO	2,160,868	441,541	372,362
IPCO	118,497	263,568	224,029
LADWP	84,341	418,433	188,721
NEVP	183,385	273,110	331,057
NWMT	40,364	71,478	69,628
PACE	824,667	198,626	284,023
PACW	248,054	142,851	277,458

PGE	88,154	214,303	82,713
PNM	113,932	76,929	26,093
PSEI	79,693	130,587	107,944
PWRX	16,732	267,654	28,967
SCL	32,420	55,646	25,956
SRP	169,868	720,349	155,433
TEPC	58,079	253,395	5,521
TIDC	32,509	38,613	583
TPWR	19,923	29,186	29,818

TABLE 3: Estimated wheel-through transfers in Q2 2022

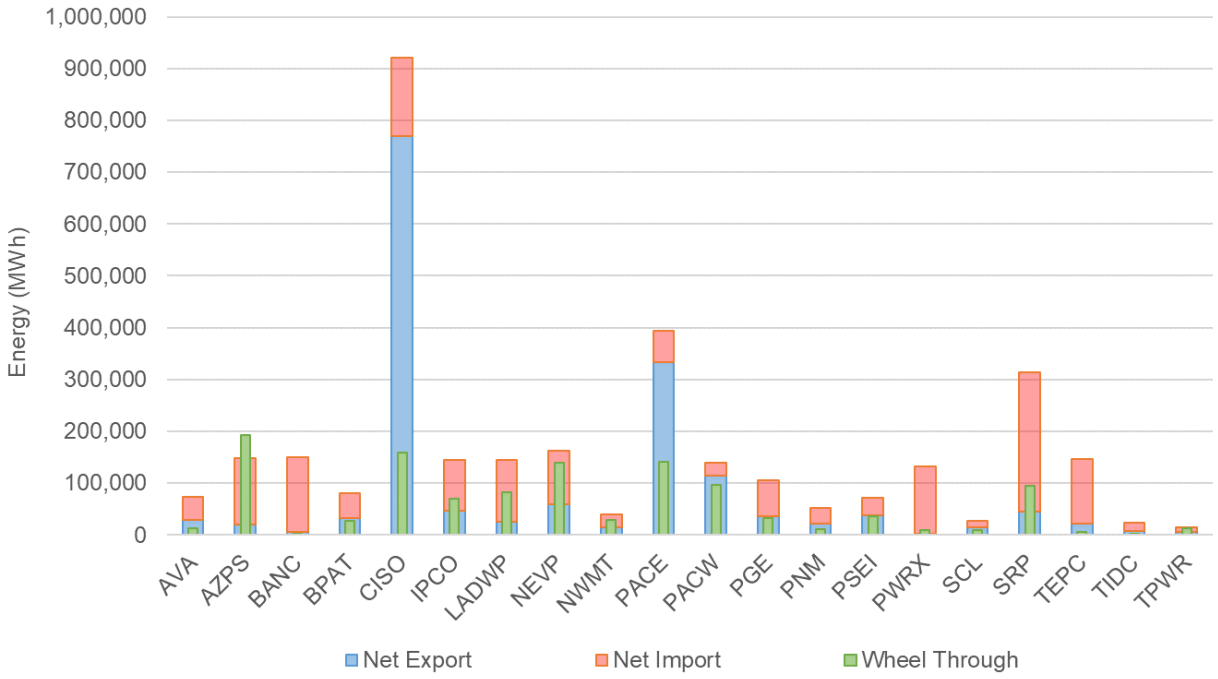


GRAPH 3: Estimated wheel-through transfers in Q1 2022

BAA	Net Export	Net Import	Wheel Through
AVA	22,848	54,990	15,462
AZPS	30,459	110,147	163,004

BANC	3,272	100,837	137
CISO	494,339	255,490	102,212
IPCO	46,954	57,693	88,700
LADWP	41,281	98,879	82,243
NEVP	55,128	82,111	84,004
NWMT	17,552	15,316	22,431
PACE	294,558	27,639	79,755
PACW	72,220	53,570	111,828
PGE	41,277	49,303	16,987
PNM	52,128	14,956	1,436
PSEI	29,559	49,335	31,492
PWRX	10,937	47,051	10,312
SCL	13,337	16,984	7,077
SRP	45,994	238,211	2,708
TIDC	12,011	12,809	147
TPWR	8,702	7,234	8,205

TABLE 4: Estimated wheel-through transfers in April 2022

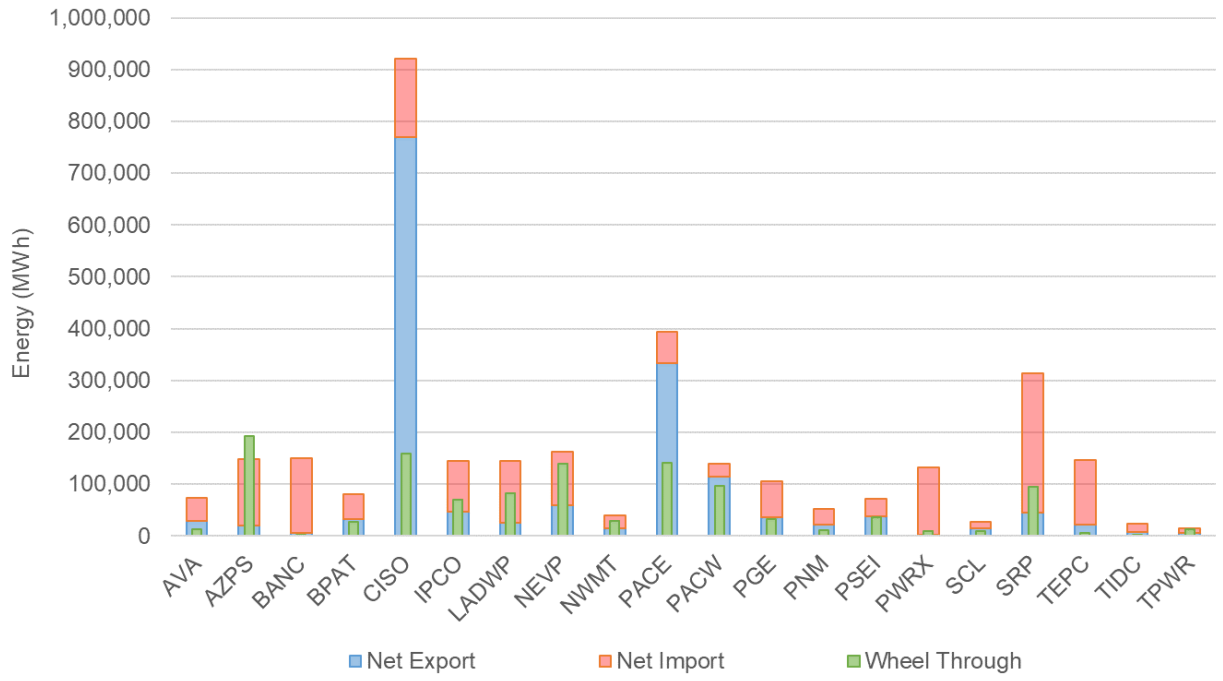


GRAPH 4: Estimated wheel-through transfers in April 2022

BAA	Net Export	Net Import	Wheel Through
AVA	29,449	44,558	13,391
AZPS	20,765	128,333	192,081
BANC	6,170	143,248	1,180
BPAT	32,468	48,067	27,379
CISO	769,360	151,522	159,118
IPCO	47,285	97,739	70,512
LADWP	25,667	118,873	82,789
NEVP	59,358	103,585	138,445
NWMT	13,868	25,684	28,454
PACE	332,732	60,441	140,277
PACW	114,734	24,756	95,945
PGE	36,218	68,781	33,058

PNM	21,064	30,427	11,916
PSEI	37,049	35,461	35,640
PWRX	2,802	130,251	9,266
SCL	14,237	12,194	8,916
SRP	45,112	269,052	94,156
TEPC	22,104	123,726	4,955
TIDC	6,752	16,343	135
TPWR	5,415	9,570	12,541

TABLE 5: Estimated wheel-through transfers in May 2022

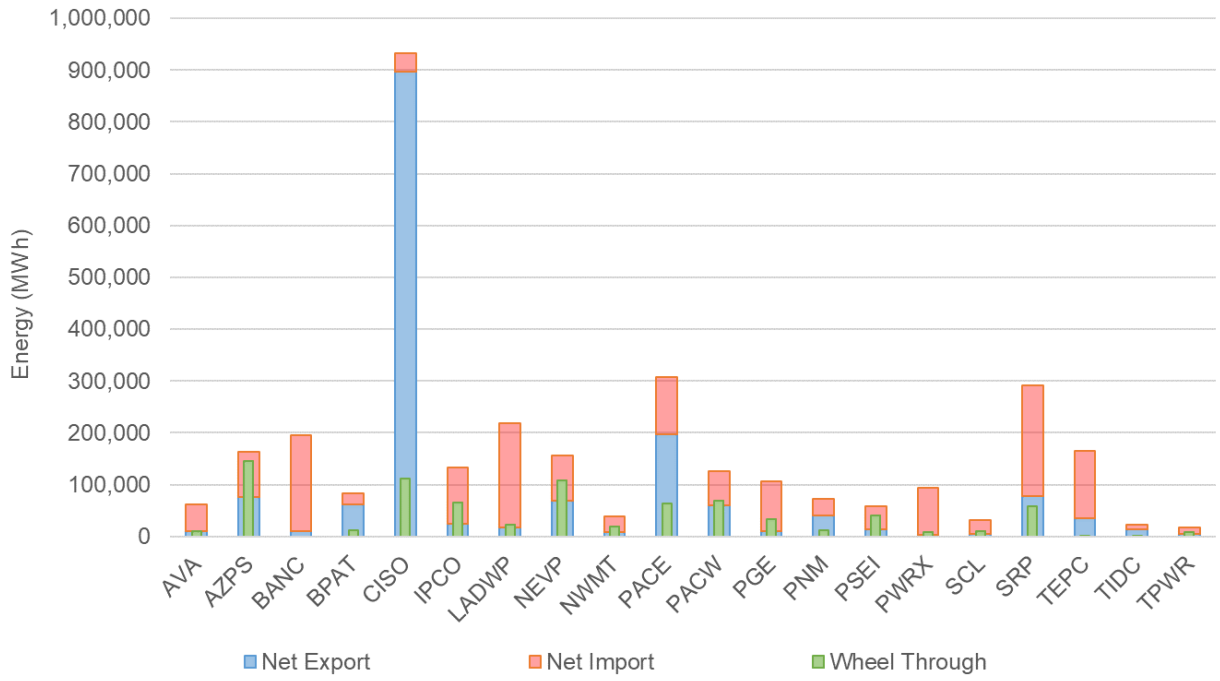


GRAPH 5: Estimated wheel-through transfers in May 2022

BAA	Net Export	Net Import	Wheel Through
AVA	10,269	52,249	10,968

AZPS	76,036	87,001	145,473
BANC	9,886	186,320	-
BPAT	61,283	22,373	12,192
CISO	897,170	34,529	111,033
IPCO	24,257	108,136	64,817
LADWP	17,394	200,681	23,689
NEVP	68,899	87,414	108,608
NWMT	8,944	30,478	18,743
PACE	197,378	110,546	63,991
PACW	61,100	64,525	69,685
PGE	10,660	96,220	32,669
PNM	40,739	31,545	12,741
PSEI	13,085	45,791	40,812
PWRX	2,992	90,351	9,389
SCL	4,846	26,468	9,964
SRP	78,761	213,086	58,569
TEPC	35,975	129,669	567
TIDC	13,745	9,460	300
TPWR	5,806	12,383	9,072

TABLE 6: Estimated wheel-through transfers in June 2022



GRAPH 6: Estimated wheel-through transfers in June 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 Q2 2022 was calculated to be 31,330 MWh (April) + 41,764 MWh (May) + 45,259 MWh (June) = 118,352 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_2/MWh, avoided curtailments displaced an estimated 50,655 metric tons of CO_2 for Q2 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 CO_2, 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
Total		1,782,720	762,925

TABLE 7: Total reduction in curtailment of renewable energy and associated reductions in CO_2

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
April	*AVA*	up	21	91
	AZPS	up	30	286
	BANC	up	7	113
	CISO	up	367	2,072
	IPCO	up	34	159
	LADWP	up	59	315
	NEVP	up	26	332
	NWMT	up	36	118
	PACE	up	116	516
	PACW	up	45	190
	PGE	up	33	177
	PNM	up	40	177
	PSEI	up	39	203
	PWRX	up	77	319
	SCL	up	5	45
	SRP	up	32	152
April	*TIDC*	up	2	14
	TPWR	up	3	29
	ALL EIM	**up**	**471**	**2,759**
	AVA	down	22	87
	AZPS	down	38	229
	BANC	down	5	88
	CISO	down	148	1,682
	IPCO	down	36	223

	LADWP	down	45	279
	NEVP	down	16	395
	NWMT	down	31	135
	PACE	down	116	470
	PACW	down	60	186
	PGE	down	62	219
	PNM	down	49	163
	PSEI	down	27	174
	PWRX	down	76	314
	SCL	down	3	38
	SRP	down	17	160
	TIDC	down	1	19
	TPWR	down	4	34
	ALL EIM	**down**	**326**	**2,122**
	AVA	up	21	84
May	*AZPS*	up	33	286
	BANC	up	7	113
	BPAT	up	85	236
	CISO	up	363	2,072
	IPCO	up	38	159
	LADWP	up	66	315
	NEVP	up	0	332
	NWMT	up	36	129
May	*PACE*	up	118	516
	PACW	up	49	190
	PGE	up	51	277
	PNM	up	40	149
	PSEI	up	41	203
	PWRX	up	71	319
	SCL	up	5	45
	SRP	up	25	169

	TEPC	up	37	135
	TIDC	up	0	14
	TPWR	up	4	25
	ALL WEIM	**up**	**359**	**2,759**
	AVA	down	33	84
	AZPS	down	38	229
	BANC	down	3	88
	BPAT	down	139	385
	CISO	down	142	1,682
	IPCO	down	61	223
	LADWP	down	51	279
	NEVP	down	0	395
	NWMT	down	38	135
	PACE	down	116	470
May	*PACW*	down	55	221
	PGE	down	55	219
	PNM	down	40	163
	PSEI	down	36	174
	PWRX	down	59	314
	SCL	down	2	37
	SRP	down	15	143
	TEPC	down	33	149
	TIDC	down	1	19
	TPWR	down	3	19
	ALL EIM	**down**	**337**	**2,122**
June	*AVA*	up	17	84
	AZPS	up	40	286
	BANC	up	7	113
	BPAT	up	64	407
	CISO	up	363	1,967
	IPCO	up	41	159

	LADWP	up	66	315
	NEVP	up	0	332
	NWMT	up	24	128
	PACE	up	135	516
	PACW	up	47	200
	PGE	up	48	177
	PNM	up	34	179
	PSEI	up	40	203
	PWRX	up	71	225
	SCL	up	5	45
	SRP	up	30	169
	TEPC	up	42	135
	TIDC	up	0	15
	TPWR	up	4	26
	ALL WEIM	**up**	**358**	**2,560**
	AVA	down	23	84
June	*AZPS*	down	39	229
	BANC	down	3	88
	BPAT	down	139	402
	CISO	down	149	1,682
	IPCO	down	63	223
	LADWP	down	56	279
	NEVP	down	0	327
June	*NWMT*	down	30	156
	PACE	down	129	470
	PACW	down	57	221
	PGE	down	65	219
	PNM	down	45	163
	PSEI	down	33	174
	PWRX	down	67	239
	SCL	down	2	34

	SRP	down	22	159
	TEPC	down	26	134
	TIDC	down	1	19
	TPWR	down	2	24
	ALL WEIM	**down**	**342**	**2,122**

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.

	April		**May**		**June**	
Direction	Up	Down	Up	Down	Up	Down
Average MW saving	1,387	1,397	1,676	1,428	1,747	1,504
Sum of BAA requirements	2,708	2,472	3,010	2,945	3,056	2,880
Percentage savings	51%	57%	56%	48%	57%	52%

Table 9: Flexible ramping procurement diversity savings in Q2 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 762,925 metric tons of CO_2, roughly the equivalent of avoiding the emissions from 160,402 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

Western Energy Imbalance Market Benefits

Third Quarter 2022

October 31, 2022

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EXECUTIVE SUMMARY

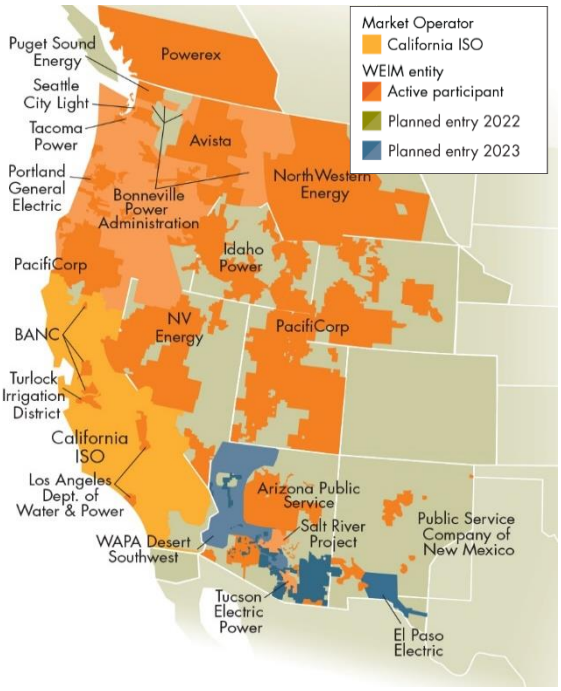
Gross benefits from WEIM since November 2014

$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.



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

2022 Q3 BENEFITS

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 CO_2** 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 month[1]. 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 quarter[2]. 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.

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

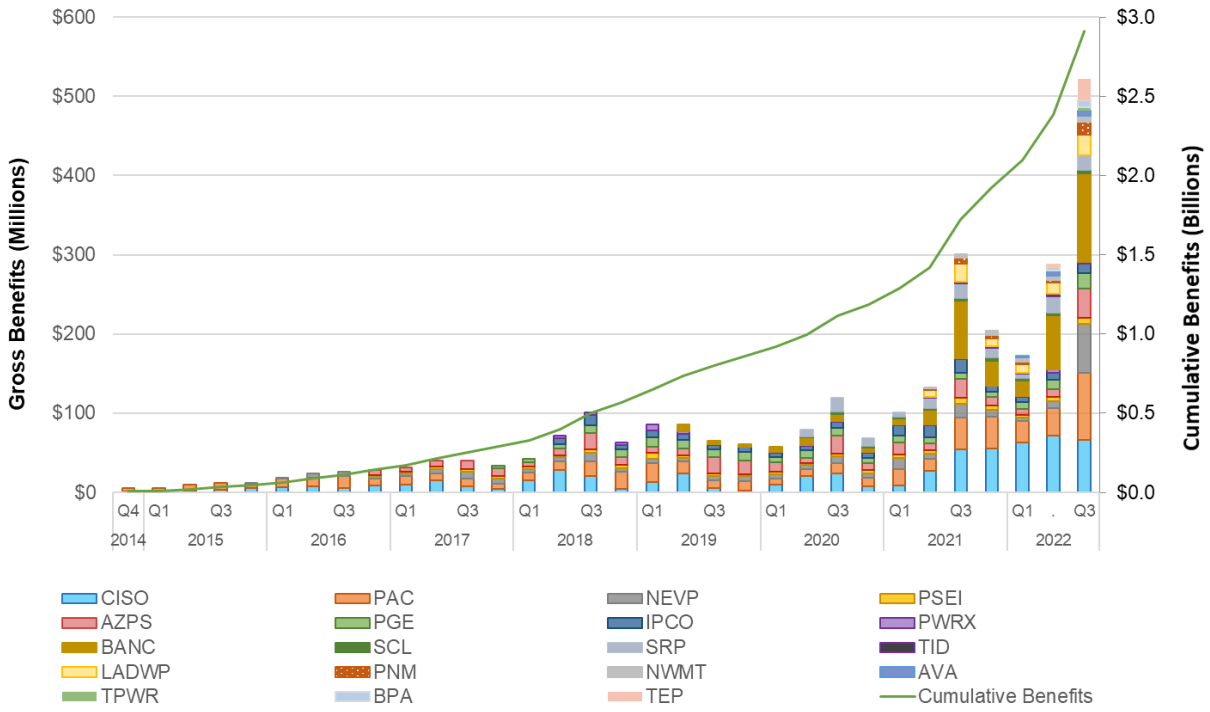
TABLE 1: Q3 2022 benefits in millions USD

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)
	AVA	BPAT	4,287	2,169
July	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
	AZPS	CISO	111,143	63,693
	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
July	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
July	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
PACE	SRP	0	0

July

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
PSEI	SCL	9,600	8,216

July

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

August	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
August	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
August	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
PACW	IPCO	15,977	9,724

August

	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
August	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
September	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

	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
September	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

	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
September	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
September	NEVP	CISO	305,456	228,955

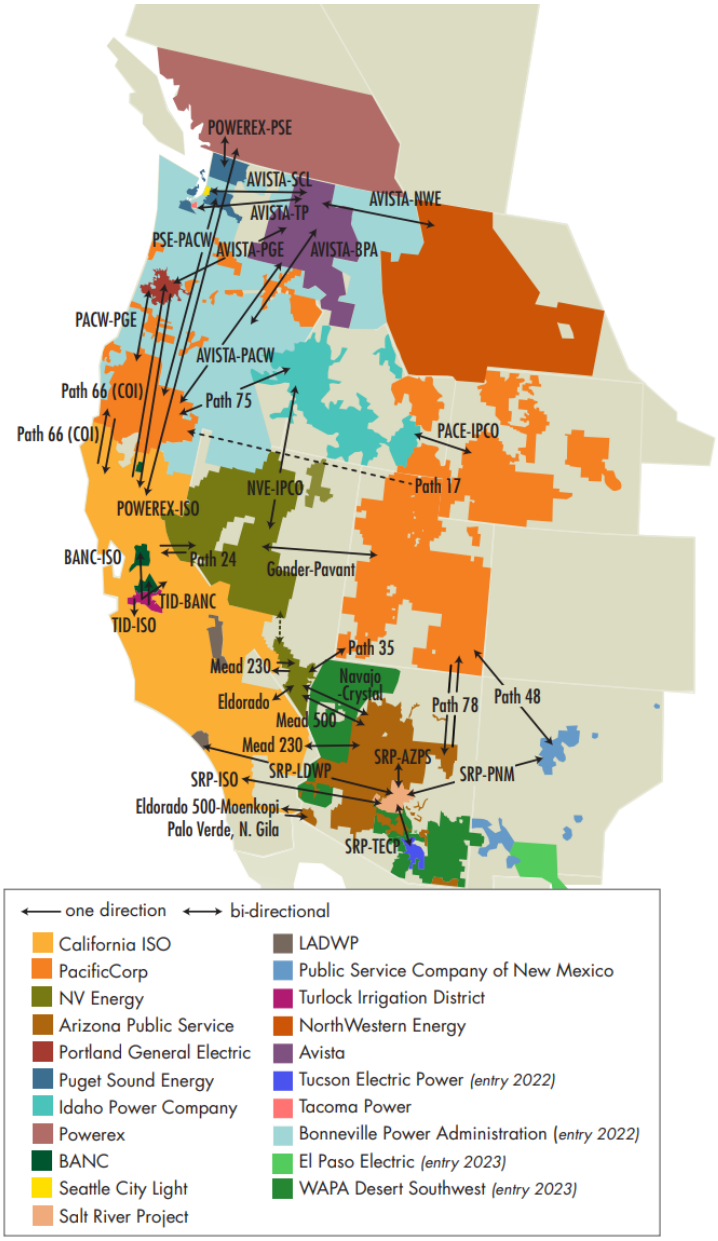
	NEVP	IPCO	26,060	24,227
	NEVP	LADWP	43,986	51,704
	NEVP	PACE	5,765	6,771
	NWMT	AVA	40,759	41,672
	NWMT	BPAT	13,608	10,591
	NWMT	IPCO	10,801	10,932
	NWMT	PACE	5,765	2,340
	NWMT	PACW	74	0
	NWMT	PGE	84	0
	NWMT	PSEI	82	0
	NWMT	TPWR	0	0
	PACE	AZPS	141,534	127,193
	PACE	IPCO	148,341	151,578
	PACE	LADWP	116,789	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
September	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
SCL	PSEI	10,624	14,678

September

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.

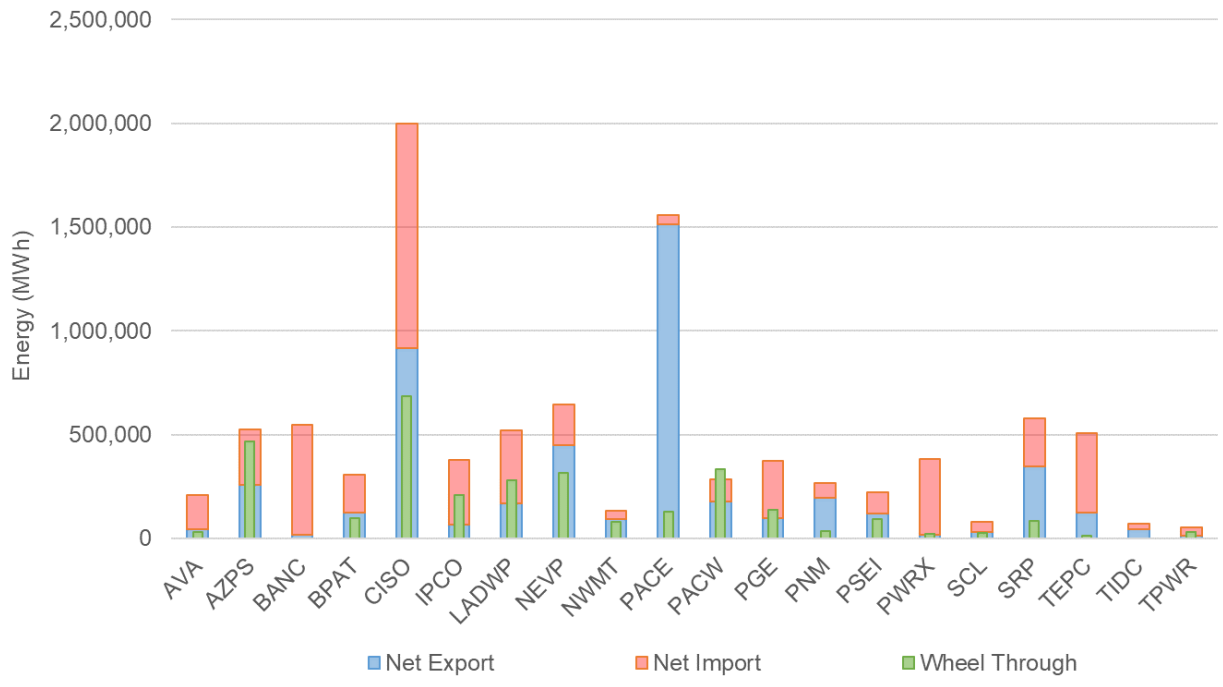
This volume reflects the total wheel-through transfers for each WEIM BAA, regardless of the potential paths used to wheel through. The net imports and exports estimated in this section reflect the overall volume of net imports and exports; in contrast, the imports and exports provided in Table 2 reflect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



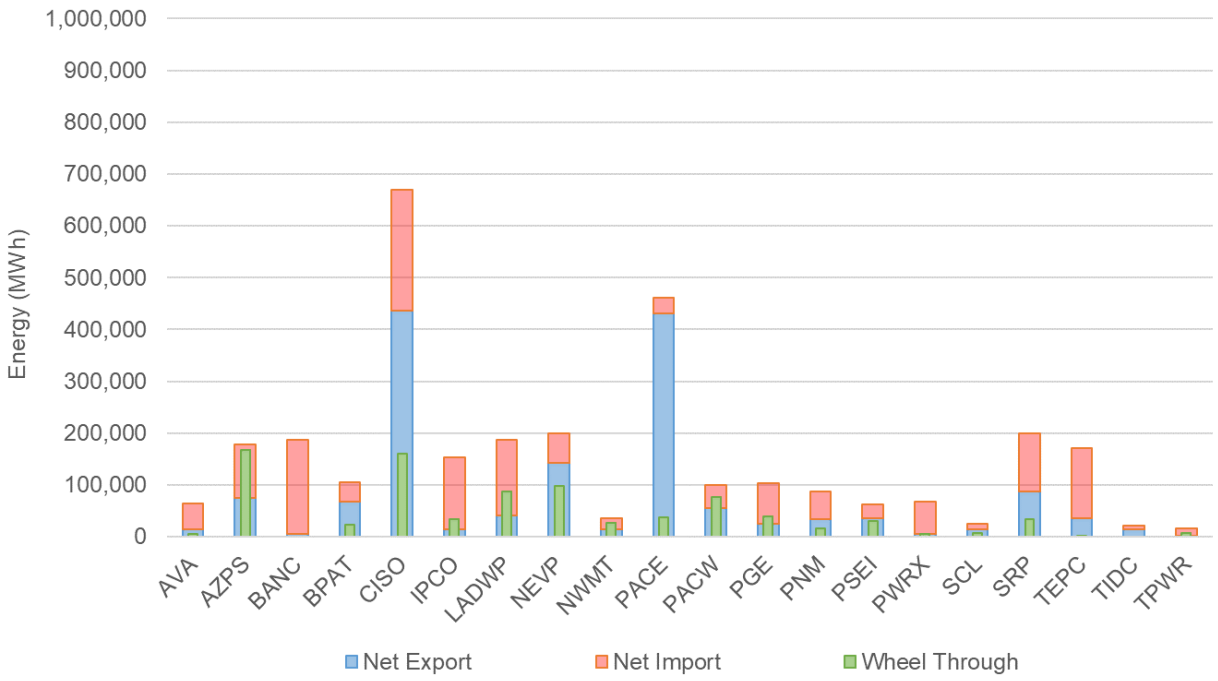
GRAPH 3: Estimated wheel-through transfers in Q3 2022

BAA	Net Export	Net Import	Wheel Through
AVA	22,848	54,990	15,462
AZPS	30,459	110,147	163,004
BANC	3,272	100,837	137
CISO	494,339	255,490	102,212
IPCO	46,954	57,693	88,700
LADWP	41,281	98,879	82,243
NEVP	55,128	82,111	84,004
NWMT	17,552	15,316	22,431
PACE	294,558	27,639	79,755
PACW	72,220	53,570	111,828
PGE	41,277	49,303	16,987
PNM	52,128	14,956	1,436
PSEI	29,559	49,335	31,492
PWRX	10,937	47,051	10,312
SCL	13,337	16,984	7,077
SRP	45,994	238,211	2,708
TIDC	12,011	12,809	147
TPWR	8,702	7,234	8,205

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

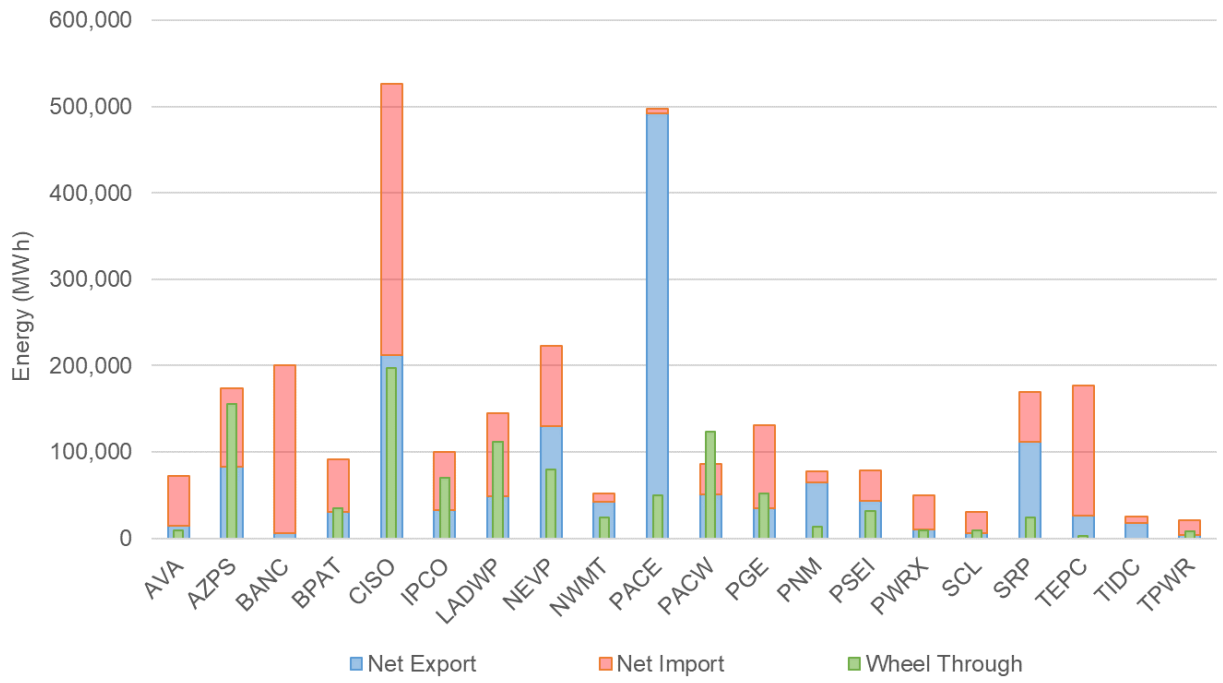


GRAPH 4: Estimated wheel-through transfers in July 2022

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

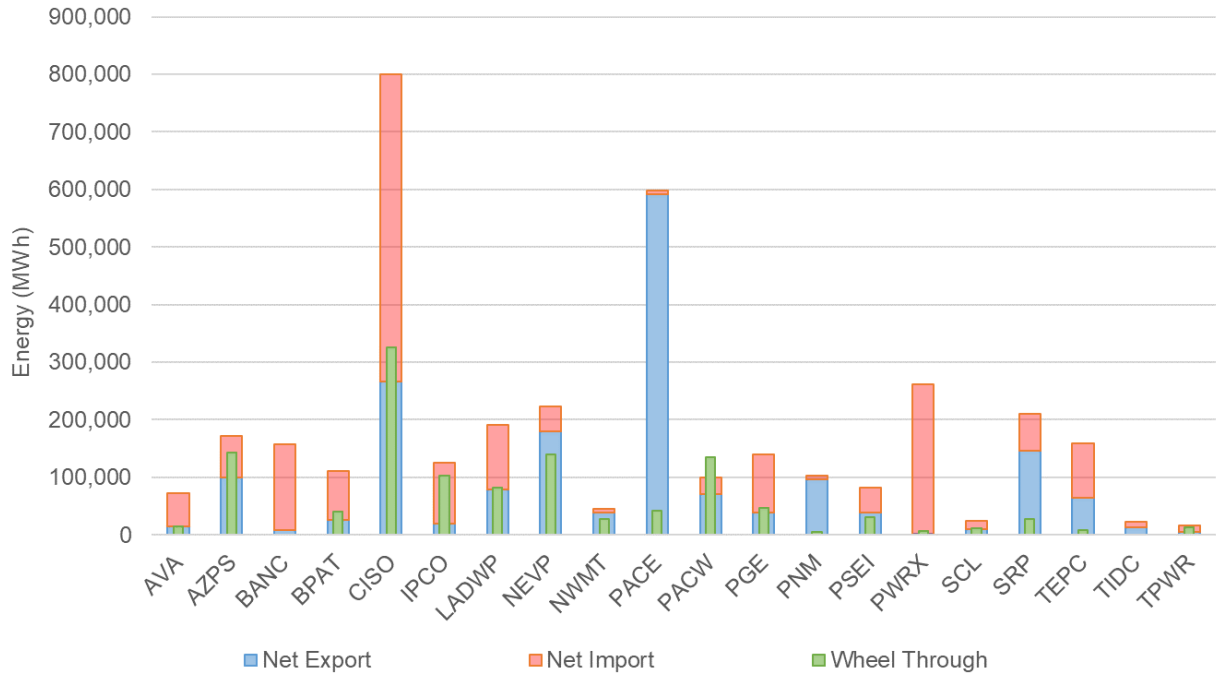


GRAPH 5: Estimated wheel-through transfers in August 2022

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 CO_2/MWh, avoided curtailments displaced an estimated 18,176 metric tons of CO_2 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 CO_2, 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 CO_2

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

July	*AZPS*	down	30	390
	BANC	down	2	154
	BPAT	down	138	402
	CISO	down	108	1,322
	IPCO	down	52	301
	LADWP	down	59	289
	NEVP	down	50	360
	NWMT	down	44	171
	PACE	down	111	652
	PACW	down	59	208
	PGE	down	55	286
	PNM	down	37	182
	PSEI	down	31	198
	PWRX	down	67	246
	SCL	down	1	28
	SRP	down	37	175
	TEPC	down	30	110
	TIDC	down	2	23
	TPWR	down	3	24
	ALL EIM	**down**	**370**	**1,852**
August	*AVA*	up	16	65
	AZPS	up	46	344
	BANC	up	10	82
	BPAT	up	109	460
	CISO	up	355	2,608
	IPCO	up	60	216
	LADWP	up	47	415
	NEVP	up	63	423
	NWMT	up	19	111
	PACE	up	132	592
	PACW	up	42	186

	PGE	up	60	223
	PNM	up	40	200
	PSEI	up	28	161
	PWRX	up	61	223
August	*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	*PACW*	down	33	160
	PGE	down	38	185
	PNM	down	38	229
	PSEI	down	26	213
	PWRX	down	57	307
	SCL	down	2	26
	SRP	down	25	544
	TEPC	down	37	215
	TIDC	down	3	32
	TPWR	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.

	July		**August**		**September**	
Direction	Up	Down	Up	Down	Up	Down
Average MW saving	1,909	1,912	1,886	1,917	1,708	1,928
Sum of BAA requirements	3,336	2,877	3,356	2,954	3,175	2,934
Percentage savings	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 CO_2, 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

Western Energy Imbalance Market Benefits

Fourth Quarter 2022

January 30, 2023

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EXECUTIVE SUMMARY

Gross benefits from WEIM since November 2014

$3.40 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.

Q4 2022 Gross Benefits by Participant

	(millions $)
Arizona Public Service	$34.87
Avista	$9.73
BANC	$83.44
BPA	$12.96
California ISO	$88.53
Idaho Power	$17.18
LADWP	$25.17
NV Energy	$42.33
NorthWestern Energy	$12.95
PacifiCorp	$53.87
Portland General Electric	$21.11
PNM	$11.55
Puget Sound Energy	$14.81
Powerex	$3.45
Seattle City Light	$4.71
Salt River Project	$31.04
Tacoma Power	$4.07
TEP	$11.21
TID	$2.31
Total	$485.29

2022 Q4 BENEFITS

ECONOMICAL

$485.29 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

10,960

Metric tons of CO_2** avoided curtailments

OPERATIONAL

58%

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 Q4 2022

Table 1 shows the estimated WEIM gross benefits by each region per month[1]. The monthly savings presented show $99.25 million for October, $129.34 million for November, and $256.70 million for December with a total estimated benefit of $485.29 million for this quarter[2]. 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.

Region	October	November	December	Total
APS	$4.68	$3.32	$26.87	$34.87
AVA	$1.60	$2.43	$5.70	$9.73
BANC	$13.91	$24.57	$44.96	$83.44
BPA	$2.15	$2.24	$8.57	$12.96
CISO	$26.39	$40.63	$21.51	$88.53
IPCO	$3.92	$4.00	$9.26	$17.18
LADWP	$3.72	$6.74	$14.71	$25.17
NVE	$7.38	$9.69	$25.26	$42.33
NWMT	$2.83	$1.68	$8.44	$12.95
PAC	$12.40	$10.85	$30.62	$53.87
PGE	$3.73	$4.67	$12.71	$21.11
PNM	$2.19	$2.50	$6.86	$11.55
PSE	$2.11	$2.60	$10.10	$14.81
PWRX	$0.52	$0.18	$2.75	$3.45
SCL	$0.97	$1.07	$2.67	$4.71
SRP	$6.63	$8.51	$15.90	$31.04
TPWR	$0.59	$0.95	$2.53	$4.07
TEP	$3.01	$1.90	$6.30	$11.21
TID	$0.52	$0.81	$0.98	$2.31
Total	$99.25	$129.34	$256.70	$485.29

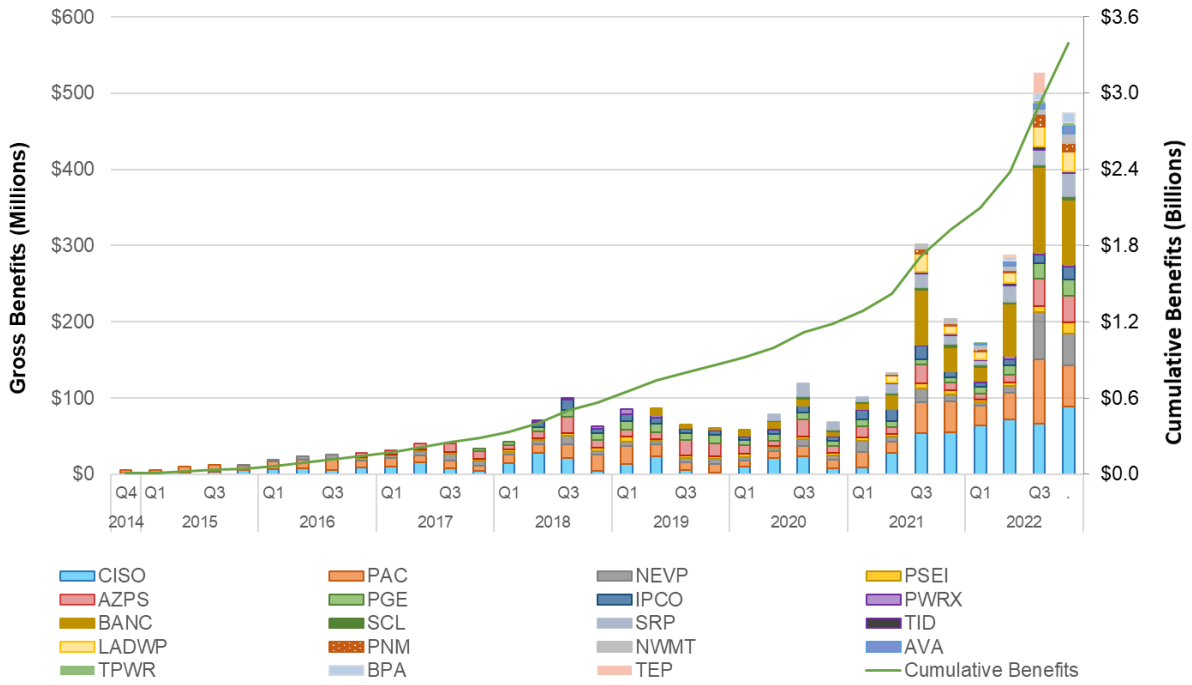
TABLE 1: Q4 2022 benefits in millions USD

CUMULATIVE ECONOMIC BENEFITS SINCE INCEPTION

Since the start of the WEIM in November 2014, the cumulative economic benefits of the market have totaled $3.40 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)
October	AVA	BPAT	15,158	12,587
	AVA	CISO	0	0
	AVA	IPCO	26,459	30,539
	AVA	NWMT	1,270	1,446
	AVA	PACW	1,320	1,715
	AVA	PGE	0	0
	AVA	PSEI	48	0
	AVA	SCL	3	0
	AVA	TPWR	0	0
	AZPS	CISO	192,466	157,183
	AZPS	LADWP	21,821	24,761
	AZPS	NEVP	4,788	7,232
	AZPS	PACE	18,644	12,065
	AZPS	PNM	7,838	11,773
	AZPS	SRP	6,054	4,026
	AZPS	TEPC	14,440	16,207
	BANC	BPAT	0	0
	BANC	CISO	975	2,168
	BANC	TIDC	32	0
	BPAT	AVA	7,866	9,835
	BPAT	BANC	0	0
	BPAT	CISO	22,265	28,438
	BPAT	IPCO	1,871	0

October	BPAT	LADWP	0	0
	BPAT	NEVP	0	0
	BPAT	NWMT	5,158	3,882
	BPAT	PACW	1,618	2,544
	BPAT	PGE	18,376	19,890
	BPAT	PSEI	15,371	13,882
	BPAT	PWRX	3,154	116
	BPAT	SCL	2,308	2,148
	BPAT	TPWR	7,834	8,742
	CISO	AVA	0	0
	CISO	AZPS	10,968	10,765
	CISO	BANC	176,979	181,497
	CISO	BPAT	29,414	37,685
	CISO	LADWP	32,588	41,322
	CISO	NEVP	7,163	9,378
	CISO	PACW	3,856	23,974
	CISO	PGE	19,121	32,229
	CISO	PWRX	182,958	202,784
	CISO	SRP	39,021	47,568
	CISO	TEPC	0	50
	CISO	TIDC	2,904	3,495
	IPCO	AVA	18,149	15,602
	IPCO	BPAT	1,447	24
	IPCO	NEVP	17,199	15,814
	IPCO	NWMT	129	329
	IPCO	PACE	3,919	2,623
	IPCO	PACW	19,330	16,217
October	IPCO	PSEI	0	0

	IPCO	SCL	3,050	2,414
October	LADWP	AZPS	1,020	783
	LADWP	BPAT	0	0
	LADWP	CISO	72,253	60,516
	LADWP	NEVP	13,252	14,137
	LADWP	PACE	36,626	40,015
	LADWP	TEPC	0	0
	NEVP	AZPS	2,331	2,585
	NEVP	BPAT	0	0
	NEVP	CISO	151,640	113,102
	NEVP	IPCO	80,489	71,536
	NEVP	LADWP	51,010	56,748
	NEVP	PACE	9,150	5,830
	NWMT	AVA	17,794	16,950
	NWMT	BPAT	16,143	11,477
	NWMT	IPCO	26,879	29,525
	NWMT	PACE	10,900	6,778
	NWMT	PACW	46	0
	NWMT	PGE	2	0
	NWMT	PSEI	0	0
	NWMT	TPWR	1,668	1,410
	PACE	AZPS	60,262	64,728
	PACE	IPCO	116,013	124,712
	PACE	LADWP	38,487	33,775
	PACE	NEVP	58,737	55,391
	PACE	NWMT	12,863	10,755
	PACE	PACW	29,618	25,279
October	PACE	SRP	0	0

	PACE	TEPC	702	2,084
October	PACW	AVA	2,440	2,992
	PACW	BPAT	6,910	6,058
	PACW	CISO	41,606	59,413
	PACW	IPCO	15,321	19,077
	PACW	NWMT	0	0
	PACW	PGE	38,473	33,653
	PACW	PSEI	23,217	20,909
	PACW	SCL	1,460	1,189
	PGE	AVA	0	0
	PGE	BPAT	40,539	38,923
	PGE	CISO	18,375	16,560
	PGE	NWMT	0	0
	PGE	PACW	19,409	31,612
	PGE	PSEI	0	0
	PGE	SCL	1,402	1,059
	PGE	TPWR	1,834	1,837
	PNM	AZPS	50,316	42,351
	PNM	SRP	1,609	1,431
	PNM	TEPC	24,024	22,571
	PSEI	AVA	0	0
	PSEI	BPAT	14,148	19,217
	PSEI	IPCO	0	0
	PSEI	NWMT	2	0
	PSEI	PACW	0	0
	PSEI	PGE	0	0
	PSEI	PWRX	18,178	18,857
October	PSEI	SCL	8,355	7,596

	PSEI	TPWR	6,452	11,381
October	PWRX	BPAT	3,299	218
	PWRX	CISO	0	0
	PWRX	PSEI	8,918	10,556
	SCL	AVA	0	0
	SCL	BPAT	1,138	2,710
	SCL	IPCO	1,775	2,887
	SCL	PACW	669	1,147
	SCL	PGE	831	1,382
	SCL	PSEI	5,400	10,023
	SRP	AZPS	7,000	8,635
	SRP	CISO	169,609	159,863
	SRP	PACE	0	0
	SRP	PNM	92	189
	SRP	TEPC	31,310	38,448
	TEPC	AZPS	649	0
	TEPC	CISO	46,986	42,114
	TEPC	LADWP	0	0
	TEPC	PACE	7	27
	TEPC	PNM	5,722	5,558
	TEPC	SRP	2,796	2,212
	TIDC	BANC	36	0
	TIDC	CISO	19,733	18,321
	TPWR	AVA	0	0
	TPWR	BPAT	8,764	12,810
	TPWR	NWMT	670	1,113
	TPWR	PGE	607	1,156
	TPWR	PSEI	10,490	9,840

November	AVA	BPAT	9,872	9,792
	AVA	CISO	0	0
	AVA	IPCO	27,850	24,185
	AVA	NWMT	5,106	5,780
	AVA	PACW	2,175	2,744
	AVA	PGE	48	0
	AVA	PSEI	0	0
	AVA	SCL	0	0
	AVA	TPWR	0	0
	AZPS	CISO	169,811	123,910
	AZPS	LADWP	17,593	13,016
	AZPS	NEVP	9,297	11,454
	AZPS	PACE	25,509	23,635
	AZPS	PNM	18,378	24,773
	AZPS	SRP	5,415	4,088
	AZPS	TEPC	3,491	3,962
	BANC	BPAT	0	0
	BANC	CISO	405	233
	BANC	TIDC	25	0
	BPAT	AVA	8,159	6,366
	BPAT	BANC	0	0
	BPAT	CISO	9,885	16,776
	BPAT	IPCO	2,127	0
	BPAT	LADWP	0	0
	BPAT	NEVP	0	0
	BPAT	NWMT	9,659	4,329
	BPAT	PACW	4,465	5,948
November	BPAT	PGE	22,607	20,730

	BPAT	PSEI	13,237	13,088
November	BPAT	PWRX	4,764	0
	BPAT	SCL	2,841	2,101
	BPAT	TPWR	11,212	12,518
	CISO	AVA	0	0
	CISO	AZPS	17,159	20,078
	CISO	BANC	234,883	238,370
	CISO	BPAT	18,391	24,670
	CISO	LADWP	22,495	26,855
	CISO	NEVP	17,012	20,969
	CISO	PACW	18,738	38,561
	CISO	PGE	22,570	37,719
	CISO	PWRX	116,263	128,587
	CISO	SRP	26,378	33,224
	CISO	TEPC	0	0
	CISO	TIDC	3,407	3,462
	IPCO	AVA	14,643	14,186
	IPCO	BPAT	1,816	0
	IPCO	NEVP	38,862	22,356
	IPCO	NWMT	534	1,004
	IPCO	PACE	3,679	2,057
	IPCO	PACW	11,779	17,466
	IPCO	PSEI	0	0
	IPCO	SCL	5,841	5,584
	LADWP	AZPS	1,470	1,894
	LADWP	BPAT	0	0
	LADWP	CISO	101,230	92,703
November	LADWP	NEVP	15,365	19,462

	LADWP	PACE	20,870	23,045
November	LADWP	TEPC	0	0
	NEVP	AZPS	1,685	3,980
	NEVP	BPAT	0	0
	NEVP	CISO	172,364	121,695
	NEVP	IPCO	39,730	38,318
	NEVP	LADWP	20,804	26,069
	NEVP	PACE	18,659	16,759
	NWMT	AVA	13,472	13,343
	NWMT	BPAT	10,242	6,741
	NWMT	IPCO	13,944	13,045
	NWMT	PACE	12,126	6,640
	NWMT	PACW	5	0
	NWMT	PGE	12	0
	NWMT	PSEI	28	0
	NWMT	TPWR	0	0
	PACE	AZPS	62,929	66,771
	PACE	IPCO	75,414	73,707
	PACE	LADWP	23,204	21,709
	PACE	NEVP	86,307	75,628
	PACE	NWMT	12,517	15,086
	PACE	PACW	24,706	25,635
	PACE	SRP	0	0
	PACE	TEPC	267	770
	PACW	AVA	6,109	6,452
	PACW	BPAT	9,244	6,035
	PACW	CISO	64,046	92,137
November	PACW	IPCO	19,534	23,428

	PACW	NWMT	7	0
November	PACW	PGE	33,945	31,961
	PACW	PSEI	19,253	18,488
	PACW	SCL	1,479	1,248
	PGE	AVA	0	0
	PGE	BPAT	36,874	37,663
	PGE	CISO	44,156	41,706
	PGE	NWMT	22	0
	PGE	PACW	19,603	31,002
	PGE	PSEI	0	0
	PGE	SCL	1,420	1,244
	PGE	TPWR	0	0
	PNM	AZPS	51,866	39,582
	PNM	SRP	1,545	1,342
	PNM	TEPC	15,852	16,442
	PSEI	AVA	7	0
	PSEI	BPAT	15,156	17,988
	PSEI	IPCO	0	0
	PSEI	NWMT	40	0
	PSEI	PACW	13,153	16,071
	PSEI	PGE	0	0
November	PSEI	PWRX	11,824	11,395
	PSEI	SCL	12,130	10,341
	PSEI	TPWR	8,472	11,446
	PWRX	BPAT	5,169	0
	PWRX	CISO	0	0
	PWRX	PSEI	15,870	16,888
	SCL	AVA	0	0

	SCL	BPAT	1,904	2,695
November	SCL	IPCO	4,640	4,581
	SCL	PACW	666	980
	SCL	PGE	805	1,158
	SCL	PSEI	5,586	8,341
	SRP	AZPS	24,218	24,520
	SRP	CISO	178,030	154,174
	SRP	PACE	0	0
	SRP	PNM	1,109	1,248
	SRP	TEPC	22,138	28,468
	TEPC	AZPS	269	0
	TEPC	CISO	24,735	19,095
	TEPC	LADWP	0	0
	TEPC	PACE	54	385
	TEPC	PNM	10,725	10,931
	TEPC	SRP	28,475	22,127
	TIDC	BANC	17	0
	TIDC	CISO	18,516	17,906
	TPWR	AVA	0	0
	TPWR	BPAT	9,018	11,092
	TPWR	NWMT	0	0
	TPWR	PGE	0	0
	TPWR	PSEI	10,053	10,147
December	AVA	BPAT	16,513	16,892
	AVA	CISO	354	361
	AVA	IPCO	20,615	15,885
	AVA	NWMT	8,675	3,211
	AVA	PACW	2,182	1,879

	AVA	PGE	0	0
	AVA	PSEI	50	0
	AVA	SCL	0	0
	AVA	TPWR	0	0
	AZPS	CISO	217,909	187,535
	AZPS	LADWP	40,012	42,673
	AZPS	NEVP	21,042	22,865
	AZPS	PACE	73,138	72,884
	AZPS	PNM	57,843	37,746
	AZPS	SRP	5,860	3,921
December	AZPS	TEPC	7,254	6,300
	BANC	BPAT	0	0
	BANC	CISO	360	295
	BANC	TIDC	33	0
	BPAT	AVA	21,382	14,912
	BPAT	BANC	0	0
	BPAT	CISO	18,784	23,780
	BPAT	IPCO	3,299	297
	BPAT	LADWP	0	0
	BPAT	NEVP	0	0
	BPAT	NWMT	14,272	3,753
	BPAT	PACW	3,807	4,382
	BPAT	PGE	16,120	16,001
	BPAT	PSEI	17,181	15,102
	BPAT	PWRX	6,119	0
	BPAT	SCL	6,427	6,174
	BPAT	TPWR	11,931	12,834
	CISO	AVA	50	49

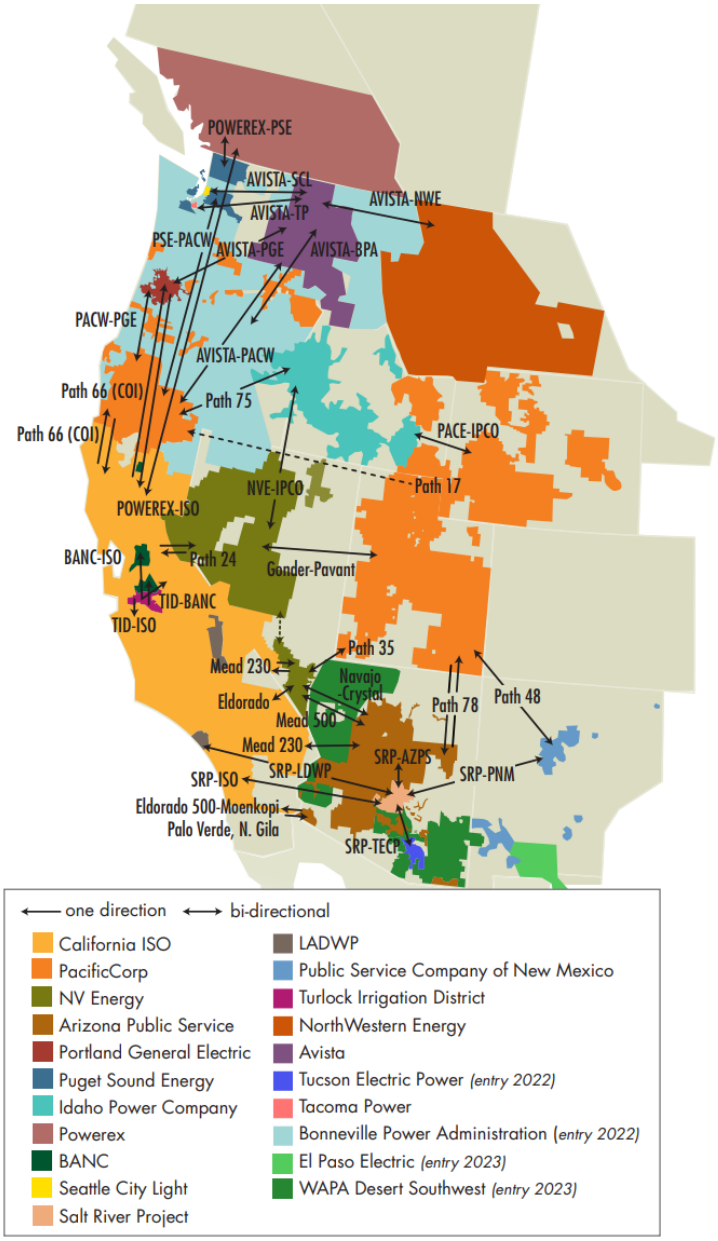
	CISO	AZPS	10,910	13,784
December	CISO	BANC	243,805	245,309
	CISO	BPAT	31,124	38,622
	CISO	LADWP	18,592	22,935
	CISO	NEVP	47,868	49,634
	CISO	PACW	24,801	54,705
	CISO	PGE	35,322	55,003
	CISO	PWRX	67,544	76,385
	CISO	SRP	6,169	10,517
	CISO	TEPC	0	16
December	CISO	TIDC	7,962	7,231
	IPCO	AVA	30,665	30,978
	IPCO	BPAT	713	0
	IPCO	NEVP	34,077	23,009
	IPCO	NWMT	395	1,472
	IPCO	PACE	16,019	6,920
	IPCO	PACW	41,591	27,917
	IPCO	PSEI	0	0
	IPCO	SCL	10,017	9,044
	LADWP	AZPS	6,205	6,437
	LADWP	BPAT	0	0
	LADWP	CISO	86,038	76,740
	LADWP	NEVP	28,959	34,065
	LADWP	PACE	27,482	24,068
	LADWP	TEPC	0	0
	NEVP	AZPS	5,931	7,783
	NEVP	BPAT	0	0
December	NEVP	CISO	126,215	92,655

	NEVP	IPCO	74,249	63,113
December	NEVP	LADWP	16,409	16,169
	NEVP	PACE	32,771	23,723
	NWMT	AVA	29,257	32,584
	NWMT	BPAT	9,227	7,194
	NWMT	IPCO	16,759	16,697
	NWMT	PACE	26,611	9,625
	NWMT	PACW	44	0
	NWMT	PGE	45	0
	NWMT	PSEI	355	0
	NWMT	TPWR	0	0
	PACE	AZPS	34,112	23,767
	PACE	IPCO	60,699	60,112
	PACE	LADWP	21,211	24,983
	PACE	NEVP	86,163	75,891
	PACE	NWMT	12,889	19,264
	PACE	PACW	24,651	24,279
	PACE	SRP	0	0
	PACE	TEPC	573	306
	PACW	AVA	5,636	4,509
	PACW	BPAT	14,823	12,052
	PACW	CISO	46,461	66,361
	PACW	IPCO	20,463	21,587
	PACW	NWMT	3	0
	PACW	PGE	40,592	37,467
	PACW	PSEI	23,009	21,643
	PACW	SCL	1,597	1,456
December	PGE	AVA	0	0

	PGE	BPAT	42,026	42,746
December	PGE	CISO	43,528	41,651
	PGE	NWMT	298	0
	PGE	PACW	12,010	20,839
	PGE	PSEI	0	0
	PGE	SCL	1,605	1,450
	PGE	TPWR	0	0
	PNM	AZPS	63,186	78,499
	PNM	SRP	2,494	2,653
	PNM	TEPC	18,123	20,165
	PSEI	AVA	2	0
	PSEI	BPAT	17,207	17,624
	PSEI	IPCO	0	0
	PSEI	NWMT	132	0
	PSEI	PACW	12,207	14,049
	PSEI	PGE	0	0
	PSEI	PWRX	6,210	6,361
	PSEI	SCL	16,491	16,172
	PSEI	TPWR	5,473	6,745
	PWRX	BPAT	9,262	0
	PWRX	CISO	0	0
	PWRX	PSEI	19,063	19,179
	SCL	AVA	0	0
	SCL	BPAT	2,506	2,789
	SCL	IPCO	4,734	5,644
	SCL	PACW	603	806
	SCL	PGE	792	988
December	SCL	PSEI	6,638	8,276

December	SRP	AZPS	31,010	27,353
	SRP	CISO	112,006	103,851
	SRP	PACE	0	0
	SRP	PNM	3	3
	SRP	TEPC	26,398	26,296
	TEPC	AZPS	416	188
	TEPC	CISO	72,158	68,914
	TEPC	LADWP	547	640
	TEPC	PACE	1,332	887
	TEPC	PNM	18,980	12,548
	TEPC	SRP	8,538	9,468
	TIDC	BANC	122	0
	TIDC	CISO	8,770	8,897
	TPWR	AVA	0	0
	TPWR	BPAT	12,015	13,298
	TPWR	NWMT	0	0
	TPWR	PGE	0	0
	TPWR	PSEI	17,779	17,616

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

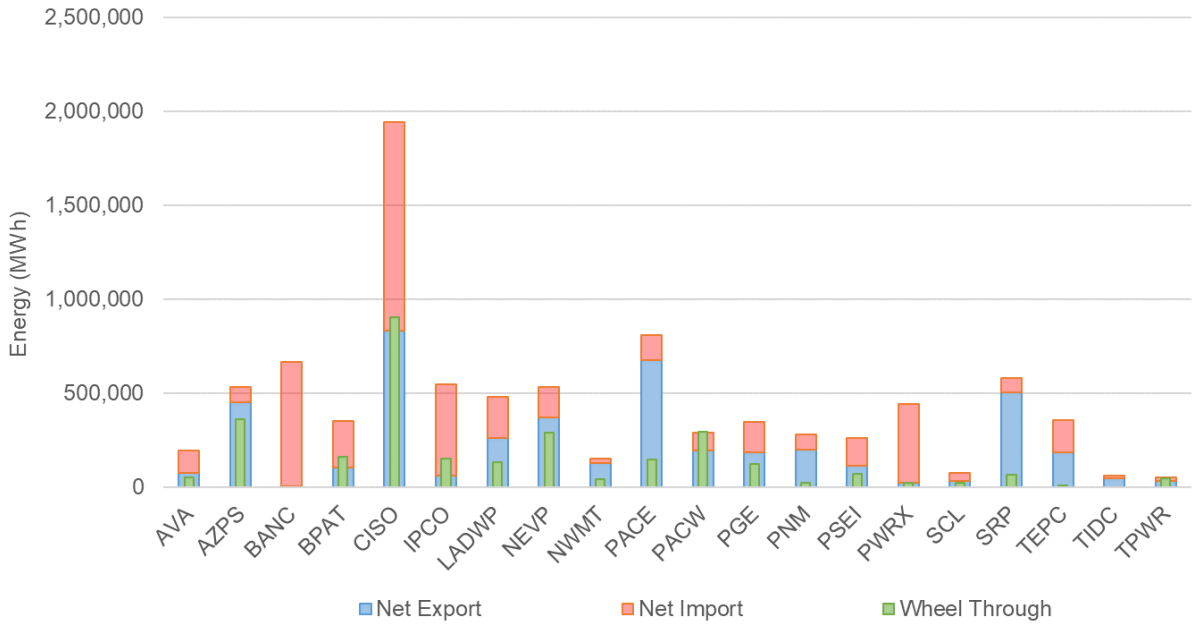
This volume reflects the total wheel-through transfers for each WEIM BAA, regardless of the potential paths used to wheel through. The net imports and exports estimated in this section reflect the overall volume of net imports and exports; in contrast, the imports and exports provided in Table 2 reflect 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	76,406	118,148	50,611
AZPS	450,985	83,461	361,025
BANC	2,697	665,176	-
BPAT	106,572	247,609	161,995
CISO	834,232	1,105,856	903,198
IPCO	61,352	485,208	153,667
LADWP	260,650	218,438	133,216
NEVP	368,747	165,967	291,319
NWMT	127,090	26,505	44,920

PACE	677,683	131,016	146,951
PACW	195,076	96,713	293,040
PGE	183,493	164,535	124,801
PNM	200,941	80,674	24,095
PSEI	115,928	144,662	69,316
PWRX	23,028	420,672	23,813
SCL	31,497	46,312	22,908
SRP	505,405	74,935	67,643
TEPC	183,825	170,815	11,269
TIDC	45,124	14,187	-
TPWR	31,920	21,761	45,153

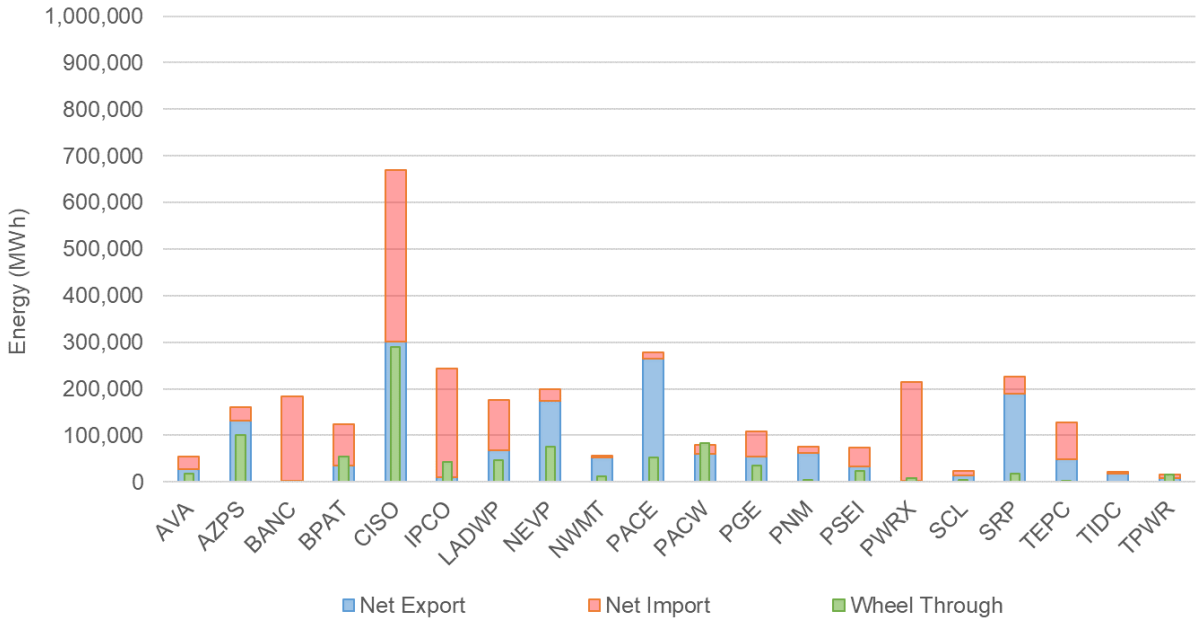
TABLE 3: Estimated wheel-through transfers in Q4 2022



GRAPH 3: Estimated wheel-through transfers in Q4 2022

BAA	Net Export	Net Import	Wheel Through
AVA	28,087	27,179	18,200
AZPS	131,719	28,320	101,527
BANC	2,168	181,497	-
BPAT	35,475	87,708	54,002
CISO	301,772	368,703	288,975
IPCO	9,475	234,727	43,549
LADWP	67,890	109,045	47,561
NEVP	173,265	25,418	76,536
NWMT	52,954	4,340	13,186
PACE	264,269	14,882	52,457
PACW	60,473	19,671	82,818
PGE	54,798	53,116	35,194
PNM	62,616	13,783	3,737
PSEI	32,766	40,925	24,286
PWRX	1,809	212,792	8,965
SCL	13,725	9,984	4,423
SRP	188,884	36,986	18,251
TEPC	48,947	78,396	964
TIDC	18,321	3,495	-
TPWR	8,878	7,329	16,041

TABLE 4: Estimated wheel-through transfers in October 2022

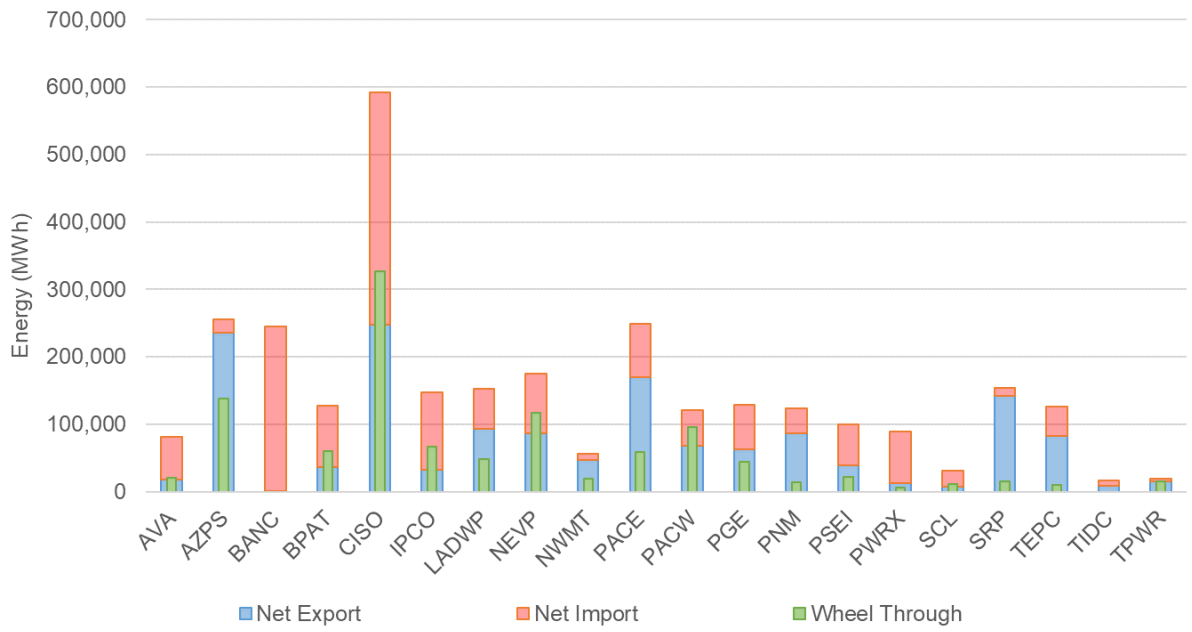


GRAPH 4: Estimated wheel-through transfers in October 2022

BAA	Net Export	Net Import	Wheel Through
AVA	30,282	28,128	12,218
AZPS	83,298	35,284	121,541
BANC	233	238,370	-
BPAT	34,377	69,198	47,478
CISO	284,906	392,748	287,587
IPCO	19,904	134,514	42,749
LADWP	99,728	50,273	37,376
NEVP	109,099	52,146	97,723
NWMT	26,794	13,225	12,974
PACE	243,821	37,035	35,485
PACW	65,859	24,518	113,890
PGE	65,789	45,741	45,827
PNM	51,010	30,596	6,356

PSEI	43,754	43,463	23,488
PWRX	8,116	131,210	8,771
SCL	10,059	12,822	7,696
SRP	173,991	26,363	34,419
TEPC	52,114	49,217	425
TIDC	17,906	3,462	-
TPWR	7,478	10,203	13,761

TABLE 5: Estimated wheel-through transfers in November 2022

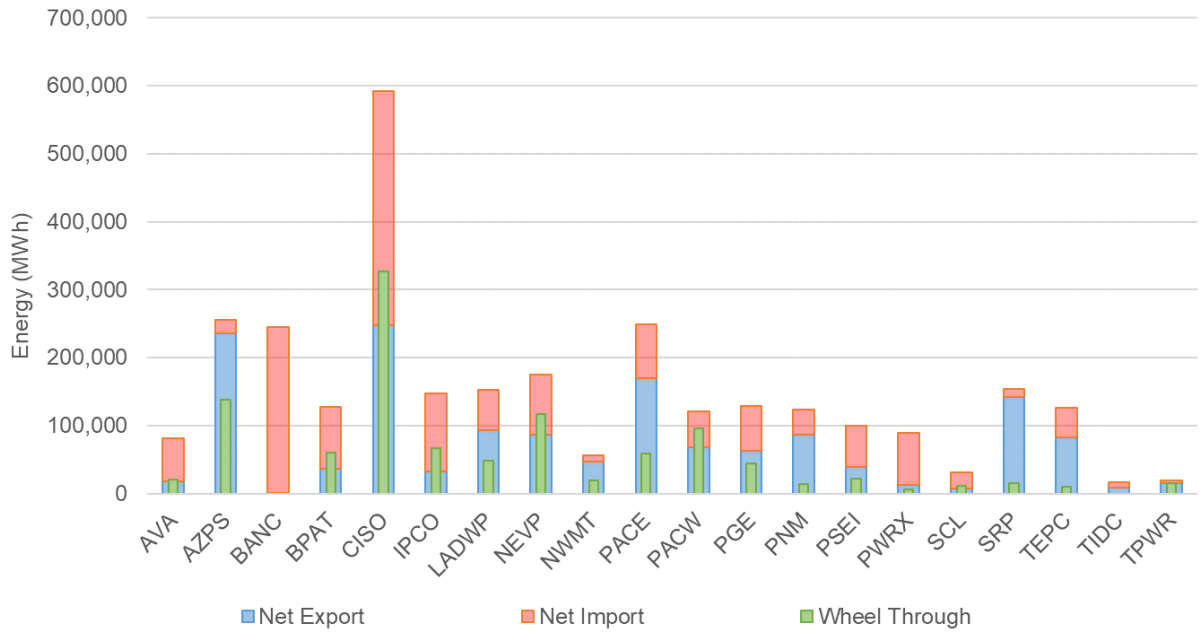


GRAPH 5: Estimated wheel-through transfers in November 2022

BAA	Net Export	Net Import	Wheel Through
AVA	18,037	62,841	20,192

AZPS	235,968	19,857	137,956
BANC	295	245,309	-
BPAT	36,720	90,703	60,515
CISO	247,554	344,404	326,636
IPCO	31,972	115,968	67,369
LADWP	93,031	59,120	48,279
NEVP	86,383	88,403	117,061
NWMT	47,342	8,940	18,759
PACE	169,592	79,098	59,009
PACW	68,744	52,524	96,332
PGE	62,906	65,678	43,781
PNM	87,315	36,295	14,001
PSEI	39,409	60,275	21,541
PWRX	13,102	76,669	6,076
SCL	7,713	23,507	10,790
SRP	142,530	11,586	14,973
TEPC	82,764	43,202	9,881
TIDC	8,897	7,231	-
TPWR	15,564	4,229	15,351

TABLE 6: Estimated wheel-through transfers in December 2022



GRAPH 6: Estimated wheel-through transfers in December 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 Q4 2022 was calculated to be 10,571 MWh (October) + 9,270 MWh (November) + 5,767 MWh (December) = 25,609 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_2/MWh, avoided curtailments displaced an estimated 10,960 metric tons of CO_2 for Q4 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 CO_2, 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
	4	25,609	10,960
Total		1,850,797	792,061

TABLE 7: Total reduction in curtailment of renewable energy and associated reductions in CO_2

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
October	*AVA*	up	0	95
	AZPS	up	0	328
	BANC	up	0	76
	BPAT	up	0	401
	CISO	up	0	2,768
	IPCO	up	0	253
	LADWP	up	0	361
	NEVP	up	0	410
	NWMT	up	0	111
	PACE	up	0	506
	PACW	up	0	123
	PGE	up	0	191
	PNM	up	0	169
	PSEI	up	0	166
	PWRX	up	0	247
	SCL	up	0	41
	SRP	up	0	302
	TEPC	up	0	220
	TIDC	up	0	19
	TPWR	up	0	15
	ALL EIM	**up**	**0**	**2,583**
	AVA	down	0	113

October	*AZPS*	down	0	444
	BANC	down	0	134
	BPAT	down	0	581
	CISO	down	0	1,145
	IPCO	down	0	198
	LADWP	down	0	357
	NEVP	down	0	471
	NWMT	down	0	150
	PACE	down	0	613
	PACW	down	0	157
	PGE	down	0	185
	PNM	down	0	218
	PSEI	down	0	137
	PWRX	down	0	307
	SCL	down	0	26
	SRP	down	0	519
	TEPC	down	0	176
	TIDC	down	0	25
	TPWR	down	0	18
	ALL EIM	**down**	**0**	**1,593**
November	*AVA*	up	15	87
	AZPS	up	48	328
	BANC	up	7	76
	BPAT	up	47	371
	CISO	up	321	2,758
	IPCO	up	29	253
	LADWP	up	41	361
	NEVP	up	24	463
	NWMT	up	4	127
	PACE	up	100	447
	PACW	up	36	178

	PGE	up	35	190
	PNM	up	44	141
	PSEI	up	30	167
	PWRX	up	70	310
November	*SCL*	up	3	30
	SRP	up	27	302
	TEPC	up	43	220
	TIDC	up	2	19
	TPWR	up	2	19
	ALL WEIM	**up**	**491**	**2,684**
	AVA	down	7	103
	AZPS	down	36	369
	BANC	down	4	140
	BPAT	down	72	639
	CISO	down	192	1,250
	IPCO	down	46	198
	LADWP	down	52	285
	NEVP	down	21	471
	NWMT	down	30	126
	PACE	down	176	538
	PACW	down	27	139
	PGE	down	31	230
	PNM	down	38	218
	PSEI	down	32	137
	PWRX	down	79	340
	SCL	down	3	28
	SRP	down	30	344
	TEPC	down	22	167
	TIDC	down	2	25
	TPWR	down	3	24
	ALL EIM	**down**	**308**	**1,989**

December	*AVA*	up	17	81
	AZPS	up	56	300
	BANC	up	8	83
	BPAT	up	54	386
	CISO	up	313	2,337
	IPCO	up	34	189
	LADWP	up	40	393
	NEVP	up	20	463
	NWMT	up	25	127
	PACE	up	115	460
	PACW	up	48	174
	PGE	up	48	200
	PNM	up	44	155
	PSEI	up	39	167
	PWRX	up	85	294
	SCL	up	5	31
	SRP	up	29	280
	TEPC	up	60	220
	TIDC	up	2	19
	TPWR	up	4	19
	ALL WEIM	**up**	**455**	**2,771**
	AVA	down	17	86
	AZPS	down	26	246
	BANC	down	6	82
	BPAT	down	98	639
	CISO	down	153	1,332
	IPCO	down	42	194
	LADWP	down	43	262
	NEVP	down	22	408
	NWMT	down	42	124
	PACE	down	165	501

December	*PACW*	down	27	143
	PGE	down	28	204
	PNM	down	37	141
	PSEI	down	35	153
	PWRX	down	56	345
	SCL	down	5	28
	SRP	down	22	344
	TEPC	down	26	165
	TIDC	down	1	17
	TPWR	down	3	24
	ALL WEIM	**down**	**319**	**2,175**

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.

	October		**November**		**December**	
Direction	Up	Down	Up	Down	Up	Down
Average MW saving	1,517	1,720	1,551	1,603	1,617	1,606
Sum of BAA requirements	2,908	2,657	2,866	2,622	3,056	2,632
Percentage savings	52%	65%	54%	61%	53%	61%

Table 9: Flexible ramping procurement diversity savings in Q4 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 792,061 metric tons of CO_2, roughly the equivalent of avoiding the emissions from 166,527 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

Western Energy Imbalance Market Benefits

Fisrt Quarter 2023

April 27, 2023

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EXECUTIVE SUMMARY

Gross benefits from WEIM since November 2014

$3.86 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.

Q1 2023 Gross Benefits by Participant

	(millions $)
Arizona Public Service	$26.53
Avista	$6.38
BANC	$44.85
BPA	$11.83
California ISO	$67.86
Idaho Power	$13.32
LADWP	$30.84
NV Energy	$47.38
NorthWestern Energy	$12.60
PacifiCorp	$70.31
Portland General Electric	$21.75
PNM	$22.45
Puget Sound Energy	$15.37
Powerex	$16.80
Seattle City Light	$4.21
Salt River Project	$31.39
Tacoma Power	$6.55
TEP	$10.39
TID	$3.01
Total	$463.82

2023 Q1 BENEFITS

ECONOMICAL

$463.82 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

22,685

Metric tons of CO_2** avoided curtailments

OPERATIONAL

50%

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 Q1 2023

Table 1 shows the estimated WEIM gross benefits by each region per month[1]. The monthly savings presented show $188.96 million for January, $127.41 million for February, and $147.45 million for March with a total estimated benefit of $463.82 million for this quarter[2]. 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.

Region	January	February	March	Total
APS	$11.57	$7.26	$7.70	$26.53
AVA	$2.84	$1.65	$1.89	$6.38
BANC	$18.56	$20.88	$5.41	$44.85
BPA	$4.57	$4.20	$3.06	$11.83
CISO	$22.41	$17.64	$27.81	$67.86
IPCO	$6.32	$3.33	$3.67	$13.32
LADWP	$11.78	$10.19	$8.87	$30.84
NVE	$17.95	$8.35	$21.08	$47.38
NWMT	$8.07	$2.60	$1.93	$12.60
PAC	$33.24	$14.83	$22.24	$70.31
PGE	$9.29	$6.51	$5.95	$21.75
PNM	$10.28	$5.06	$7.11	$22.45
PSE	$7.33	$3.47	$4.57	$15.37
PWRX	$2.15	$7.73	$6.92	$16.80
SCL	$1.74	$1.05	$1.42	$4.21
SRP	$12.40	$9.00	$9.99	$31.39
TPWR	$3.25	$1.23	$2.07	$6.55
TEP	$4.18	$1.68	$4.53	$10.39
TID	$1.03	$0.75	$1.23	$3.01
Total	$188.96	$127.41	$147.45	$463.82

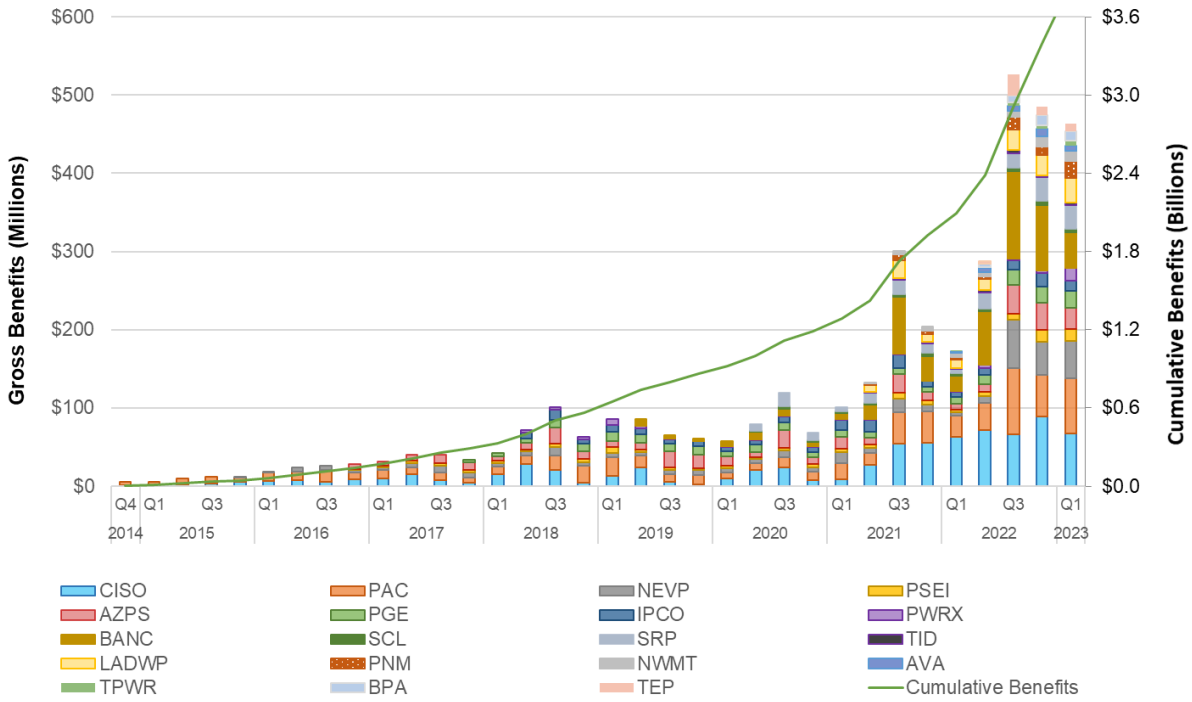
TABLE 1: Q1 2023 benefits in millions USD

CUMULATIVE ECONOMIC BENEFITS SINCE INCEPTION

Since the start of the WEIM in November 2014, the cumulative economic benefits of the market have totaled $3.86 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)
January	AVA	BPAT	14,447	12,743
	AVA	CISO	0	0
	AVA	IPCO	25,928	22,418
	AVA	NWMT	3,527	2,075
	AVA	PACW	8,338	9,885
	AVA	PGE	0	0
	AVA	PSEI	0	0
	AVA	SCL	0	0
	AVA	TPWR	0	0
	AZPS	CISO	239,844	188,035
	AZPS	LADWP	54,635	54,691
	AZPS	NEVP	14,963	15,504
	AZPS	PACE	35,647	38,963
	AZPS	PNM	5,920	2,973
	AZPS	SRP	2,800	2,312
	AZPS	TEPC	5,524	1,721
	BANC	BPAT	0	0
	BANC	CISO	5,730	5,948
	BANC	TIDC	29	0
	BPAT	AVA	9,832	9,473
	BPAT	BANC	0	0
	BPAT	CISO	26,238	33,920
	BPAT	IPCO	9,644	271

January	BPAT	LADWP	0	0
	BPAT	NEVP	0	0
	BPAT	NWMT	16,374	2,157
	BPAT	PACW	5,710	5,451
	BPAT	PGE	27,517	29,698
	BPAT	PSEI	14,731	14,954
	BPAT	PWRX	3,413	0
	BPAT	SCL	3,419	3,355
	BPAT	TPWR	7,335	8,831
	CISO	AVA	0	0
	CISO	AZPS	13,475	17,544
	CISO	BANC	101,677	105,617
	CISO	BPAT	23,062	26,574
	CISO	LADWP	49,505	56,542
	CISO	NEVP	18,639	20,381
	CISO	PACW	15,177	34,803
	CISO	PGE	35,840	53,953
	CISO	PWRX	154,650	171,000
	CISO	SRP	2,381	4,371
	CISO	TEPC	0	0
	CISO	TIDC	4,468	4,804
	IPCO	AVA	18,399	19,962
	IPCO	BPAT	426	166
	IPCO	NEVP	50,872	42,378
	IPCO	NWMT	218	565
	IPCO	PACE	39,298	18,343
	IPCO	PACW	30,297	31,398
January	IPCO	PSEI	0	0

	IPCO	SCL	9,620	8,790
January	LADWP	AZPS	169	289
	LADWP	BPAT	0	0
	LADWP	CISO	36,044	30,065
	LADWP	NEVP	10,247	11,522
	LADWP	PACE	18,160	19,136
	LADWP	TEPC	0	0
	NEVP	AZPS	250	844
	NEVP	BPAT	0	0
	NEVP	CISO	175,550	131,046
	NEVP	IPCO	49,907	49,266
	NEVP	LADWP	36,279	37,424
	NEVP	PACE	14,755	12,031
	NWMT	AVA	30,886	31,569
	NWMT	BPAT	9,417	8,840
	NWMT	IPCO	22,211	22,310
	NWMT	PACE	22,893	13,364
	NWMT	PACW	0	0
	NWMT	PGE	71	0
	NWMT	PSEI	285	0
	NWMT	TPWR	0	0
	PACE	AZPS	57,485	51,918
	PACE	IPCO	61,980	64,413
	PACE	LADWP	20,362	23,037
	PACE	NEVP	64,559	58,882
	PACE	NWMT	10,358	13,373
	PACE	PACW	40,489	39,802
January	PACE	SRP	0	0

	PACE	TEPC	55	302
January	PACW	AVA	6,464	5,835
	PACW	BPAT	5,869	5,212
	PACW	CISO	57,547	89,428
	PACW	IPCO	19,341	18,889
	PACW	NWMT	2	0
	PACW	PGE	64,408	64,217
	PACW	PSEI	20,751	19,480
	PACW	SCL	1,402	1,248
	PGE	AVA	0	0
	PGE	BPAT	28,931	31,304
	PGE	CISO	29,499	28,293
	PGE	NWMT	165	0
	PGE	PACW	14,299	18,163
	PGE	PSEI	0	0
	PGE	SCL	1,241	1,141
	PGE	TPWR	0	0
	PNM	AZPS	113,667	119,571
	PNM	SRP	498	465
	PNM	TEPC	15,512	17,130
	PSEI	AVA	0	0
	PSEI	BPAT	25,093	31,195
	PSEI	IPCO	0	0
	PSEI	NWMT	136	0
	PSEI	PACW	11,026	13,840
	PSEI	PGE	0	0
	PSEI	PWRX	13,662	15,620
January	PSEI	SCL	13,531	11,598

	PSEI	TPWR	407	570
January	PWRX	BPAT	18,442	0
	PWRX	CISO	0	0
	PWRX	PSEI	14,029	14,617
	SCL	AVA	0	0
	SCL	BPAT	1,139	1,906
	SCL	IPCO	3,741	4,651
	SCL	PACW	516	774
	SCL	PGE	789	1,094
	SCL	PSEI	5,235	8,650
	SRP	AZPS	49,716	50,770
	SRP	CISO	117,888	110,109
	SRP	PACE	0	0
	SRP	PNM	0	0
	SRP	TEPC	5,623	7,555
	TEPC	AZPS	812	40
	TEPC	CISO	62,756	61,758
	TEPC	LADWP	137	162
	TEPC	PACE	840	876
	TEPC	PNM	14,631	15,096
	TEPC	SRP	10,235	9,133
	TIDC	BANC	184	190
	TIDC	CISO	17,941	17,086
	TPWR	AVA	0	0
	TPWR	BPAT	11,559	12,150
	TPWR	NWMT	0	0
	TPWR	PGE	0	0
	TPWR	PSEI	23,512	23,880

February	AVA	BPAT	5,279	3,457
	AVA	CISO	0	0
	AVA	IPCO	30,101	26,908
	AVA	NWMT	8,116	7,304
	AVA	PACW	5,404	5,719
	AVA	PGE	0	0
	AVA	PSEI	0	0
	AVA	SCL	0	0
	AVA	TPWR	0	0
	AZPS	CISO	121,604	89,140
	AZPS	LADWP	29,838	26,510
	AZPS	NEVP	27,657	25,294
	AZPS	PACE	128,447	130,889
	AZPS	PNM	9,649	9,443
	AZPS	SRP	1,545	1,483
	AZPS	TEPC	2,310	2,350
	BANC	BPAT	0	0
	BANC	CISO	1,189	682
	BANC	TIDC	77	0
	BPAT	AVA	10,013	8,934
	BPAT	BANC	0	0
	BPAT	CISO	16,204	24,965
	BPAT	IPCO	13,746	7,826
	BPAT	LADWP	0	0
	BPAT	NEVP	0	0
	BPAT	NWMT	18,506	8,124
	BPAT	PACW	8,771	6,464
February	BPAT	PGE	29,445	29,808

	BPAT	PSEI	22,973	24,062
February	BPAT	PWRX	4,877	0
	BPAT	SCL	5,075	4,840
	BPAT	TPWR	11,241	13,604
	CISO	AVA	0	0
	CISO	AZPS	42,390	39,061
	CISO	BANC	169,164	175,480
	CISO	BPAT	26,038	28,530
	CISO	LADWP	45,705	50,036
	CISO	NEVP	68,821	56,244
	CISO	PACW	22,574	55,675
	CISO	PGE	62,842	89,377
	CISO	PWRX	304,096	326,115
	CISO	SRP	31,532	30,711
	CISO	TEPC	0	0
	CISO	TIDC	6,530	7,114
	IPCO	AVA	22,331	26,192
	IPCO	BPAT	1,540	779
	IPCO	NEVP	23,409	14,186
	IPCO	NWMT	191	738
	IPCO	PACE	15,762	8,421
	IPCO	PACW	28,915	21,610
	IPCO	PSEI	0	0
	IPCO	SCL	7,578	7,099
	LADWP	AZPS	1,083	1,949
	LADWP	BPAT	0	0
	LADWP	CISO	18,190	14,640
February	LADWP	NEVP	10,565	10,472

	LADWP	PACE	19,162	16,736
February	LADWP	TEPC	0	0
	NEVP	AZPS	829	2,108
	NEVP	BPAT	0	0
	NEVP	CISO	70,252	44,499
	NEVP	IPCO	77,369	67,803
	NEVP	LADWP	30,651	34,471
	NEVP	PACE	100,091	87,196
	NWMT	AVA	12,646	12,559
	NWMT	BPAT	2,857	775
	NWMT	IPCO	19,350	18,526
	NWMT	PACE	29,657	25,144
	NWMT	PACW	0	0
	NWMT	PGE	0	0
	NWMT	PSEI	195	0
	NWMT	TPWR	0	0
	PACE	AZPS	32,910	27,943
	PACE	IPCO	39,841	33,920
	PACE	LADWP	10,562	10,073
	PACE	NEVP	16,583	14,061
	PACE	NWMT	7,867	6,093
	PACE	PACW	26,877	17,452
	PACE	SRP	0	0
	PACE	TEPC	0	0
	PACW	AVA	7,496	8,647
	PACW	BPAT	2,345	1,680
	PACW	CISO	33,658	46,692
February	PACW	IPCO	22,740	28,416

	PACW	NWMT	0	0
February	PACW	PGE	45,848	42,930
	PACW	PSEI	20,930	20,019
	PACW	SCL	1,425	1,319
	PGE	AVA	0	0
	PGE	BPAT	22,706	23,755
	PGE	CISO	25,404	23,302
	PGE	NWMT	0	0
	PGE	PACW	25,456	28,718
	PGE	PSEI	0	0
	PGE	SCL	1,341	1,289
	PGE	TPWR	0	0
	PNM	AZPS	90,489	91,889
	PNM	SRP	1,128	1,556
	PNM	TEPC	14,685	16,367
	PSEI	AVA	0	0
	PSEI	BPAT	24,244	26,069
	PSEI	IPCO	0	0
	PSEI	NWMT	314	0
	PSEI	PACW	19	0
	PSEI	PGE	0	0
	PSEI	PWRX	22,045	22,782
	PSEI	SCL	19,703	17,653
	PSEI	TPWR	4,953	5,785
	PWRX	BPAT	16,060	0
	PWRX	CISO	0	0
	PWRX	PSEI	7,676	7,094
February	SCL	AVA	0	0

	SCL	BPAT	504	601
February	SCL	IPCO	6,078	6,984
	SCL	PACW	821	1,002
	SCL	PGE	831	1,059
	SCL	PSEI	4,878	6,181
	SRP	AZPS	38,548	45,286
	SRP	CISO	174,867	161,834
	SRP	PACE	0	0
	SRP	PNM	23	5
	SRP	TEPC	24,646	24,850
	TEPC	AZPS	1,800	683
	TEPC	CISO	29,966	26,352
	TEPC	LADWP	152	272
	TEPC	PACE	371	121
	TEPC	PNM	10,702	7,802
	TEPC	SRP	31,790	30,468
	TIDC	BANC	12	0
	TIDC	CISO	17,975	16,672
	TPWR	AVA	0	0
	TPWR	BPAT	5,585	6,249
	TPWR	NWMT	0	0
	TPWR	PGE	0	0
	TPWR	PSEI	12,520	13,643
March	AVA	BPAT	9,088	5,439
	AVA	CISO	0	0
	AVA	IPCO	15,021	10,702
	AVA	NWMT	19,795	18,901
	AVA	PACW	5,058	5,192

	AVA	PGE	0	0
March	AVA	PSEI	0	0
	AVA	SCL	18	0
	AVA	TPWR	0	0
	AZPS	CISO	94,839	72,171
	AZPS	LADWP	23,695	31,347
	AZPS	NEVP	47,626	41,500
	AZPS	PACE	157,262	161,848
	AZPS	PNM	15,947	17,827
	AZPS	SRP	4,154	3,967
	AZPS	TEPC	3,646	4,856
	BANC	BPAT	0	0
	BANC	CISO	44,574	36,068
	BANC	TIDC	3,432	2,735
	BPAT	AVA	11,325	10,021
	BPAT	BANC	0	0
	BPAT	CISO	17,197	22,876
	BPAT	IPCO	14,535	4,749
	BPAT	LADWP	0	0
	BPAT	NEVP	0	0
	BPAT	NWMT	17,054	12,962
	BPAT	PACW	4,837	3,257
	BPAT	PGE	24,718	22,672
	BPAT	PSEI	15,618	20,547
	BPAT	PWRX	4,923	0
	BPAT	SCL	4,745	4,992
	BPAT	TPWR	10,188	13,112
March	CISO	AVA	0	0

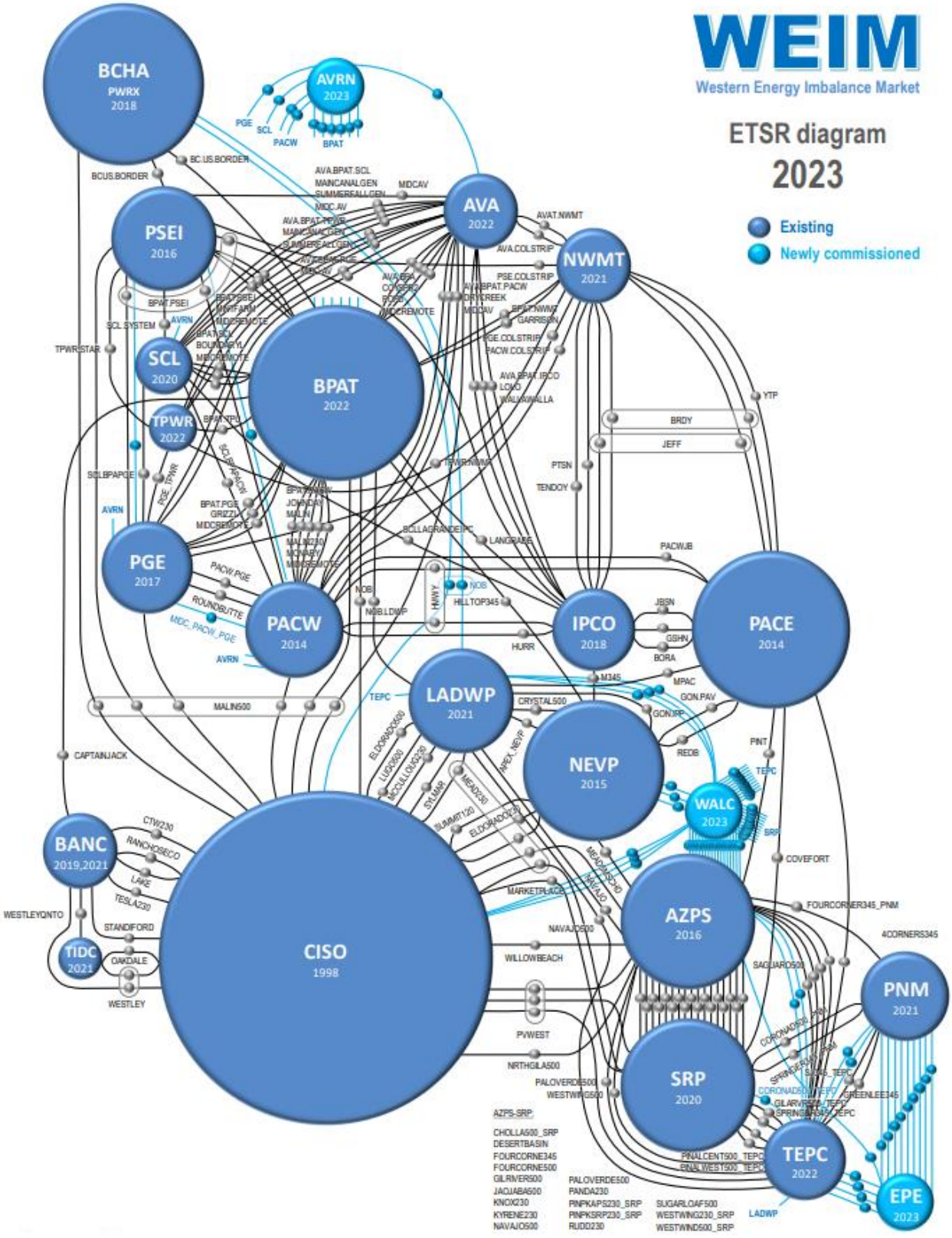
	CISO	AZPS	41,759	30,917
March	CISO	BANC	43,639	57,361
	CISO	BPAT	31,944	35,760
	CISO	LADWP	50,554	51,085
	CISO	NEVP	83,463	66,098
	CISO	PACW	12,786	41,442
	CISO	PGE	49,531	71,815
	CISO	PWRX	320,642	338,692
	CISO	SRP	57,800	54,009
	CISO	TEPC	0	0
	CISO	TIDC	13,747	14,714
	IPCO	AVA	30,978	32,600
	IPCO	BPAT	6,070	6,616
	IPCO	NEVP	27,095	16,084
	IPCO	NWMT	1,024	1,548
	IPCO	PACE	56,934	50,980
	IPCO	PACW	40,885	30,879
	IPCO	PSEI	5,331	4,233
	IPCO	SCL	9,549	8,271
	LADWP	AZPS	2,818	4,747
	LADWP	BPAT	0	0
	LADWP	CISO	37,042	26,249
	LADWP	NEVP	23,056	22,861
	LADWP	PACE	29,943	34,177
	LADWP	TEPC	0	0
	NEVP	AZPS	3,215	5,454
	NEVP	BPAT	0	0
March	NEVP	CISO	62,375	46,255

	NEVP	IPCO	57,556	49,906
March	NEVP	LADWP	19,634	19,823
	NEVP	PACE	212,357	186,860
	NWMT	AVA	10,554	9,244
	NWMT	BPAT	5,717	3,668
	NWMT	IPCO	6,618	5,441
	NWMT	PACE	43,856	41,416
	NWMT	PACW	0	0
	NWMT	PGE	1	0
	NWMT	PSEI	110	0
	NWMT	TPWR	0	0
	PACE	AZPS	18,149	12,804
	PACE	IPCO	31,322	32,991
	PACE	LADWP	7,604	4,718
	PACE	NEVP	5,031	3,178
	PACE	NWMT	6,576	4,985
	PACE	PACW	31,300	24,028
	PACE	SRP	0	0
	PACE	TEPC	0	0
	PACW	AVA	6,192	6,250
	PACW	BPAT	6,379	4,744
	PACW	CISO	17,710	37,856
	PACW	IPCO	16,380	15,076
	PACW	NWMT	0	0
	PACW	PGE	65,927	56,243
	PACW	PSEI	40,077	37,812
	PACW	SCL	1,724	1,375
March	PGE	AVA	0	0

	PGE	BPAT	41,815	29,998
March	PGE	CISO	17,578	15,852
	PGE	NWMT	1	0
	PGE	PACW	10,172	16,529
	PGE	PSEI	2,480	2,995
	PGE	SCL	1,306	1,242
	PGE	TPWR	0	0
	PNM	AZPS	114,933	125,827
	PNM	SRP	803	852
	PNM	TEPC	13,343	12,707
	PSEI	AVA	0	0
	PSEI	BPAT	33,095	26,767
	PSEI	IPCO	2,931	2,478
	PSEI	NWMT	97	0
	PSEI	PACW	5,289	6,876
	PSEI	PGE	1,040	1,124
	PSEI	PWRX	23,355	26,297
	PSEI	SCL	23,516	21,716
	PSEI	TPWR	7,682	7,104
	PWRX	BPAT	16,390	0
	PWRX	CISO	0	0
	PWRX	PSEI	7,650	6,979
	SCL	AVA	7	0
	SCL	BPAT	856	846
	SCL	IPCO	5,394	5,905
	SCL	PACW	359	522
	SCL	PGE	721	814
March	SCL	PSEI	3,440	4,061

March	SRP	AZPS	53,332	52,849
	SRP	CISO	136,422	125,198
	SRP	PACE	0	0
	SRP	PNM	58	91
	SRP	TEPC	25,779	23,480
	TEPC	AZPS	2,770	2,511
	TEPC	CISO	65,489	67,012
	TEPC	LADWP	0	0
	TEPC	PACE	5,869	4,703
	TEPC	PNM	21,855	16,460
	TEPC	SRP	24,516	21,236
	TIDC	BANC	4,589	5,538
	TIDC	CISO	19,037	15,510
	TPWR	AVA	0	0
	TPWR	BPAT	6,029	4,742
	TPWR	NWMT	0	0
	TPWR	PGE	0	0
	TPWR	PSEI	6,198	7,767

TABLE 2: Energy transfers (MWh) in the FMM and RTD markets for Q1 2023



GRAPH 2: WEIM transfer

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.

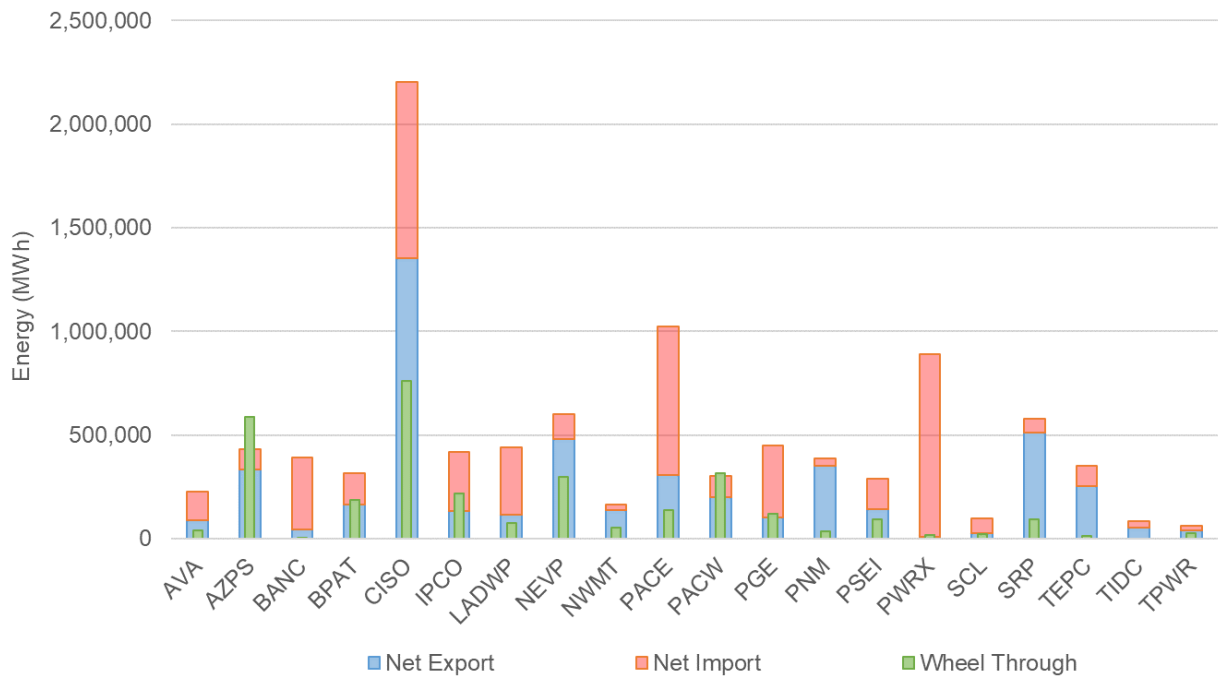
This volume reflects the total wheel-through transfers for each WEIM BAA, regardless of the potential paths used to wheel through. The net imports and exports estimated in this section reflect the overall volume of net imports and exports; in contrast, the imports and exports provided in Table 2 reflect 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	89,033	139,575	41,711
AZPS	335,627	97,806	587,198
BANC	45,406	344,159	27
BPAT	163,219	151,860	188,705

CISO	1,354,826	848,513	760,999
IPCO	134,840	282,849	217,001
LADWP	116,399	323,748	76,443
NEVP	478,330	121,989	296,657
NWMT	138,434	24,401	54,423
PACE	307,605	714,838	136,367
PACW	198,530	104,643	314,838
PGE	103,768	345,990	118,814
PNM	350,796	34,129	35,569
PSEI	143,862	143,365	93,611
PWRX	9,974	881,791	18,715
SCL	24,259	75,138	20,791
SRP	510,350	68,884	91,678
TEPC	253,452	100,086	11,232
TIDC	54,996	29,366	-

TABLE 3: Estimated wheel-through transfers in Q1 2023

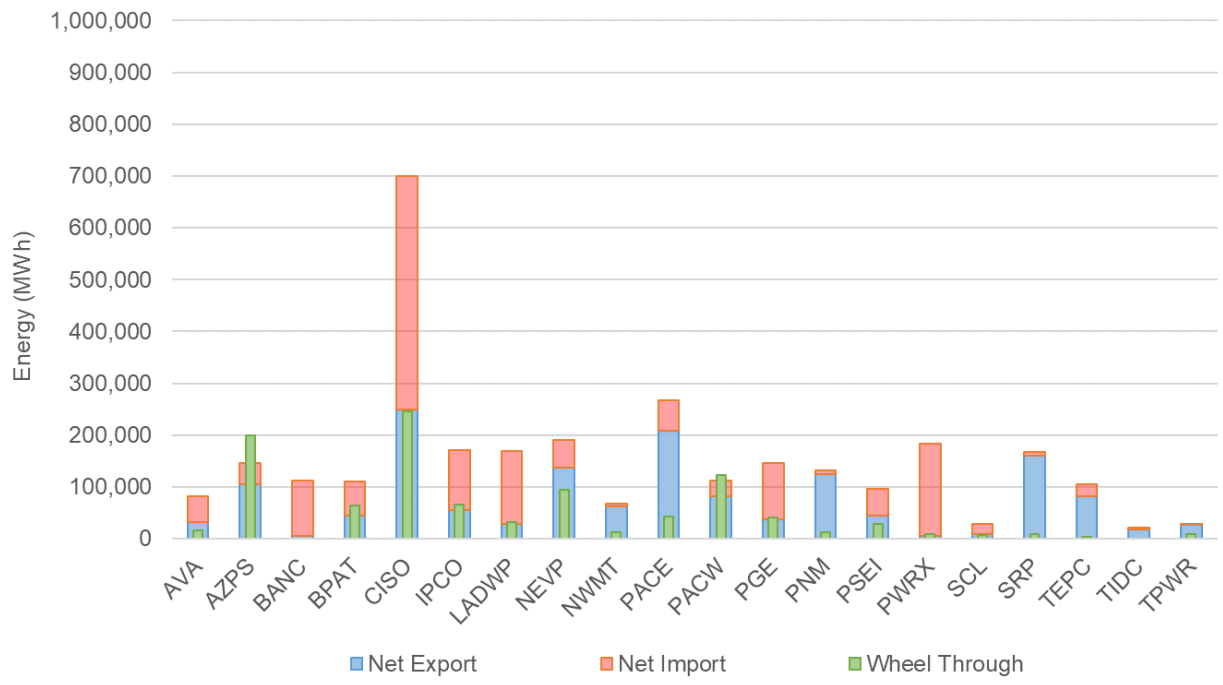


GRAPH 3: Estimated wheel-through transfers in Q1 2023

BAA	Net Export	Net Import	Wheel Through
AVA	31,563	51,280	15,559
AZPS	104,474	41,250	199,725
BANC	5,948	105,806	-
BPAT	44,031	66,013	64,078
CISO	250,023	450,123	245,565
IPCO	54,962	115,578	66,641
LADWP	28,738	139,583	32,273
NEVP	136,668	54,724	93,943
NWMT	63,081	5,166	13,003
PACE	208,253	59,238	43,474
PACW	81,578	31,385	122,731

PGE	37,956	108,018	40,945
PNM	125,036	5,939	12,130
PSEI	44,148	52,906	28,675
PWRX	5,951	177,954	8,665
SCL	9,611	18,669	7,464
SRP	160,003	7,850	8,432
TEPC	82,788	22,430	4,278
TIDC	17,276	4,804	-
TPWR	27,342	714	8,688

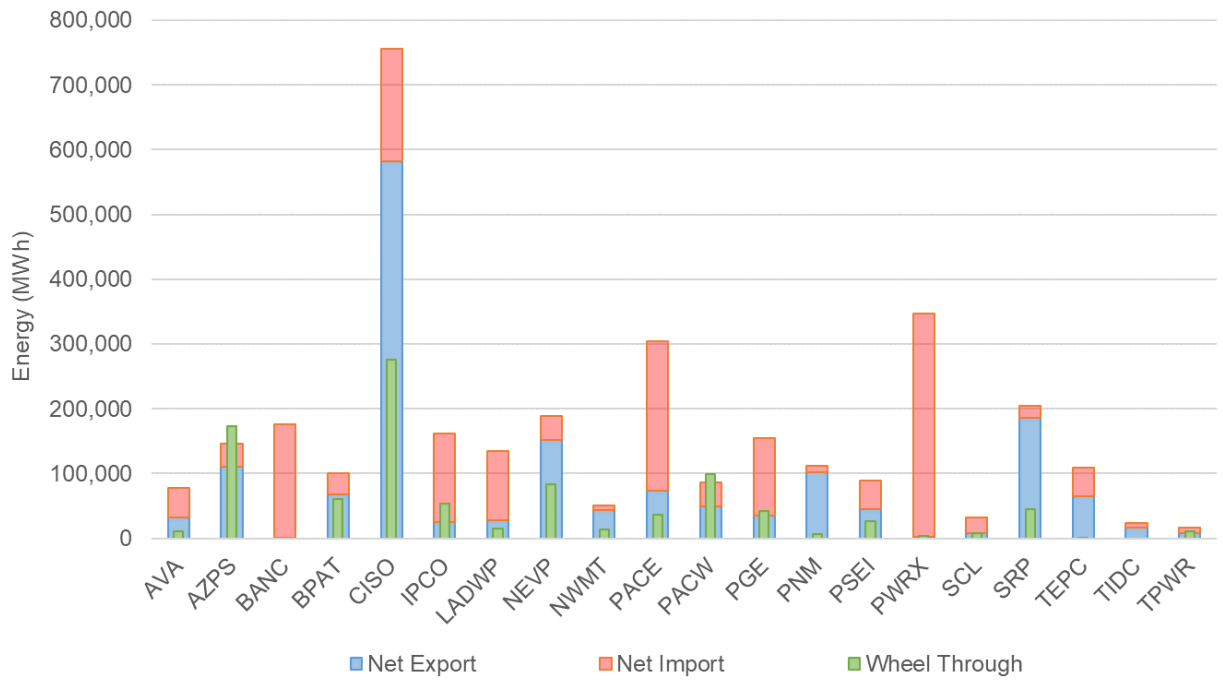
TABLE 4: Estimated wheel-through transfers in January 2023



GRAPH 4: Estimated wheel-through transfers in January 2023

BAA	Net Export	Net Import	Wheel Through
AVA	32,236	45,181	11,152
AZPS	111,287	35,097	173,822
BANC	682	175,480	-
BPAT	68,437	31,704	60,190
CISO	582,404	172,838	275,940
IPCO	25,221	136,577	53,806
LADWP	28,307	105,874	15,489
NEVP	152,045	36,225	84,033
NWMT	43,070	8,325	13,934
PACE	72,930	231,896	36,612
PACW	49,803	36,741	99,900
PGE	34,474	120,584	42,590
PNM	102,484	9,921	7,329
PSEI	45,624	44,335	26,665
PWRX	2,650	344,454	4,444
SCL	7,714	24,087	8,114
SRP	186,532	18,775	45,443
TEPC	65,427	43,296	271
TIDC	16,672	7,114	-
TPWR	8,439	7,936	11,453

TABLE 5: Estimated wheel-through transfers in February 2023

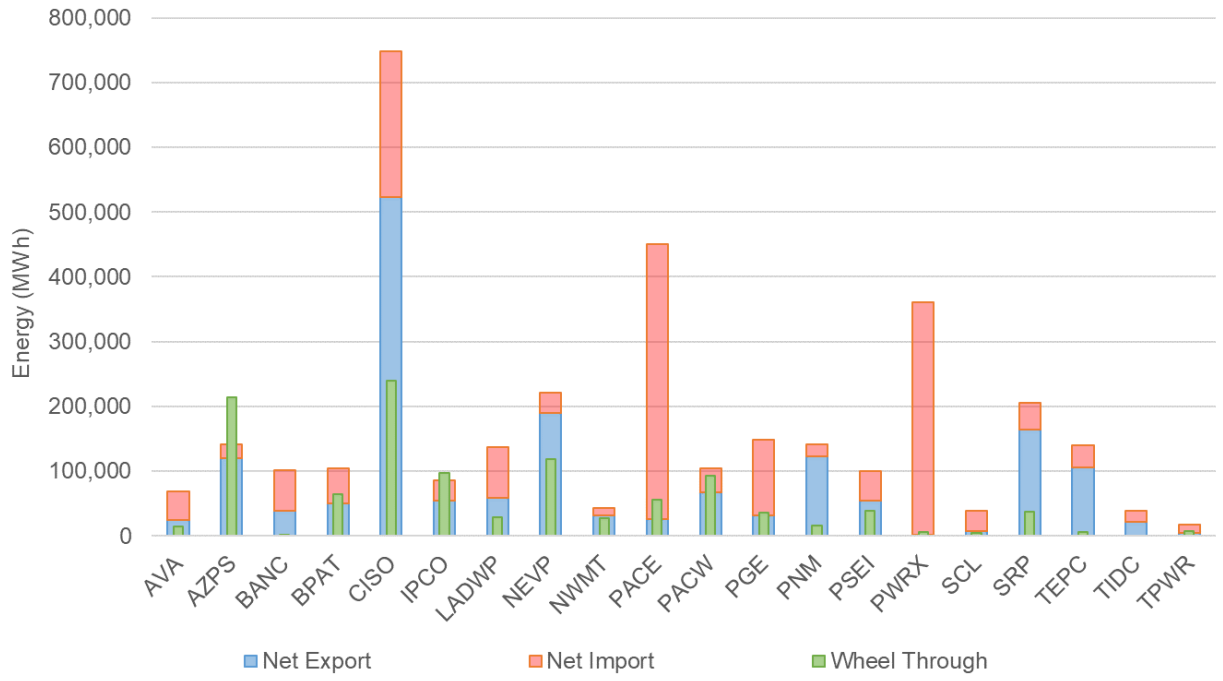


GRAPH 5: Estimated wheel-through transfers in February 2023

BAA	Net Export	Net Import	Wheel Through
AVA	25,234	43,115	15,000
AZPS	119,866	21,459	213,651
BANC	38,775	62,872	27
BPAT	50,751	54,143	64,437
CISO	522,398	225,552	239,494
IPCO	54,657	30,694	96,554
LADWP	59,353	78,291	28,681
NEVP	189,617	31,040	118,681
NWMT	32,284	10,909	27,486
PACE	26,422	423,704	56,281
PACW	67,148	36,517	92,207
PGE	31,338	117,388	35,279

PNM	123,276	18,268	16,109
PSEI	54,090	46,125	38,271
PWRX	1,373	359,383	5,606
SCL	6,934	32,383	5,214
SRP	163,815	42,260	37,803
TEPC	105,237	34,359	6,684
TIDC	21,048	17,449	-
TPWR	4,982	12,689	7,526

TABLE 6: Estimated wheel-through transfers in March 2023



GRAPH 6: Estimated wheel-through transfers in March 2023

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 Q1 2023 was calculated to be 8,283 MWh (January) + 21,976 MWh (February) + 22,743 MWh (March) = 53,002 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_2/MWh, avoided curtailments displaced an estimated 22,685 metric tons of CO_2 for Q1 2023. 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 CO_2, 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
	4	25,609	10,960
2023	1	53,002	22,685
Total		1,903,799	814,746

TABLE 7: Total reduction in curtailment of renewable energy and associated reductions in CO_2

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
January	*AVA*	up	22	81
	AZPS	up	49	284
	BANC	up	10	96
	BPAT	up	82	371

	CISO	up	248	2,337
	IPCO	up	36	189
	LADWP	up	30	393
	NEVP	up	20	446
	NWMT	up	22	127
	PACE	up	90	460
	PACW	up	49	174
	PGE	up	51	200
	PNM	up	39	155
	PSEI	up	74	167
	PWRX	up	78	294
	SCL	up	7	31
	SRP	up	17	201
	TEPC	up	66	193
	TIDC	up	2	17
	TPWR	up	3	19
	ALL EIM	**up**	**315**	**2,771**
	AVA	down	11	92
	AZPS	down	23	231
January	*BANC*	down	6	152
	BPAT	down	141	639
	CISO	down	187	1,332
	IPCO	down	36	194
	LADWP	down	38	297
	NEVP	down	24	414
	NWMT	down	41	124
	PACE	down	176	461
	PACW	down	34	163
	PGE	down	28	204
	PNM	down	41	141
	PSEI	down	52	153

	PWRX	down	69	356
	SCL	down	4	28
	SRP	down	20	181
	TEPC	down	0	165
	TIDC	down	1	17
	TPWR	down	2	24
	ALL EIM	**down**	**279**	**2,175**
	AVA	up	20	81
February	*AZPS*	up	39	284
	BANC	up	8	102
	BPAT	up	87	435
	CISO	up	259	2,303
	IPCO	up	44	175
	LADWP	up	49	393
	NEVP	up	26	463
	NWMT	up	32	124
	PACE	up	103	525
	PACW	up	51	174
	PGE	up	35	200
February	*PNM*	up	39	155
	PSEI	up	67	167
	PWRX	up	79	369
	SCL	up	6	31
	SRP	up	27	267
	TEPC	up	64	200
	TIDC	up	2	20
	TPWR	up	23	19
	ALL WEIM	**up**	**395**	**2,771**
	AVA	down	14	103
	AZPS	down	31	383
	BANC	down	9	152

	BPAT	down	163	639
	CISO	down	220	1,332
	IPCO	down	52	194
	LADWP	down	68	307
	NEVP	down	32	414
	NWMT	down	36	132
	PACE	down	139	451
	PACW	down	50	163
	PGE	down	45	204
	PNM	down	59	146
	PSEI	down	74	153
	PWRX	down	66	356
	SCL	down	7	28
	SRP	down	23	400
	TEPC	down	39	134
	TIDC	down	1	17
	TPWR	down	2	25
	ALL EIM	**down**	**438**	**2,175**
March	*AVA*	up	23	81
	AZPS	up	44	300
	BANC	up	7	102
	BPAT	up	76	435
	CISO	up	266	2,323
	IPCO	up	45	189
	LADWP	up	51	393
	NEVP	up	24	463
	NWMT	up	46	127
	PACE	up	103	525
	PACW	up	49	174
	PGE	up	59	200
	PNM	up	50	155

	PSEI	up	67	167
	PWRX	up	79	377
	SCL	up	6	31
	SRP	up	35	280
	TEPC	up	62	263
	TIDC	up	2	20
	TPWR	up	2	19
	ALL WEIM	**up**	**385**	**2,771**
	AVA	down	15	94
	AZPS	down	18	383
	BANC	down	5	152
	BPAT	down	109	639
	CISO	down	220	1,332
	IPCO	down	52	194
	LADWP	down	41	307
	NEVP	down	12	414
	NWMT	down	9	132
	PACE	down	96	451
	PACW	down	22	163
March	*PGE*	down	24	204
	PNM	down	36	155
	PSEI	down	10	153
	PWRX	down	46	356
	SCL	down	5	28
	SRP	down	28	400
	TEPC	down	19	129
	TIDC	down	0	19
	TPWR	down	2	25
	ALL WEIM	**down**	**1,718**	**2,175**

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.

	January		**February**		**March**	
Direction	Up	Down	Up	Down	Up	Down
Average MW saving	1,655	1,657	1,698	1,484	2,470	951
Sum of BAA requirements	2,983	2,714	2,982	3,013	4,985	3,113
Percentage savings	55%	61%	57%	49%	50%	31%

Table 9: Flexible ramping procurement diversity savings in Q1 2023

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 814,746 metric tons of CO_2, roughly the equivalent of avoiding the emissions from 171,297 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