

# **Benefits for Participating in EIM**

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### Revision History

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## Table of Contents

<b>EXECUTIVE SUMMARY .....</b>	<b>4</b>
<b>EIM BENEFITS IN Q1 2016 .....</b>	<b>5</b>
INTER-REGIONAL TRANSFERS.....	5
REDUCED RENEWABLE CURTAILMENT.....	7
FLEXIBLE RAMPING PROCUREMENT DIVERSITY SAVINGS .....	7
<b>CONCLUSION .....</b>	<b>8</b>

## Executive Summary

This is the “Quantifying EIM Benefits” report for the first quarter of 2016. The estimated gross benefits for January, February and March 2016 are \$18.90 million. This brings the EIM total benefits to \$64.60 million since it expanded the real-time market to balancing areas outside the California ISO.

The total gross benefits for Q1 2016 increased significantly from the past with the addition of NV Energy (NVE). This growth reflects the economic value associated with the increase in inter-regional transfer capability.

The benefit calculation method is described in a separate document.<sup>1</sup> This analysis demonstrates the EIM’s ability to select the most economic resources across the PacifiCorp, NVE and ISO balancing authority areas (BAAs) that comprise the EIM footprint. The benefits quantified in this report fall into three categories and were described in earlier studies.<sup>2</sup>

- **More efficient dispatch, both inter- and intra-regional, in the Fifteen-Minute Market (FMM) and Real-Time Dispatch (RTD)**, by automating dispatch every fifteen minutes and every five minutes within and across the EIM footprint, including the California ISO, PacifiCorp, and NV Energy.
- **Reduced renewable energy curtailment**, by allowing balancing authority areas to export or reduce imports of renewable generation when they would otherwise need to be economically curtailed, and
- **Reduced flexibility reserves needed in all balancing authority areas**, which saves cost by aggregating the load, wind, and solar variability and forecast errors of the combined EIM footprint. This report quantifies the diversity benefits of flexibility reserves for the entire EIM footprint.

Table 1 shows the estimated gross benefits summary for the first quarter of 2016 in millions of dollars per EIM entity.

Region	January	February	March	Total
CAISO	1.97	1.19	3.18	6.35
NV Energy	0.34	0.75	0.62	1.70
PacifiCorp	2.21	4.95	3.69	10.85
<b>Total</b>	<b>4.53</b>	<b>6.89</b>	<b>7.49</b>	<b>18.90</b>

<sup>1</sup> EIM Quarterly Benefit Report Methodology, [https://www.caiso.com/Documents/EIM\\_BenefitMethodology.pdf](https://www.caiso.com/Documents/EIM_BenefitMethodology.pdf). This report includes one enhancement to allow commitment of ISO short start units in the counterfactual dispatch.

<sup>2</sup> PacifiCorp-ISO, Energy Imbalance Markets Benefits, <http://www.caiso.com/Documents/PacifiCorp-ISOEnergyImbalanceMarketBenefits.pdf>

**Table 1: Estimated gross benefits shown are in millions and accrued in the first quarter of 2016**

One of the significant contributions to the EIM benefits are transfers across the balancing areas which provide lower supply cost, even while factoring in the cost of compliance with greenhouse gas (GHG) emissions cost when it is transferring 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 Fifteen Minute Market (FMM) and Real-Time Dispatch (RTD). Generally, the transfer limits are based on transmission rights and interchange rights that participating balancing authority areas make available to EIM, with the exception of the PACW-ISO transfer limit in RTD. The RTD transfer capacities between PACW and the ISO are dynamically 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.

Balancing authority areas may submit base scheduled transfers. These transactions occurred between NVE and PACE. The EIM inter-regional benefits are calculated based on the transfer difference between the EIM and the base schedule. This is because the benefits associated with base scheduled transfers, to the extent that they exist, should be attributed to decisions made prior to the EIM, not to the economic efficiencies gained through the EIM.

While market conditions will vary, the EIM continues to provide benefits to participating entities and their customers as demonstrated in this report.

## Background

The EIM began financially-binding operation on November 1, 2014 by optimizing resources across the ISO and PacifiCorp BAAs, which includes portions of California, Oregon, Washington, Utah, Idaho and Wyoming. NV Energy, operating in Nevada, began participating in December 2015. The EIM facilitates renewable resource integration and increases reliability by sharing information between balancing authorities on electricity delivery conditions across the EIM region. The ISO started publishing quarterly EIM benefit reports in January 2015. As other BAAs join the EIM, this report will expand to include the benefits associated with their participation.

## EIM Benefits in Q1 2016

Table 1 breaks out the estimated EIM gross benefits by each BAA per month. The savings presented in the table show \$4.53 million for January, \$6.89 million for February, and \$7.49 million for March. The increase of EIM benefit from month to month may be driven by variations in supply and demand.

## Inter-regional Transfers

One of the significant contributions to the EIM benefits is transfers across the balancing areas which provide lower supply cost. Table 2 provides the 15-minute EIM transfer volume and the 5-minute EIM transfer volume, both with base schedule transfer excluded. NVE and PACE had submitted base

schedule transfers. The EIM benefit is only attributable the transfers that occurred with EIM, but not the base schedules submitted prior to the EIM.

The transfer from BAA\_x to BAA\_y and the transfer from BAA\_y to BAA\_x are separately reported. For example, in an interval, if there is 100 MWh transfer on top of base transfer from CISO to NEVP, it will be reported as 100 MW with from\_BAA=CISO and to\_BAA=NEVP, and it will be reported as 0 MW with from\_BAA=NEVP and to\_BAA=CISO in the opposite direction. The 15-minute transfer volume results from EIM optimization in the 15-minute market with all bids and base schedules submitted into EIM. The 5-minute transfer volume results from EIM optimization in the 5-minute market with all bids and base schedules submitted into EIM, and unit commitments determined in the 15-minute market optimization.

NV Energy's EIM benefits mainly reflect inter-regional transfer benefits resulting from intra-hour transactions. This is attributed to NV Energy's optimization of its base schedules prior to submission to the EIM.

The ISO exported a significant amount of energy to NV Energy and PacifiCorp in this quarter. This compares to past quarters when the ISO had been mainly an importer. It is also worth noting that a significant level of energy that was exported by the ISO consisted of renewable generation.

Year	Month	from_BAA	to_BAA	15m EIM transfer (15m - base)	5m EIM transfer (5m - base)
2016	January	CISO	NEVP	100,643	69,845
2016	January	CISO	PACW	31,606	34,024
2016	January	NEVP	CISO	48,895	93,833
2016	January	NEVP	PACE	84,902	65,572
2016	January	PACE	NEVP	36,387	51,786
2016	January	PACE	PACW	39,612	58,139
2016	January	PACW	CISO	59,035	60,965
2016	February	CISO	NEVP	70,729	75,587
2016	February	CISO	PACW	15,617	17,377
2016	February	NEVP	CISO	69,461	92,008
2016	February	NEVP	PACE	62,732	65,937
2016	February	PACE	NEVP	48,928	49,354
2016	February	PACE	PACW	26,490	43,735
2016	February	PACW	CISO	74,595	83,854
2016	March	CISO	NEVP	136,887	139,781
2016	March	CISO	PACW	11,347	11,413
2016	March	NEVP	CISO	49,315	79,251
2016	March	NEVP	PACE	95,008	88,972
2016	March	PACE	NEVP	38,034	46,286
2016	March	PACE	PACW	9,278	23,291

<b>2016</b>	March	PACW	CISO	93,571	97,051
There is no PACW to PACE transfer capability					

**Table 2: Energy transfers (MWh) in the FMM and RTD for the first quarter of 2016**

## Reduced Renewable Curtailment

The EIM helps avoid renewable curtailments within the ISO, which has both economic and environmental benefits. The EIM benefit calculation includes the economic benefits that can be attributed to avoided renewable curtailment within the ISO. 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 2016 was calculated to be 17,261 MWh (January) + 41,287 MWh (February) + 54,399 MWh (March) = 112,948 MWh total. The energy being exported by the ISO included a significant level of renewable generation.

The environmental benefits of avoided renewable curtailment are significant. Under the assumption that avoided renewable curtailments displace production from other resources at a default emission rate of 0.428 metric tons CO<sub>2</sub>/MWh, avoided curtailments displaced an estimated 48,342 metric tons of CO<sub>2</sub> for Q1 2016. Avoided renewable curtailments may also have reduced the volume of renewable credits that would have been retracted. However, this report does not quantify the additional value in dollars associated with this benefit.

## Flexible ramping procurement diversity savings

The 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 requirement. This difference is known as the flexible ramping procurement diversity savings. Starting in March 2015, the ISO implemented an automated tool to analyze historical uncertainties and calculate the flexible ramping requirement for each BAA in the EIM. In Q1 2016, the flexible ramping requirement for the ISO varied from 300 MW to 500 MW, the requirement for PACE varied from 80 MW to 150 MW, the requirement for PACW varied from 60 MW to 100 MW, and the requirement for NVE varied from 80 MW to 100 MW. Due to the reduction in flexible ramping requirement associated with the larger EIM footprint, the total requirement across the four BAAs varied from 300 MW to 530 MW.

The flexible ramping procurement diversity savings for all the intervals averaged over a month are listed in Table 3. The percentage saving is the average MW savings divided by the sum of the four individual BAA requirements.

	January	February	March
<b>Average MW saving</b>	255	261	265
<b>Sum of BAA requirements</b>	758	752	753
<b>Percentage savings</b>	34%	35%	35%

**Table 3: Flexible ramping procurement diversity saving for the first quarter of 2016**

Under the current flexible ramping constraint design, the procured flexible ramping capacity can be fully accessed in RTD. If the flexible ramping procurement in the FMM is beneficial, it will reduce the RTD dispatch cost. With the EIM benefits being quantified on a 5-minute level, the benefit of flexible ramping is fully captured in the RTD dispatch. The EIM benefits calculated at a 5-minute level includes the savings from procuring and deploying flexible ramping. However, this analysis does not breakout the dollar savings separately because the savings are tightly integrated with the RTD dispatch.

## Conclusion

The EIM continued to show significant benefits during the first quarter of 2016. The total benefits for the quarter of \$18.90 million are consistent with pre-launch studies, and reflect the transfer benefits of a more robust EIM footprint, that includes both PacifiCorp and NV Energy.