

Benefits for Participating in EIM

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Revision History

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Executive Summary

This is the “Quantifying EIM Benefits” report for the second quarter of 2016. The estimated gross benefits for April, May and June 2016 are \$23.60 million. This brings the EIM total benefits to \$88.19 million since it expanded the real-time market to balancing areas outside the California ISO starting in November 2014.

The total gross benefits for Q2 2016 increased from the last quarter driven by seasonal changes in supply and demand. A similar trend was also observed in 2015 from Q1 to Q2.

The benefit calculation method is described in a separate document.¹ This analysis demonstrates the EIM’s ability to select the most economic resources across the PacifiCorp, NV Energy and the California 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.²

- **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 second quarter of 2016 in millions of dollars per EIM entity.

Region	April	May	June	Total
CAISO	2.56	2.24	3.09	7.89
NV Energy	1.09	1.34	2.77	5.20
PacifiCorp	4.63	2.44	3.44	10.51
Total	8.27	6.03	9.30	23.60

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

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

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

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 NV Energy 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.

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.

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 Q2 2016

Table 1 breaks out the estimated EIM gross benefits by each BAA per month. The savings presented in the table show \$8.27 million for April, \$6.03 million for May, and \$9.30 million for June.

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. NV Energy 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.

The ISO continued to export a significant amount of energy to NV Energy and PacifiCorp in this quarter, which was first observed in Q1 2016. 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	April	CISO	NEVP	151,098	141,142
2016	April	CISO	PACW	10,899	11,286
2016	April	NEVP	CISO	48,422	73,963
2016	April	NEVP	PACE	118,420	123,547
2016	April	PACE	NEVP	38,270	41,397
2016	April	PACE	PACW	10,354	21,736
2016	April	PACW	CISO	76,026	81,880
2016	May	CISO	NEVP	178,120	158,983
2016	May	CISO	PACW	27,561	27,804
2016	May	NEVP	CISO	29,820	62,126
2016	May	NEVP	PACE	134,092	133,344
2016	May	PACE	NEVP	24,513	29,969
2016	May	PACE	PACW	13,800	25,499
2016	May	PACW	CISO	54,856	52,302
2016	June	CISO	NEVP	151,491	134,804
2016	June	CISO	PACW	42,772	44,661
2016	June	NEVP	CISO	55,793	87,306
2016	June	NEVP	PACE	52,150	63,785
2016	June	PACE	NEVP	77,205	76,448

2016	June	PACE	PACW	36,809	52,867
2016	June	PACW	CISO	36,723	39,296

Table 2: Energy transfers (MWh) in the FMM and RTD for the second 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 Q2 2016 was calculated to be 67,373 MWh (April) + 49,296 MWh (May) + 42,136 MWh (June) = 158,806 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 CO₂/MWh, avoided curtailments displaced an estimated 67,969 metric tons of CO₂ for Q2 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 June 2015, the ISO implemented an automated tool to analyze historical uncertainties and calculate the flexible ramping requirement for each BAA in the EIM. In Q2 2016, the flexible ramping requirement for the ISO varied from 300 MW to 500 MW, the requirement for PACE varied from 91 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 400 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.

	April	May	June
Average MW saving	281	280	270
Sum of BAA requirements	777	770	758
Percentage savings	36%	36%	36%

Table 3: Flexible ramping procurement diversity saving for the second 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 second quarter of 2016. The total benefits for the quarter of \$23.60 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.