

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 third quarter of 2015. The estimated gross benefits for July, August, and September 2015 is \$12 million. This brings the EIM total estimated gross benefits to \$33.41 million since its launch in November 2014, which is consistent with pre-launch projections.

The gross benefit in this report is calculated in the same way as described in the [2015 Q2 report](#). The total gross benefit in the third quarter is about 18 percent higher than the previous quarter, which reflects greater economic values carried by the inter regional transfers during the hot summer season, especially in July.

This analysis continues to prove EIM’s ability to select the lowest cost resource across the PacifiCorp and ISO balancing authority areas (BAAs) and accounts for benefits within the following categories, which were described in an earlier study¹.

- **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 PacifiCorp’s two BAAs and between the PacifiCorp and California ISO BAAs.
- **Reduced renewable energy curtailment** by allowing BAAs to export or reduce imports of renewable generation when it would otherwise need to be economically curtailed.
- **Reduced flexibility reserves needed in all BAAs**, which saves cost by aggregating the load, wind, and solar variability and forecast errors of the combined EIM footprint. This report shows the diversity benefits of flexibility reserve for the whole EIM footprint.

Table 1 below shows the estimated benefits summary for the third quarter of 2015 in millions of dollars per BAA.

BAA	July	August	September	Total
ISO	\$1.67	\$0.93	\$0.88	\$3.48
PACE	\$1.85	\$1.42	\$1.23	\$4.51
PACW	\$2.16	\$0.97	\$0.87	\$4.01
Total	\$5.69	\$3.32	\$2.99	\$12.00

Table 1: Estimated benefits shown are in millions and accrued in the third quarter of 2015

One of the important contributors to EIM benefit are transfers, which allows lower supply cost, even while considering the GHG cost, from one BAA to meet demand in another. As such, the transfer volume is a good indicator of a portion of the EIM benefit. Transfers can take place in both the FMM and RTD. The FMM transfer limits between PACW and the ISO are based on the Interchange Rights PacifiCorp is

¹ PacifiCorp, Energy Imbalance Markets Summary, <http://www.caiso.com/Documents/PacifiCorp-ISOEnergyImbalanceMarketBenefits.pdf>

using for EIM transfers. This report does not consider PacifiCorp’s opportunity cost that the utility considered when using its transfer rights for the EIM. The transfer limits between PACW and the ISO in the five-minute RTD market are dynamically determined based on allocated dynamic transfer capability driven by system operating conditions. Table 2 below provides the FMM transfer volume, which is the change from base scheduled transfer², as well as the incremental RTD transfer volume. The total EIM fifteen-minute transfers and five-minute transfers for July through September 2015 were approximately 274,768 megawatt hours (MWh) from PacifiCorp to the ISO and 20,300 MWh from the ISO to PacifiCorp.

Negative RTD transfer values from PACE to PACW indicates the RTD clears less total transfer than the FMM. Negative RTD transfer values from the ISO to PACW can occur when RTD dynamic transfer flows in the opposite direction of the FMM static transfer. For example, for a particular hour, the FMM transfer can be 100 MWh from the ISO to PacifiCorp, and the RTD dynamic transfer can be 20 MWh from PacifiCorp to the ISO, resulting in a 80 MWh total transfer from the ISO to PacifiCorp. In this case, they will be reported as transfer from ISO to PacifiCorp with FMM = 100, RTD (dynamic) = -20, and total = 80.

Market	Month	PAC to ISO ³	ISO to PAC	PACE to PACW ⁴
FMM	July	97,878	7,712	85,986
	August	71,140	10,444	55,692
	September	43,153	8,931	18,798
RTD (delta from FMM)	July	29,161	-2,687	-6,277
	August	15,577	-3,555	2,400
	September	17,858	-545	4,205
Total	All	274,768	20,300	160,805

Table 2: Energy transfers (MWh) in the FMM and RTD for the third quarter of 2015

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 California, Oregon, Washington, Utah, Idaho and Wyoming. The EIM improves the integration of renewable resources and increases reliability by sharing information between balancing authorities on electricity delivery conditions across the entire EIM region. The ISO published the EIM benefit report for November and December 2014 in February 2015,⁵ the first quarter

² For the transfer from PACE to PACW, the EIM benefits are determined based on the difference between the EIM transfer volume and the counterfactual transfer volume as described in the ISO’s [Q4 2014 EIM benefit report](#).

³ For more information regarding resource type supporting EIM transfer to ISO refer to http://www.caiso.com/Documents/MarketPerformanceReport_August_2015.pdf.

⁴ PACE to PACW transfers were unavailable due to maintenance starting September 14, 2015

⁵ California ISO, http://www.caiso.com/Documents/PacifiCorp_ISO_EIMBenefitsReportQ4_2014.pdf

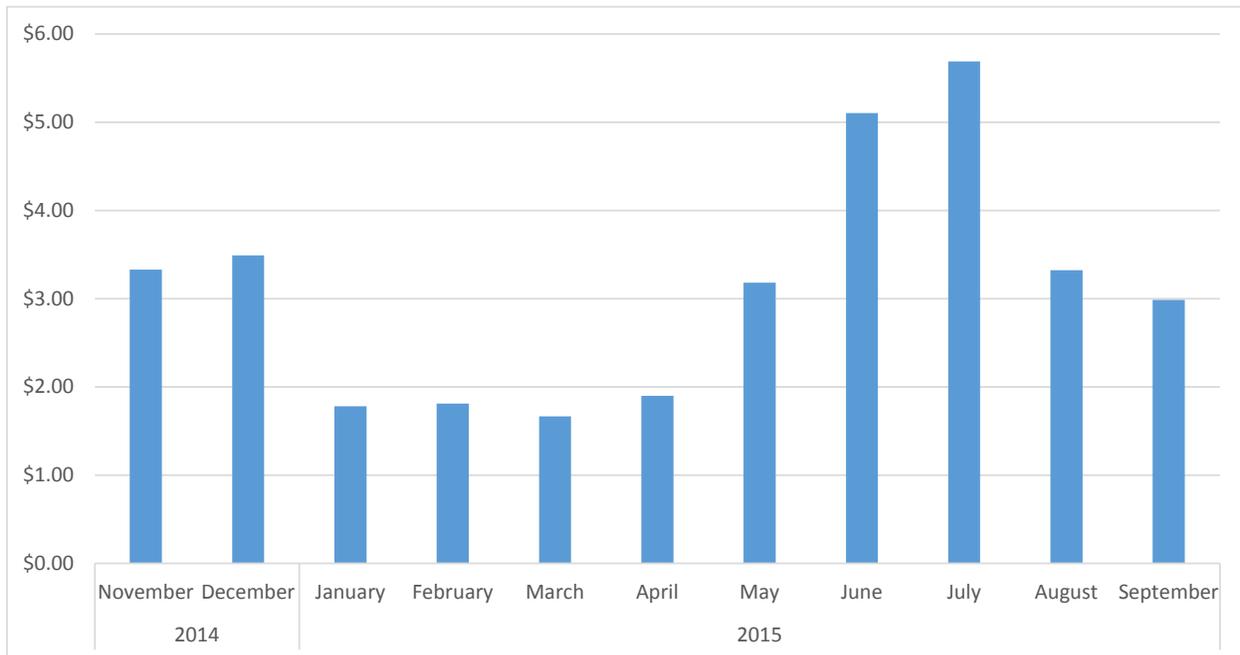
of 2015 in April 2015,⁶ and the second quarter of 2015 in July 2015.⁷ When other entities begin participating in the EIM, the reports will include those balancing authorities and associated benefits.

EIM Benefits in Q3 2015

Table 1 breaks down the estimated EIM benefit by individual BAA and by month and includes \$5.69 million for July, \$3.32 million for August, and \$2.99 million for September. As stated previously, the EIM Q3 2015 benefit of \$12.00 million is 18 percent higher than Q2 2015. The difference from last quarter mainly reflects seasonal variations in system and market conditions.

Figure 2 shows the monthly EIM benefit from November 2014 to September 2015 and indicates a downward trend as EIM benefits settle down. Several issues that may have caused market infeasibilities during the first two months of EIM, were fixed or mitigated which resulting in less calculated EIM benefits. In Q2 2015 EIM benefits were higher due to the change of calculation granularity over the method used in Q1 2015 in which the benefits were quantified on a 15-minute basis using the FMM results. The EIM benefits starting in Q2 2015 were quantified on a 5-minute granularity based on RTD results. From Q2 2015 to Q3 2015, we observed some seasonal variations in EIM benefits, which were consistent with system and market condition changes.

Figure 2: Monthly EIM benefit trend (in million dollars)



⁶ California ISO, http://www.caiso.com/Documents/PacifiCorp_ISO_EIMBenefitsReportQ1_2015.pdf

⁷ California ISO, http://www.caiso.com/Documents/PacifiCorp_ISO_EIMBenefitsReportQ2_2015.pdf

Reduced Renewable Curtailment

EIM facilitates avoided renewable curtailment in the ISO, which has both economical and environmental benefits. The EIM benefit calculation includes the economic benefit from the avoided renewable curtailment in the ISO; If not for EIM transfer the ISO renewable generation would have been curtailed. The total avoided renewable curtailment volume in MWh for Q3 2015 was quantified to be 597 (July) + 173 (August) + 58 (September) = 828 MWh. The reduced renewable curtailment is less than last quarter. This is because there were less transfers from the ISO to PacifiCorp in Q3 as a result of higher prices in the ISO, which makes it harder to curtail renewable resources at the bottom of the economic merit order supply stack.

The environmental benefits of avoided renewable curtailment are also significant. Assuming the avoided renewable curtailment displaces production from other resources at a default emission rate of 0.428 metric tons CO₂/MWh, the avoided curtailment displaced an estimated 354 metric tons of CO₂. Avoided renewable curtailment may also have saved renewable credits being retracted. This report does not quantify these additional benefits in dollar amounts.

Flexible ramping procurement diversity savings

EIM procures flexible ramping capacity in the FMM to deal with uncertainties that could occur in RTD. Because uncertainty in different BAAs may materialize in the opposite directions, the required flexible ramping for the whole EIM footprint would be less than the the sum of individual BAA's requirement. We refer to this difference as the flexible ramping procurement diversity savings. The ISO starting in March 2015 used an automated tool to analyze historical uncertainties and calculate the flexible ramping requirement for each BAA in the EIM. In Q3 2015 the flexible ramping requirement for the ISO varies from 300 MW to 500 MW, while the requirement for PACE varies from 80 MW to 150 MW, and it varies from 60 MW to 100 MW for PACW. The flexible ramping requirement for the EIM footprint was from 400 MW to 530 MW.

The flexible ramping procurement diversity savings for all the intervals averaged over a month are listed in Table 3.⁸ The percentage saving is the average MW saving divided by the sum of the three individual BAA requirements.

Diversity savings	July	August	September
Average MW	107	142	149
Percentage	18%	22%	21%

Table 3: Flexible ramping procurement diversity saving for the third quarter of 2015

⁸ From September 25, the EIM footprint flexible ramping requirement was not enforced in production with an outage reducing PACE to PACW transfer capability to zero. In this case, the flexible ramping procurement diversity savings were calculated for the ISO and PACW, which is the difference in the requirement for the ISO and PACW together and the sum of individual ISO and PACW requirements.

Under the current flexible ramping constraint design, the procured flexible ramping capacity can be fully accessible 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 to a 5-minute granularity level, the benefit of flexible ramping is fully captured in the RTD dispatch. The reported EIM benefits from 5-minute granularity includes the savings from procuring and deploying flexible ramping but we did not breakdown savings in dollars separately because it is tightly integrated in the RTD dispatch.

Conclusion

EIM continued to show significant benefits during the third quarter of 2015. The total benefit for Q3 of \$12.00 million based on the five minute market results is consistent with pre-launch studies.