Benefits for Participating in EIM

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Revision History

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Executive Summary

The Energy Imbalance Market (EIM) began financially-binding operation on November 1, 2014 by optimizing resources across the California Independent System Operator (ISO) and PacifiCorp balancing authority areas (BAAs).

This first report quantifies the estimated gross benefits from the first two months of EIM operation to be $5.97 million, which is in line with pre-launch projections. This benefit report reflects EIM's ability to select the lowest cost resource across the PacifiCorp and ISO BAAs to serve demand and accounts for the following categories as described in an earlier study conducted by Energy + Environmental Economics (E3) [1] for PacifiCorp and the ISO:

- ***More efficient dispatch, both inter- and intra-regional***, by automating dispatch every five minutes within PacifiCorp's two BAAs and between the PacifiCorp and California ISO BAAs; and
- ***Reduced renewable energy curtailment*** by allowing BAAs to export or reduce imports of renewable generation when it would otherwise need to be economically dispatched down or manually curtailed.

This report does not calculate the ***reduced flexibility reserves*** needed by the ISO and PacifiCorp BAAs, which provides additional savings by aggregating the load, wind, and solar variability and forecast errors of the combined EIM footprint. It also does not calculate the benefits in the 5-minute market. The ISO plans to add this component to future benefits reports.

The table below shows the estimated benefits summary for November and December 2014 in millions of dollars per BAA. The EIM benefit is calculated based on the methodology discussed in an earlier ISO Technical Bulletin with some practical simplifications described later in this report.

BAA	November	December	Total
ISO	$0.65	$0.59	$1.24
PACE	$1.05	$1.26	$2.31
PACW	$1.39	$1.03	$2.42
Total	$3.09	$2.88	$5.97

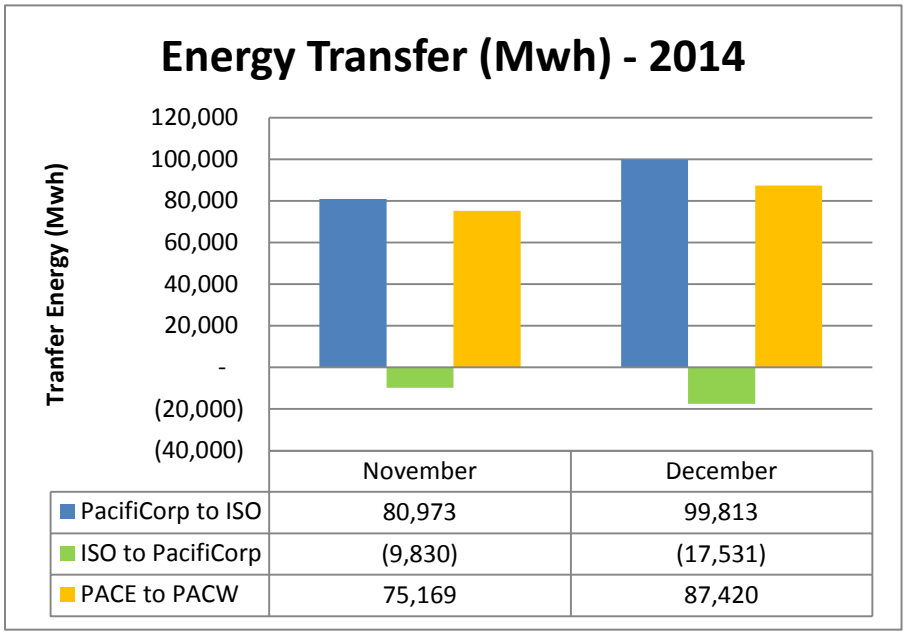
Table 1: Estimated benefits shown are in the millions and accrued for the last two months in 2014.

The EIM dispatched energy transfers up to 421 megawatts (MW) in a 15-minute interval between the PacifiCorp West BAA (PACW) and ISO, up to 220 MW from ISO to PACW, and up to 200 MW from PAC East BAA (PACE) to PACW, which were consistent with economic pricing between the regions.

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

PacifiCorp consistently exercised its Interchange Rights Holder mechanism for EIM transfers to use a large percentage of its transfer rights between PACW and the ISO. Congestion within the ISO-controlled grid also factored into the amount of capacity available for EIM transfers.

This report does not consider PacifiCorp's opportunity cost that the utility considered when deciding to use its transfer rights. Although subject to continuously varying market conditions, the benefits are expected to increase as system operations continue to improve with new resources participating and as transfer capability increases or is available during 5-minute intervals. Preliminary estimates for November and December 2014 reflect approximately 180,786 megawatt hours (MWh) transferred to ISO from PacifiCorp and 27,361 MWh transferred to PacifiCorp from the ISO (Figure 1).



	November	December
PacifiCorp to ISO	80,973	99,813
ISO to PacifiCorp	(9,830)	(17,531)
PACE to PACW	75,169	87,420

Figure 1: Energy Transfer

The estimated benefits in the first two months of operation are consistent with the March 2013 study conducted by E3 [2] for PacifiCorp and the ISO that projected annual savings in 2017 in the range of $21 million to $129 million.

While market conditions will vary, the benefits demonstrated in EIM's first two months indicate that EIM has the potential to provide benefits to participating entities and their customers for the long term.

[2] PacifiCorp, Energy Imbalance Markets Summary, http://www.caiso.com/Documents/PacifiCorp-ISOEnergyImbalanceMarketBenefits.pdf

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. This first quarterly report outlines the estimated benefits from the first two months of EIM operation. Future reports will examine EIM customer savings and benefits on a three month quarterly basis. As other entities such as NV Energy begin participating in the EIM, future reports will assess those additional balancing authorities and associated benefits.

During the design, development, and implementation over the last two years, EIM has been supported by a broad range of stakeholders, government officials and energy policy organizations. EIM participants expect to benefit from more efficient dispatch of resources both within and between BAAs, and the ability to share flexible resources to accommodate variable energy resources. A joint PacifiCorp and ISO study performed by E3 predicted the EIM's annual benefit in the range of $21 million to $129 million in 2017.[3] Likewise, a study conducted for NV Energy showed incremental benefits to all EIM participants from $9 million to $29 million.[4] In addition, the ISO built the EIM model on an existing, proven market platform that gives EIM entities a low-cost, low-risk option to participate in EIM.

In a Technical Bulletin provided to stakeholders on August 28, 2014,[5] the ISO proposed a systematic way to quantify benefits for each region served by EIM. In both the Technical Bulletin and in this report, the ISO refers to EIM benefits compared to a "counterfactual" or "business without EIM" approach. Cost savings are calculated by comparing the cost of the EIM optimized dispatch to the counterfactual cost of dispatch without EIM optimization and without intra-hour transfers between PacifiCorp and ISO that would not occur but for the EIM.

Simplified Method of Calculating Benefits

This report quantifies the estimated benefit of participating in the EIM for November and December 2014. Because of the complexity in automating the counterfactual reruns and validating the results, the ISO was unable to complete the counterfactual reruns for fourth quarter of 2014 by the publication date of this first report. However, the ISO has developed a simplified process to produce the optimized counterfactual dispatch. This method only quantifies benefits from the 15-minute market and does not attempt to quantify additional benefits from 5-minute market or diversification affecting flexible ramping requirements. The ISO will explore quantifying these benefits in future reports.

[3] PacifiCorp, Energy Imbalance Markets Summary, http://www.caiso.com/Documents/PacifiCorp-ISOEnergyImbalanceMarketBenefits.pdf
[4] NV Energy-ISO Energy Imbalance Market Economic Assessment http://www.caiso.com/Documents/NV_Energy-ISO-EnergyImbalanceMarketEconomicAssessment.pdf
[5] Quantifying the Benefits for Participating in EIM, published August 28, 2014 posted at http://www.caiso.com/Documents/TechnicalBulletin_EnergyImbalanceMarket-Benefits.pdf

The major difference from the approach discussed in the Technical Bulletin is that the counterfactual dispatches without EIM are based on the off line optimization of production data rather than re-running the EIM market clearing engine with modifications to simulate pre-EIM practice. The simplified approach provides reasonable counterfactual dispatches when no transmission constraints are binding in the PacifiCorp regions.

Counterfactual dispatch

The counterfactual dispatch for the ISO mimics ISO market operations without importing from or exporting to PacifiCorp through EIM transfers. The counterfactual dispatch for PacifiCorp mimics PacifiCorp's pre-EIM manual dispatch to meet demand with limited ability for intra-hour transfers between PacifiCorp and the ISO prior to EIM.

In cases where a counterfactual dispatch could not be produced for a balancing area using available bids, a conservative assumption was made by extending the highest bid dispatched.

ISO counterfactual dispatch

The ISO would need to meet demand without EIM transfers between PacifiCorp and the ISO. The ISO counterfactual dispatch will be constructed in the following ways.

Scenario 1: ISO counterfactual dispatch without EIM transfer from PacifiCorp to the ISO

1. Find ISO's undispatched supply (not including supply from PacifiCorp) with bids greater than or equal to the transfer point price (MALIN 500 KV);
2. Sort and stack them from low to high bid; and
3. Clear the supply stack from low to high bid up to the transfer megawatts.

The supply resources that are dispatched up to the volume of transferred megawatts are the counterfactual dispatches that the ISO would have to dispatch without importing through the EIM transfer. The counterfactual dispatch cost represents the cost of meeting demand in the ISO without economic EIM transfers from PacifiCorp.

Scenario 2: ISO counterfactual dispatch without EIM transfer from the ISO to PacifiCorp

1. Find ISO's dispatched supply with bids less than or equal to the transfer point price (MALIN 500 KV);
2. Sort and stack them from high to low bid; and
3. Clear the supply stack from high to low bid up to the transfer megawatts.

The supply resources that are dispatched down to the volume of transferred megawatts are the counterfactual dispatches that the ISO would have realized but for the EIM export transfer.

PacifiCorp counterfactual dispatch

PacifiCorp East and PacifiCorp West BAAs would need to meet demand without EIM optimization and without intra-hour transfers between PacifiCorp and the ISO. The PacifiCorp counter factual dispatch will be constructed in the following way:

1. Calculate the demand change for each BAA;
2. If the demand change results in violations of the transfer limitations between PACE and PACW, then adjust base schedules from the limited pool in each BAA to resolve the overloads in the right economic order; and
3. Economically dispatch resources from the limited pool on top of the changed base schedules from step 2 to meet PacifiCorp demand without violating the transfer limitations between PACE and PACW.

The economic clearing in step 2 and step 3 are performed the same way as in the ISO's counterfactual dispatch by going through the sorted supply stacks. The limited pool of resources reasonably approximates PacifiCorp's manual resource dispatch prior to EIM to meet intra-hour system imbalances.

This process is expected to result in the following:

- No intra-hour transfers between the ISO and PacifiCorp;
- The allowance of intra-hour transfer changes between PACE and PACW subject to directional transfer capability limitations;
- Meeting PacifiCorp's total demand (PACE and PACW) change from base schedule from a limited pool of resources; and
- The disallowance of intra-hour dispatch instructions to economically clear against each other unless it is for congestion management purposes.

EIM benefit calculation steps

For each interval and each BAA, the EIM benefit is calculated in the following way:

1. Use the simplified method to determine the optimized counterfactual dispatches would be without EIM;
2. For each region, calculate the total EIM dispatch cost as the sum of bid cost associated with the dispatch difference between the EIM dispatch and the base schedule, the EIM transfer cost (volume and price), and the greenhouse gas (GHG) cost;
3. For each region, calculate the total counterfactual dispatch cost as the sum of bid cost associated with the dispatch difference between the counterfactual dispatch and the base schedule, and the counterfactual transfer cost between PACE and PACW; and
4. Calculate each region's cost saving as the difference between the total counterfactual dispatch cost and the total EIM dispatch cost.

EIM benefits in Q4 2014

The total estimated EIM benefit is about $3.09 million for November and $2.88 million for December for a total of $5.97 million with details provided in Table 2. These numbers represent benefits from 79 percent of all the intervals where the largest absolute price difference between the Malin500 and PACE or between the Malin500 and PACW is less than $50/MWh. The intervals with price differences larger than $50/MWh are excluded to reasonably represent, but not overstate, the benefits from after-the-fact price corrections or changes as a result of the pricing waiver[6].

BAA	November	December	Total
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Table 2: Estimated benefits shown are in the millions and accrued for the last two months in 2014.

Conclusion

The estimated benefits calculation was developed through a thorough analysis and is a reasonable representation of the benefits accrued by both balancing authorities. Results are in line with expectations given market conditions and the first two months of operating the new market. Future reports will include assessing flexibility reserve benefits and 5-minute dispatch benefits that were not included in this report. Prospects for increases in customer benefits remain bright with improvements to market operations, expanding of the market with more participants, and expanding of renewables and transmission within the EIM footprint.

[6] Dec 1, 2014 Order Granting Waiver - EIM Pricing Parameters (ER15-402)
http://www.caiso.com/Documents/Dec1_2014_OrderGrantingWaiver_EIMPricingParameters_ER15-402.pdf