Memorandum

To: ISO Board of Governors

From: Petar Ristanovic, Vice President, Technology

Date: October 31, 2013

Re: **Decision on energy imbalance market design**

This memorandum requires Board action.

EXECUTIVE SUMMARY

This memorandum describes Management's proposed energy imbalance market (EIM) design. The EIM will allow balancing authorities throughout the West to voluntarily participate in a real-time imbalance energy market operated by the ISO. The EIM will optimally dispatch resources within the ISO and EIM balancing authority areas' footprint to meet the combined real-time imbalance needs of both regions in the most cost effective manner. The EIM will provide substantial benefits:

Cost savings: All EIM participants, including existing ISO market participants, will benefit from meeting their real-time imbalances from a larger pool of diverse resources.

Improved renewable integration: The EIM will help integrate renewable resources by capturing the benefits of geographical diverse load and resources, which enables the output variation in one region to counterbalance variation in another.

Increased reliability: The EIM will improve reliability by providing information that enhances operational awareness and responsiveness to grid conditions across its large footprint.

Management proposes the following motion:

Moved, that the ISO Board of Governors approves the proposed energy imbalance market design, as described in the memorandum dated October 31, 2013; and

Moved, that the ISO Board of Governors authorizes Management to make all necessary and appropriate filings with the Federal Energy Regulatory Commission to implement the proposed tariff change.

DISCUSSION AND ANALYSIS

The EIM is a real-time market to dispatch economic bids voluntarily offered by participating resources to efficiently balance supply, transfers between balancing authority areas, and load across its footprint. The EIM will be part of the ISO's real-time market and leverage the FERC Order No. 764 market design changes approved by the Board in May 2013. As such, the EIM will include a 15-minute market and 5-minute dispatch across the combined network of the ISO and EIM balancing authorities. In addition, the EIM design has isolated, where appropriate, market neutrality and cost allocations to each individual balancing authority. Allocation to the EIM balancing authority will allow flexibility in how EIM balancing authorities design their tariffs and rules for participating in the EIM.

History

Industry leaders in the West have explored and promoted the EIM concept for several years. The Western Electricity Coordinating Council launched a major initiative and study effort in 2010. Late in 2011, the State-Provincial Steering Committee of the Western Interstate Energy Board created the PUC-EIM group to advance the concept and understanding of an EIM. Several other groups and individual balancing areas are currently exploring implementation options. Many of these efforts have centered on creating a new organization, new systems and tariff to operate an EIM.

The ISO took the initiative to develop and present a conceptual EIM design proposal to the PUC-EIM group in March 2012. The conceptual proposal provided the EIM services through the ISO's existing real-time market platform. PacifiCorp expressed interest in the ISO proposal. A joint benefits study was performed leading to a memorandum of understanding with PacifiCorp in early 2013. In March 2013, the Board approved moving forward with the PacifiCorp implementation in parallel with this stakeholder process that will allow PacifiCorp and other balancing authorities in the West to take advantage of this important service in the future. The PacifiCorp implementation agreement was approved by FERC on June 28, 2013.

Leveraging ISO's existing market processes

EIM processes will be similar and integrated with the ISO's existing market processes. The primary difference is that the EIM only includes the ISO's real-time market and not the ISO's day-ahead market. The EIM will have some unique characteristics to reflect this difference and to ensure EIM balancing authorities have sufficient generation resources available in the real-time market, that costs between balancing authorities are allocated according to ISO guiding principles, and protections are in place so convergence bidding does not cause cost uplifts in EIM balancing authorities. In addition, an EIM balancing authority maintains all the responsibilities of a balancing authority.

The basic elements of the proposed EIM design align with the ISO's market processes. In the day-ahead timeframe, EIM balancing authorities will submit load forecasts and

anticipated resource base schedules to the ISO. This information will allow the ISO to identify infeasible schedules, such as those that might cause transmission overloads in the EIM footprint, and provide advisory information to EIM balancing authorities so they can revise the base schedules to resolve any infeasibilities. These EIM base schedules will help to improve the accuracy of the ISO's day-ahead market model.

The ISO has based the EIM on the real-time market design the ISO plans to implement in the spring of 2014.[1] This design, which was developed in part to comply with FERC Order No. 764, consists of a 15-minute market and a 5-minute dispatch. Each of these market runs will produce schedules and locational marginal prices for resources. The EIM will also commit short-start generation units in the 15-minute market. Like the ISO's current real-time market, the EIM will enforce a flexible ramping constraint to commit and position resources to meet future load and supply variability and uncertainty. Finally, the EIM design includes provisions to mitigate local market power that mirrors local market power mitigation currently applied in the ISO's real-time market. In addition, over the next six months, the ISO will determine if EIM transfer limits between balancing authorities are competitive. If EIM transfer limits are not competitive, the constraints will be included in the market power mitigation process. This will address stakeholder concerns that system market power may exist between balancing authorities participating in the EIM.

The following describes specific elements included in the EIM design:

Establishment of hourly base schedules and hourly resource plan

The ISO will receive hourly base schedules from all resources within the EIM balancing authority area and interchange transactions 75 minutes prior to the operating hour. These hourly base schedules will balance against the load forecast and serve as the baseline for settling imbalance energy in the EIM. The combination of load forecasts, base schedules and the bid range from participating resources will become the hourly resource plan for the EIM balancing authority. The EIM balancing authority scheduling coordinator will have visibility to all elements of the resource plan and the results of the various checks in the resource sufficiency evaluation described below and will be able to make changes to hourly base schedules to resolve unbalanced supply and demand, transmission flow overloads, insufficient participating resource bid range and ramping capability. This provides the EIM balancing authority scheduling coordinator with the opportunity to resolve any identified issues prior to the start of the EIM. At 40 minutes prior to the operating hour, the hourly resource plan is approved by the EIM balancing authority scheduling coordinator. In addition to hourly base schedules, participating resources will have the opportunity to submit bid offers for EIM dispatch by 75 minutes prior to the operating hour.

[1] *Integration of Variable Energy Resources* (Order No. 764), 139 FERC ¶ 61,246 (2012). Implementation of EIM in the fall of 2014 is dependent on FERC's approval of the ISO's real-time market design to implement Order No. 764.

Resource sufficiency evaluation

The EIM does not include forward resource adequacy requirements or obligations for resources to submit bids, but instead includes several elements to ensure each EIM balancing authority has sufficient resources to serve its load while still realizing the benefits of increased resource diversity. The EIM design elements that ensure resource sufficiency include:

- **Load base schedule adjustments.** If base schedules from generation resources in a resource plan are insufficient to meet the load forecast, the ISO will lower the load base schedule to equal the scheduled generation. The resulting shortfall will be settled through EIM along with any applicable under-scheduling penalties (see next bullet) as will be reflected in the flexible ramping requirements;
- **Under-scheduling and over-scheduling penalties and resource balancing provisions.** If an EIM balancing authority does not use the ISO's forecast, or uses the ISO forecast but does not schedule resources within 1 percent of actual demand, then it will be subject to penalties if its actual load is 5 percent more than scheduled. The penalties collected will be allocated to the other balancing authorities who have not incurred a scheduling penalty for the operating day;
- **Flexible ramping sufficiency test.** Prior to commencing the EIM, the ISO will calculate a flexible ramping requirement. The requirement is based upon the ISO load forecast, ISO variable energy resource forecast, and the ISO's historical assessment of the ramping capability needed to meet forecast uncertainty and variability. If there are differences between submitted base schedules and ISO forecasts, the difference will increase the required bid range from EIM participating resources. An EIM balancing authority will be determined to have insufficient energy bids if (1) the bid range from participating resources cannot meet the ISO forecast of demand plus flexible ramping capacity, or (2) the ramping capability of participating resources cannot meet the EIM balancing authority's flexible ramping constraint. In such cases, the transfers between the deficient EIM balancing authority and other EIM balancing authorities will be frozen at previous levels; and
- **Real-time congestion balancing accounts**. These accounts provide a strong incentive for each EIM balancing authority to resolve congestion with its own resources prior to real-time. If the hourly resource plan provided by an EIM balancing authority has unresolved congestion, the cost of managing that congestion in the EIM will accrue in the real-time congestion balancing account. Each EIM balancing authority will have a separate account attributable to the transmission constraints located within each balancing authority area.

Settlement of imbalances

For purposes of settlements, the ISO will financially settle EIM schedules relative to hourly base schedules approved by each EIM balancing authority as follows:

- The ISO will settle differences between hourly base schedules and 15-minute schedules at 15-minute locational marginal prices. EIM balancing authorities will settle any adjustments to base schedules made prior to an operating hour as specified in their open access transmission tariffs.
- The ISO will settle differences between 15-minute schedules and actual real-time output or flow at the 5-minute locational marginal price.
- Participating resources will receive bid cost recovery in the event real-time market revenues over a day do not cover their real-time commitment and dispatched bid costs. Each EIM balancing authority will have an account based upon the bid cost recovery payments made to resources located in its area.
- The ISO will settle EIM load differences with the EIM balancing authority from hourly base schedules based on a weighted-average of the 15-minute and 5-minute prices within each load area.
- EIM settlement will include neutrality accounts that track differences between payments received from load and payments to generation. The ISO will calculate neutrality accounts for each balancing authority and where appropriate consider transfers between balancing authorities in calculating the final amounts.
- Resources having economic energy dispatch held back to meet the flexible ramping constraint will be compensated for opportunity costs. Each balancing authority will be allocated its portion of the compensation to resources for meeting the constraint for its area.
- For bid cost recovery, neutrality accounts, and the flexible ramping constraint, each EIM balancing authority will allocate these amounts according to its respective open access transmission tariffs.

Convergence bidding settlement in EIM constraints

Convergence bids settled in the ISO market can add to the real-time congestion balancing account in the event of reduced transmission limits from the day-ahead market to the real-time market. As described above, the ISO will allocate the costs of congestion attributable to constraints located within an EIM balancing authority to its congestion balancing account. But since the EIM will not include a day-ahead market, there will not be convergence bidding within EIM balancing authorities, and consequently it would not be appropriate to allocate uplift charges attributable to convergence bids to an EIM balancing authority's account. Therefore, the ISO will allocate any increased congestion charges that are attributable to a convergence bid's

impact on a constraint within an EIM balancing authority area back to the convergence bidder.

California greenhouse gas regulation

Imports of energy into California and generation of energy within California from greenhouse gas emitting resources are subject to the California Cap on Greenhouse Gas Emissions regulated by the California Air Resources Board. Energy generated outside of California that is not imported into California is not subject to this regulation.

The EIM design accounts for this regulation through the following, which has been accepted by California Air Resources Board management and staff:

- For generation within an EIM balancing authority, the cost of the greenhouse gas compliance obligation will be included in dispatching energy from these resources to serve ISO load, but will otherwise be excluded.
- The energy produced by each generator within an EIM balancing authority that serves ISO load will be calculated by the ISO. EIM participating resources' scheduling coordinators will be provided with summary reports listing these amounts which will be the basis of their greenhouse gas regulation compliance obligation with the California Air Resources Board.
- EIM participating resource scheduling coordinators can include the costs of their greenhouse gas regulation compliance obligation as an adder to their energy bids.

The EIM has been designed so that the greenhouse gas compliance costs will not affect the locational marginal price in an EIM balancing authority area. Rather, the market optimization will calculate the marginal cost difference between EIM generation serving load in the ISO and serving load outside of the ISO. This difference will be the marginal greenhouse gas regulation compliance cost and will be the rate the ISO will use to calculate a payment to each generator in an EIM balancing authority for its output that served ISO imbalances. This payment will be funded through the price paid within the ISO for imbalance energy.

Transmission service

Management proposes for the first year of EIM operation that there be no charge between the ISO and EIM balancing authorities for use of transmission to support EIM transfers. During this time, as stakeholders gain operational experience and additional balancing authorities consider joining the EIM, the ISO will coordinate with stakeholders to consider various alternatives for a long-term transmission rate design.

Governance

Concurrent with this stakeholder process, the ISO is conducting a separate stakeholder engagement to design an EIM governance structure that will provide stakeholders an opportunity to provide input on EIM matters and lead to a long-term independent EIM governance structure. The ISO will seek Board decision on the governance proposal in December 2013.

Additional Board activities prior to implementation

Implementation of EIM is planned for October 2014. Prior to implementation, the ISO will perform market simulations and perform extensive testing. Management will brief the Board on the results the simulations prior to go-live. In addition, Management during this time will assess whether local market power mitigation needs to be expanded to be applied at the system level for each EIM balancing authority area. Once the actual transfer capability between PacifiCorp and the ISO has been established, Management can better determine whether these constraints need to be evaluated for competiveness to be used as a basis of market power mitigation in the market software.

POSITIONS OF THE PARTIES

The EIM stakeholder initiative was extensive. The ISO held five stakeholder meetings including meetings in Phoenix and Portland. In addition, the ISO held five technical workshops to discuss specific design elements in more technical detail.

Stakeholder input has generally supported the goal of establishing an EIM. PacifiCorp supports the proposed EIM design and believes it is consistent with the implementation agreement approved by FERC on June 28, 2013. The following addresses the stakeholder positions raised during the stakeholder process. A detailed stakeholder comment matrix is attached for reference.

Position 1: A few stakeholders disagree with the proposed transmission service reciprocity approach

Response: In the initial implementation, PacifiCorp will be using transmission rights it currently owns to support transfers between the ISO and PacifiCorp. In addition, PacifiCorp is requiring long term transmission within its two balancing authority areas, PACW and PACE, for resources to participate. As a result, all transmission utilized in the EIM will have been purchased prior to its use in the EIM. Finally, the ISO will commence a stakeholder initiative to evaluate other transmission service alternatives. This initiative will be informed by operational experience gained over the first year of EIM operation.

Position 2: Some stakeholders believe the design should include a transition period in which transfer capability between the ISO and other balancing authorities in the EIM is phased in.

Response: Some stakeholders have argued that limiting EIM transfers to zero would allow more time to discuss market design elements such as greenhouse gas, cost allocation, and transmission service. Others have advocated that the ISO should gradually increase EIM transfer capability up to a maximum amount determined prior to implementation. Management believes it is premature to define a transition period prior to market simulation. In addition, the initial implementation will already be limited to PacifiCorp's two balancing authorities and the transmission rights made available by PacifiCorp. However, the ISO will seek tariff authority to establish limits on EIM transfer capability under certain limited circumstances. Any phase-in approach would be determined in the EIM implementation plan and will be discussed in an open session of the ISO Board prior to EIM go-live.

Position 3: Some stakeholders assert that the resource sufficiency evaluation is insufficient to prevent resource "leaning."

Response: The discussion of capacity "leaning" has been debated throughout the stakeholder initiative. The debate centers on what time period of resource sufficiency should be within the scope of EIM. Management believes that long term resource adequacy is under the purview of local regulatory authorities and day-ahead resource sufficiency should be addressed at a WECC level. The EIM's proposed resource sufficiency evaluation provides measures to address real-time market leaning within the EIM. The checks outlined above ensure that each EIM balancing authority provides sufficient resources to independently meet its load forecast, variable energy uncertainty and ramping requirement before leveraging the balance of the EIM footprint to efficiently meet its imbalance needs.

Position 4: Because some resources may not want to be subject to California's greenhouse gas regulations, greenhouse gas compliance cost bidding rules should include a "flag" indicating resources that are not available for import into California.

Response: The proposed rule allows participating resources to set very high greenhouse gas cost adders that will likely result in a resource not being dispatched to serve California load, but does not guarantee it. While this approach may result in very high greenhouse gas payments if a bid close to the bid cap is dispatched to serve California load, the same potential exists under the current market where energy that is imported into California includes greenhouse gas component that, along with the energy price, can be up to the bid cap. In addition, providing a "flag" that allows a participating resource to elect that its energy cannot support California load is inconsistent with the fundamental purpose of EIM, which is to share resources across the entire EIM footprint to serve load most economically. The greenhouse gas proposal is supported by PacifiCorp; therefore, the initial implementation of EIM can move forward without the need for such a greenhouse gas flag. However, the ISO plans to consider this for future

implementation and will list this issue in the ISO 2013 stakeholder initiatives catalog for further stakeholder review. As other balancing authorities consider joining the EIM, there may be justification for the flag, such as legal restrictions that prevent complying with CARB's program. If a flag is implemented, the bidding rules would also be reassessed.

Position 5: Some California stakeholders feel convergence bidding is inconsistent with EIM and the proposed allocation of EIM real-time congestion balancing account charges to convergence bidders is not symmetrical.

Response: Since the ISO's day-ahead market does not include the EIM, Management believes it is inappropriate for the real-time settlement of convergence bids to result in charges to the EIM balancing authority's congestion balancing account. The proposed allocation of congestion uplift charges on an EIM balancing authority's constraints to convergence bidders is appropriate because the convergence bids are not exposed to day-ahead congestion on EIM balancing authority constraints. The proposed allocation does not allocate congestion credits on an EIM balancing authority's constraints to convergence bidders. If credits were allocated to convergence bidders, an EIM balancing authority could make out-of-market payments to convergence bidders when the hourly resource plan includes base schedules below the transmission limits and congestion materializes in the EIM. As discussed in the resource sufficiency evaluation section above, EIM balancing authorities should be incentivized to approve base schedules free of congestion. This incentive would be reduced if this behavior resulted in out-of-market payments to ISO convergence bidders.

Position 6: Stakeholders, the Market Surveillance Committee and Department of Market Monitoring have expressed the potential need for the EIM transfer limits to be subject to market power mitigation. The Market Surveillance Committee's Final Opinion as well as the memo by the Department of Market Monitoring are attached for reference.

Response: Over the next six months, the ISO will determine if EIM transfer limits are competitive. The competitiveness of EIM transfer limits is dependent upon the actual transfer capability made available. If EIM transfer limits are not competitive, a mechanism is needed to address potential system market power of an EIM balancing authority area. The EIM software will include functionality that allows the application of market power mitigation rules on the constraints enforcing the EIM transfer limits.

Position 7: Some stakeholders have expressed the need for exit provisions including an exit timeline and potential exit fees.

Response: The voluntary nature of EIM participation has been a fundamental tenet of the EIM and has always included the ability to leave the EIM if benefits are not realized. Currently, the ISO has no exit costs for existing PTOs, but does have a two-year exit notification timeline. An EIM balancing authority that wishes to exit the EIM will be required to provide approximately a six-month notification. The actual exit date will be

aligned with the network model release that removes the EIM balancing authority from the real-time market. The implementation agreement and EIM administrative rate reduce the potential for stranded costs. Prior to joining the EIM, an implementation agreement for each new balancing authority will need to be approved by FERC. The implementation agreement will include payments to the ISO to cover startup costs of adding the new EIM balancing authority. The EIM administrative rate covers the ongoing costs of participating in the EIM and will continue to be recovered until the outgoing EIM balancing authority is removed from the network model.

CONCLUSION

Management respectfully requests Board approval of the energy imbalance market design as described in this memorandum. Through the stakeholder initiative, the EIM has moved from concept to a design, which can be realized in October 2014. The proposed design is consistent with the PacifiCorp implementation agreement and will continue to evolve based upon operational experience and stakeholder requested enhancements. Finally, the design is robust and will allow other balancing authorities to join the EIM expanding the benefits for all in the West.